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IIRE Journal of Maritime Research and Development

Maritime sector has always been influencing the global economy. Shipping facilitates the bulk transportation of raw material, oil and gas products, food, and manufactured goods across international borders. Shipping is truly global in nature, and it can easily be said that without shipping, the intercontinental trade of commodities would come to a standstill.

Recognizing the importance of research in various aspects of maritime and logistic sector, IIRE through its Journal of Maritime Research and Development (IJMRD) encourages research work and provides a platform for publication of articles, manuscripts, technical notes, papers, *etc.* on a wide range of relevant topics listed below:

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- Other Current Topics of Interest in Shipping

Editorial Board

Editorial

De-carbonization and Digitalization continue to be the dominating theme in the shipping industry. Matter of fact, this decade, the 2020's, is proving to be the decisive decade for both these themes of shipping, and they are not mutually exclusive either. Regulations from key bodies like the IMO and EU are taking shape now, that are driving industry stakeholders to implement plans now, which will influence the direction of digitalization and decarbonization efforts in the coming decades. In July 2023, the IMO completed the first revision of its greenhouse gas (GHG) strategy, and the revised strategy now aims to reduce, well-to-wake, GHG emissions by 20% in 2030, by 70% in 2040, and to reach net-zero 'by or around' 2050. Achieving such decarbonization goals requires a large-scale transition to new fuels, which is already underway!

Likewise, the fourth industrial revolution is also expected to have a substantial impact on the maritime industry ecosystem where the digitalized and intelligent networking of data is expected to bring significant advantages to the shipping industry, reducing their operational costs, while increasing the overall revenue and additionally, the ships of the future will meet strict requirements related to pollution, and Energy Efficiency. In such a rapidly evolving world of shipping, education stands as the cornerstone of progress, shaping minds, moulding futures, and fuelling innovation. Yet again, as we gaze into the horizon of the future, we find ourselves now at a critical juncture, where the traditional paradigms of education are being challenged by the winds of change. Navigating the future will call for transforming maritime education for the next generation.

This issue of the IIRE Journal aptly carries research papers in tune with the sentiments expressed. While one paper carries a comprehensive review of green fuels for sustainable shipping so essential to navigate towards sustainability in the face of tighter regulatory regime, two papers examine the pervasive influence of technology in education which presents both opportunities and challenges, making it a double-edged sword. There is also a well-researched paper on application of Outcome Based Education in Seamanship to adequately and comprehensively comply to the STCW listed competencies.

Lastly, with all eyes focused on transformations in digitalization and decarbonization, we as an industry need to commit ourselves as much to safety as to transformation. After all, the safe and timely transition towards a digitally smart and carbon-neutral future may be compromised if the safety-related risks, particularly those perpetuated by mental health issues that these transitions bring about are not accounted for. The paper on mental and emotional preparation of seafarers alludes this essence and wraps up the edition.

Happy Reading!

IIRE Journal of Maritime Research and Development (IJMRD)

Volume 8 Issue 1, April 2024

LEVERAGING TECHNOLOGICAL ADVANCEMENTS FOR ENHANCED MARITIME EDUCATION AND TRAINING

Capt. Yogesh Shah[1]

Abstract

This paper delves into the transformative impact of integrating advanced technology within maritime education and training. Focusing on simulators, multimedia resources, and mobile applications, it illuminates the innovative shift towards online learning and assessments in the maritime industry. The study explores the originality of this technological integration, highlighting its pioneering role in reshaping traditional teaching methods. By leveraging cutting-edge simulators, immersive multimedia tools, and easily accessible app-based resources, this research showcases compelling results. It elucidates how these advancements foster not only a more engaging and practical learning environment but also significantly enhance the skill development and decision-making capabilities of maritime professionals.

The study's findings underscore the potential applications of these technological advancements in maritime education. They indicate a paradigm shift towards more adaptable and efficient training methodologies, promising vast implications for the industry's workforce. These innovations have the potential to create a dynamic learning landscape, ensuring that maritime professionals are better equipped to navigate the complexities of modern maritime operations. Thus, this paper accentuates the paramount importance of technology in revolutionizing maritime education, emphasizing its originality, transformative results, and promising applications. Its insights advocate for the widespread adoption of these technological advancements, ultimately fostering a more skilled, adaptable, and competent maritime workforce.

Keywords: Maritime Education; Technology Integration; Digitalization; Training Methodologies; Technological Advancements.

1. INTRODUCTION

The vastness and complexity of the maritime industry demand a workforce with exceptional skills and unwavering competency. Traditionally, maritime education and training have relied heavily

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on classroom instruction and hands-on experience onboard vessels. While these approaches have served the industry well for decades, they are now facing limitations in addressing the ever-evolving demands of the modern maritime landscape in the form of autonomous ships and possibly nuclear-powered ships. This necessitates a paradigm shift towards innovative learning methodologies that leverage the transformative power of technology.

In this context, the integration of advanced technology within maritime education and training emerges as a game-changer. By embracing cutting-edge simulators, immersive multimedia resources such as augmented reality (AR) and virtual reality (VR), and readily accessible mobile applications, maritime institutions are paving the way for a more engaging, interactive, and effective learning experience. This transformative shift marks a significant departure from traditional pedagogical methods, ushering in an era of digitalized education that promises to revolutionize the maritime industry. The transformative potential of technology in maritime education is multifaceted.

Firstly, it facilitates the creation of realistic and immersive simulated environments. These advanced simulators, often equipped with high-fidelity visuals and meticulously replicated control systems, provide trainees with the opportunity to practice critical skills and procedures in a safe and controlled setting. This allows them to hone their decision-making abilities, develop situational awareness, and master complex manoeuvres without the inherent risks associated with real-world scenarios.

The International Maritime Organization (IMO) emphasizes simulator training as a crucial component of mandatory maritime training. STCW Compliance: Certain simulator courses, such as LNG Cargo Tanker and Ballast Handling, comply with STCW Convention regulations. The sole compulsory simulator training prescribed by the STCW convention pertains to radar and ARPA utilization. T

he 2010-amended STCW further mandates the use of simulators for instruction in electronic chart display and information systems (ECDIS). In these particular scenarios, simulators represent the sole recognized means of showcasing proficiency. However, in all other cases, while approved simulator training and assessment are permissible, they are not obligatory, merely constituting one of several methods endorsed by the convention for training and validating competence.

Secondly, technology integration fosters the development of innovative multimedia resources. Interactive video lectures, animated simulations, and 3D models provide students with a dynamic and visually engaging learning experience. This enhances comprehension, promotes deeper engagement, and facilitates knowledge retention.

Additionally, mobile applications offer readily accessible learning materials and allow for self-paced learning, further enhancing the flexibility and accessibility of maritime education.

The integration of these technological advancements transcends traditional classroom boundaries and fosters a more collaborative learning environment. Online platforms facilitate peer-to-peer interaction, enabling students to discuss course material, share experiences, and learn from each other. This collaborative approach enriches the learning experience and fosters a sense of community among future maritime professionals.

By leveraging the transformative power of technology, maritime education and training are poised to undergo a significant revolution. This digitalization journey promises to create a dynamic learning landscape equipped to address the challenges and opportunities of the modern maritime world.

2. LITERATURE REVIEW

The following pages delves into the literature review section of the paper.

2.1 Introduction

The maritime industry is undergoing a significant transformation, driven by technological advancements and evolving operational demands. To ensure a competent and skilled workforce capable of navigating these complexities, maritime education and training (MET) institutions are increasingly integrating advanced technologies into their curriculum. This chapter delves into the existing body of literature surrounding the integration of technological advancements in MET, focusing on identifying specific technologies, analysing their effectiveness, and exploring their potential applications.

2.2 Technological Advancements

2.2.1 Simulators:

Simulators have become a cornerstone of modern MET, providing a safe and controlled environment for trainees to hone their skills and develop critical decision-making abilities.

Different types of simulators serve diverse purposes:

- Full Mission Simulators: These sophisticated simulators replicate the bridge environment of a real vessel, offering high-fidelity visuals and realistic scenarios for practicing complex navigation and manoeuvring tasks. Studies by Jensen and Østergaard-Nielsen (2018) and Pedersen (2011) highlight the effectiveness of full mission simulators in improving navigational skills, situational awareness, and crisis management.
- Part-Task Simulators: These simulators focus on specific tasks or equipment, such as cargo handling, engine room operations, or firefighting procedures. They provide a cost-effective alternative to full mission simulators and offer targeted training for specific skill development.
- Desktop Simulators: These readily accessible software programs offer basic simulations for navigation, communication, and emergency response training. They are valuable tools for individual practice and self-paced learning, particularly for remote trainees or those with limited access to maritime training facilities.

2.2.2 Multimedia Resources:

Interactive multimedia resources are revolutionizing maritime education by enhancing knowledge retention and engagement. Capretz (2017) emphasizes the effectiveness of video lectures, animations, and 3D models in delivering complex information in an engaging and visually stimulating manner. These resources are often integrated with learning management systems, allowing for personalized learning experiences and convenient access to educational materials [6].

2.2.3 Mobile Applications:

Mobile applications offer a convenient and accessible platform for maritime professionals to engage in self-paced learning and skill development. Koutsomitropoulos and Psannis (2019) highlight the potential of mobile applications for accessing course materials, completing assessments, and connecting with peers for collaborative learning. Leong and Ting (2018) further emphasize the effectiveness of mobile applications in delivering maritime-specific safety training and providing real-time situational awareness.

2.3 Effectiveness of Technology Integration

Numerous research studies have investigated the effectiveness of technology integration in MET. A study by Sjøtun and Østergaard-Nielsen (2017) found that incorporating a learning management system into maritime education significantly enhanced student performance and learning outcomes. Similarly, Østergaard-Nielsen and Pedersen (2014) demonstrated that mobile applications improved trainee satisfaction and motivation while facilitating collaborative learning and knowledge sharing.

Furthermore, research by Karlsen (2016) highlighted the cost-effectiveness of technology-based training compared to traditional classroom instruction. Simulated environments can provide realistic training experiences at a fraction of the cost associated with real-world scenarios.

2.4 Potential Applications and Future Trends

The potential applications of technological advancements in MET are vast and continue to evolve.

Key areas include:

- Bridging the Gap between Theory and Practice: Technology can bridge the gap between theoretical knowledge and practical skills by providing immersive and realistic training environments. Simulated scenarios allow trainees to apply their knowledge in a safe and controlled setting, enhancing their preparedness for real-world situations.
- Personalized Learning and Adaptive Training: Technology can facilitate personalized learning by tailoring training programs to individual needs and learning styles. Adaptive training systems can adjust the difficulty level and content based on the trainee's progress, ensuring that they are challenged appropriately and receive the most effective training.
- Developing Critical Thinking and Problem-Solving Skills: Technology can promote the development of critical thinking and problem-solving skills through interactive simulations and gamified learning experiences. Trainees are encouraged to analyse situations, make informed decisions, and adapt their strategies in response to changing scenarios.

- Enhancing Workforce Adaptability and Lifelong Learning: Technology can foster a more adaptable and lifelong learning culture in the maritime workforce. Mobile applications and online learning platforms provide readily accessible educational resources, promoting continuous learning and skill development throughout a seafarer's career.
- Compliance with Evolving Regulatory Requirements: The maritime industry is subject to frequent regulatory changes. Technology can assist in meeting these evolving requirements by providing up-to-date training materials and facilitating compliance with the latest regulations and standards.

2.5 Summary

The integration of technological advancements represents a significant shift in maritime education and training from the conventional apprenticeship type of training to the advanced concept of immersive learning. This section has explored the various technologies impacting the field, analysed their effectiveness, and discussed their potential.

3. METHODOLOGY

The following section showcases the methodology used for this paper.

3.1 Research Design

This study adopts a qualitative approach to comprehensively understand the impact of technological advancements on maritime education and training. By focusing on qualitative data collection and analysis methods, this design aims to capture the subjective experiences and perceptions of stakeholders involved in maritime education and training.

3.1.1 Qualitative Research:

Semi-structured interviews were conducted with maritime instructors and administrators actively involved in integrating technology into their training programs. The interviews explored their perspectives on challenges, opportunities, and recommendations related to technology integration in MET (Maritime Education & Training).

Focus group discussions were held with maritime trainees to delve into their experiences using various technologies for learning. These discussions allowed for open-ended exploration of preferences, challenges, and suggestions for improvement.

3.1.2 Justification of Qualitative Approach:

Qualitative research is well-suited for exploring complex phenomena and understanding the subjective experiences and perceptions of individuals. By focusing on qualitative methods, this study aims to provide rich insights into the nuanced dynamics of technology integration in maritime education and training.

3.2 Data Collection

3.2.1 Qualitative Data Collection:

Semi-structured interviews were conducted with a purposive sample of maritime instructors and administrators, capturing diverse perspectives on technology integration in MET (Maritime Education & Training).

Focus group discussions were held with separate groups of maritime trainees, allowing for in-depth exploration of their experiences using technology for learning.

3.2.2 Data Collection Instruments:

A standardized survey questionnaire was developed to measure trainees' perceptions of the effectiveness of various technological tools. The questionnaire included items related to ease of use, accessibility, engagement, and overall learning effectiveness.

Pre- and post-training assessments consisted of multiple-choice questions, open-ended questions, and practical skill evaluations designed to assess knowledge and skill development in specific maritime domains.

Semi-structured interviews were carried out to explore the experiences and perspectives of instructors and administrators. This included open-ended questions about the challenges and opportunities of technology integration, observed impacts on trainees, and recommendations for future development.

Focus group discussions were carried out to encourage open and collaborative discussions among trainees about their experiences using technology for learning. These discussions included prompts to discuss specific technologies, perceived benefits and drawbacks, and suggestions for improvement.

All data collection instruments were piloted and refined to ensure clarity and relevance.

3.2.3 Ensuring Data Quality:

Interview and focus group sessions were recorded with participants' consent and transcribed verbatim for analysis.

Qualitative data were analysed using thematic analysis to identify recurring themes and patterns in participants' responses.

3.3 Data Analysis

3.3.1 Qualitative Data Analysis:

Thematic analysis was employed to analyse interview and focus group transcripts, allowing for the identification of key themes and patterns in participants' experiences and perceptions.

3.4 Ethical Considerations

Informed consent was obtained from all participants before their involvement in the research.

Participants were assured of anonymity and confidentiality throughout the research process.

3.5 Limitations of the Study

This qualitative research study has some limitations that should be considered when interpreting the findings:

- Small sample size: The qualitative sample size was relatively small, potentially limiting the generalizability of the findings to the broader population of maritime educators, administrators, and trainees.

- Self-reported data: Participants' experiences and perceptions were based on self-reported data, which may be subject to bias and individual interpretation.
- Specific focus: The study focused on exploring the experiences and perceptions of stakeholders regarding technology integration in MET, and findings may not be generalizable to other contexts.
- Temporal scope: The study provides a snapshot of current perspectives on technology integration in maritime education and training and may not capture future developments in the field.

4. RESULTS

This section presents the findings of the research on the impact of technological advancements on maritime education and training.

4.1 Perceptions of Barriers to Technology Adoption

Participants were asked to identify the primary barriers, if any, to the widespread adoption of technological advancements in maritime education. A total of 102 responses were collected through the online survey. The responses were analysed, and the following themes emerged:

- Internet Connectivity: Several participants highlighted internet connectivity issues as a significant barrier. Limited access to reliable internet services could hinder the effective implementation of technology-based learning platforms.
- Cost Constraints: Cost emerged as a prominent concern among respondents. The expense associated with acquiring and maintaining technological resources, such as simulators or multimedia tools, was cited as a barrier to adoption.
- Need for Practical Knowledge and Simulation: Some respondents expressed the need for more practical knowledge and simulation opportunities. This suggests a perceived gap between theoretical learning and real-world application, which technology may not adequately address.
- Resistance to Change: Resistance to change, particularly among older generations of instructors or educators, was identified as a barrier. Traditional teaching methods, rooted in

outdated practices like paper chart navigation, were cited as examples of resistance to embracing modern technological tools.

- Accessibility and User-Friendliness: The accessibility and user-friendliness of technology were noted as important factors influencing adoption. Participants emphasized the importance of making technological tools widespread and easy to understand and use for both instructors and trainees.
- Intent or Motivation: Lastly, participants highlighted the importance of intent or motivation as a barrier to technology adoption. This suggests that a lack of clear objectives or incentives for integrating technology into maritime education programs could impede adoption efforts.

Overall, the responses reflect a range of concerns and challenges that may impact the widespread adoption of technological advancements in maritime education. Addressing these barriers effectively will be essential for maximizing the benefits of technology in enhancing learning outcomes and preparing future maritime professionals for the demands of the industry.

4.2 Other Insights from the Online Survey

In addition to identifying barriers, participants provided valuable insights into their experiences and perceptions regarding technology integration in maritime education. These insights offer further context and understanding of the challenges and opportunities associated with leveraging technological advancements in training programs.

Figure 1

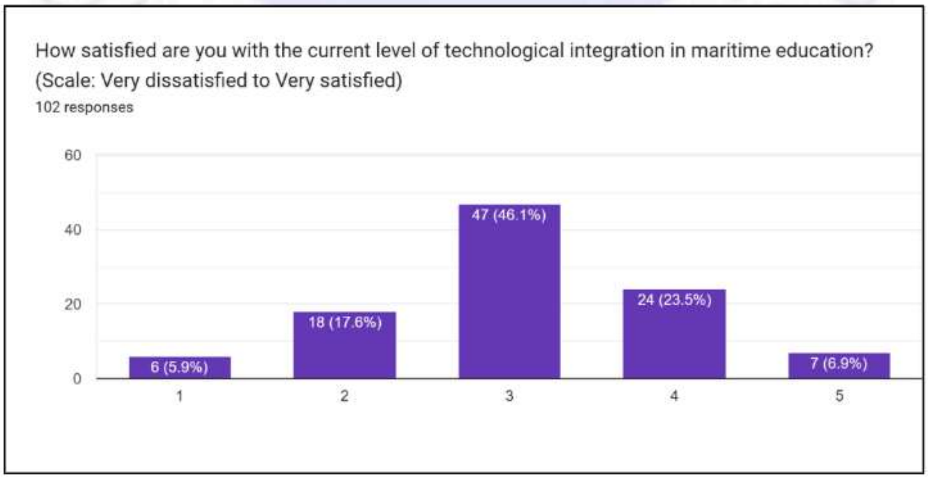
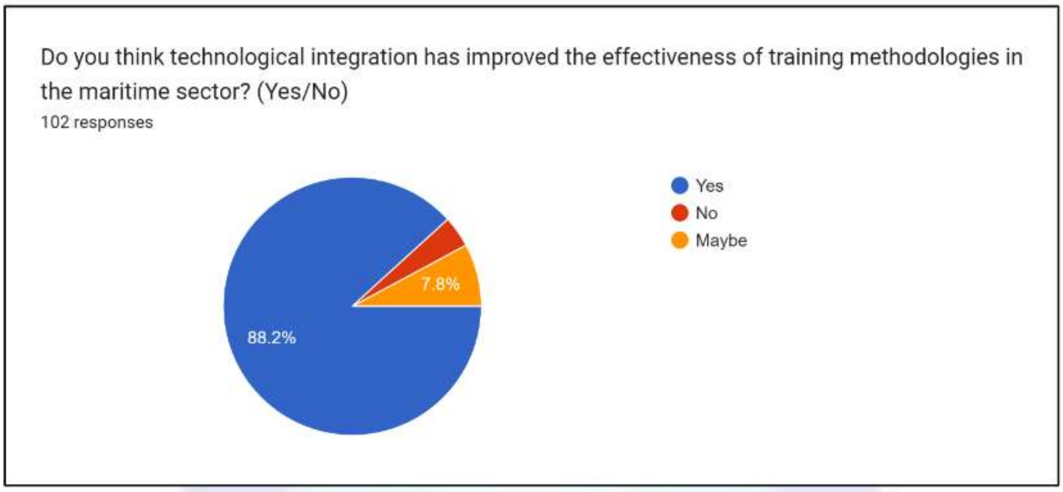


Figure 2



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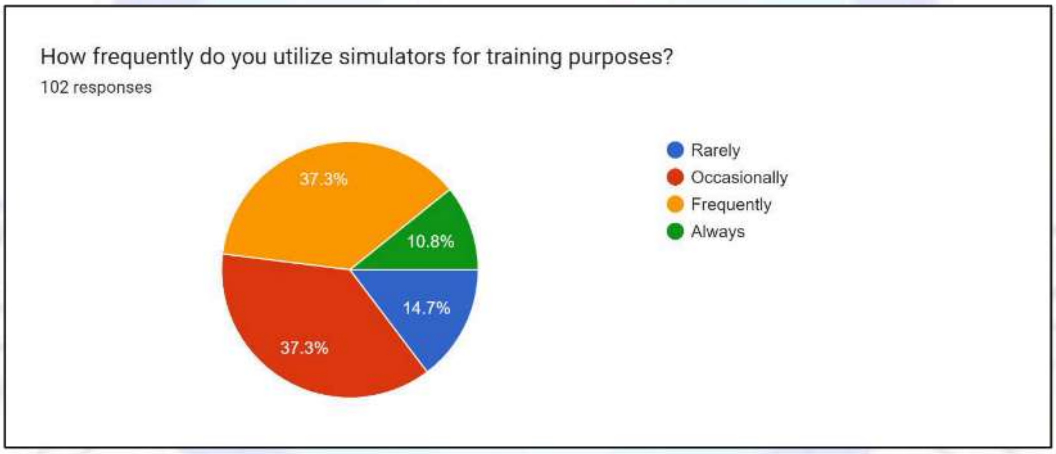

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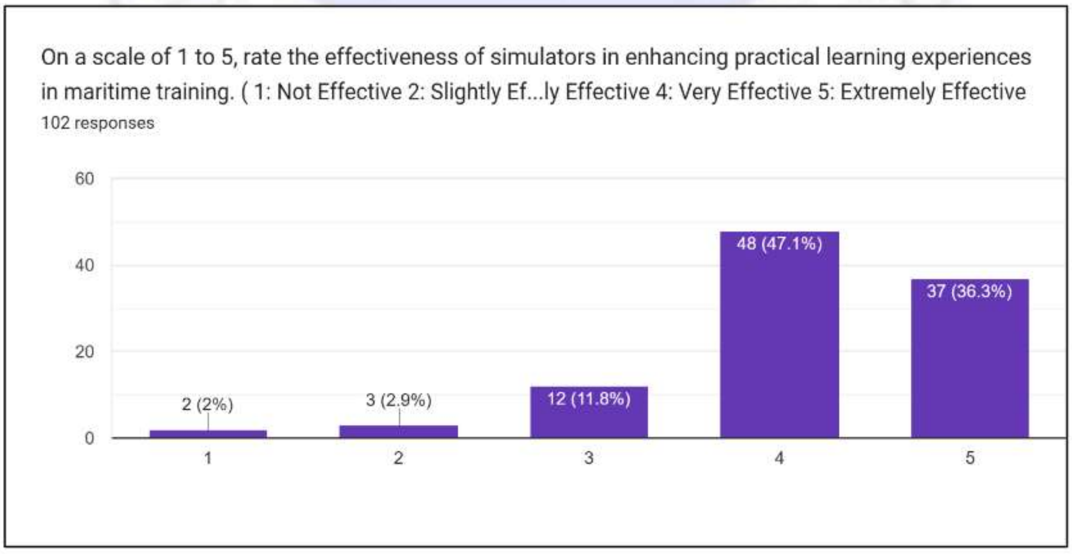

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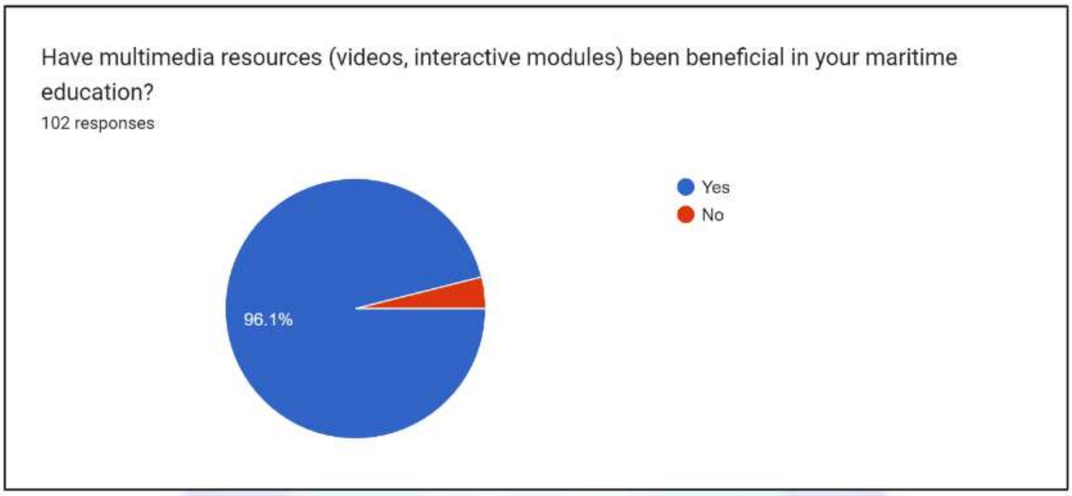
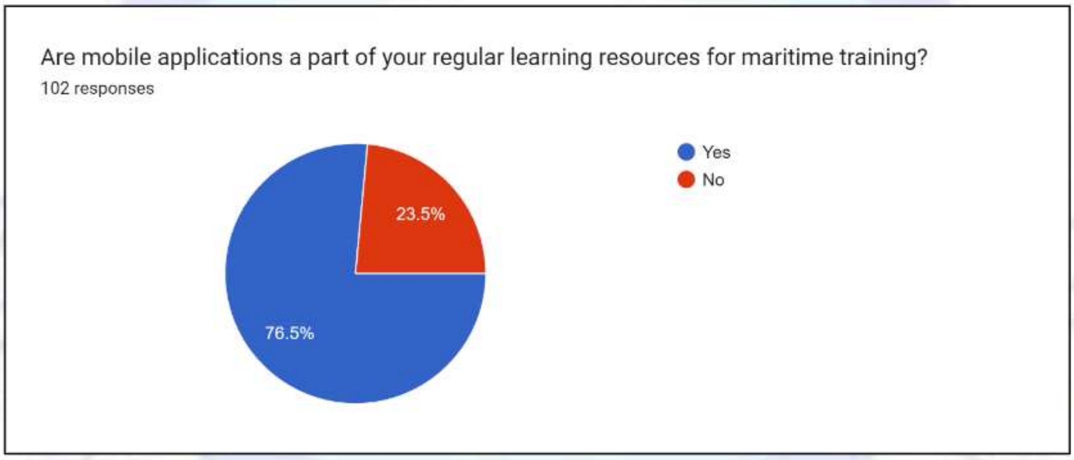


Figure 6



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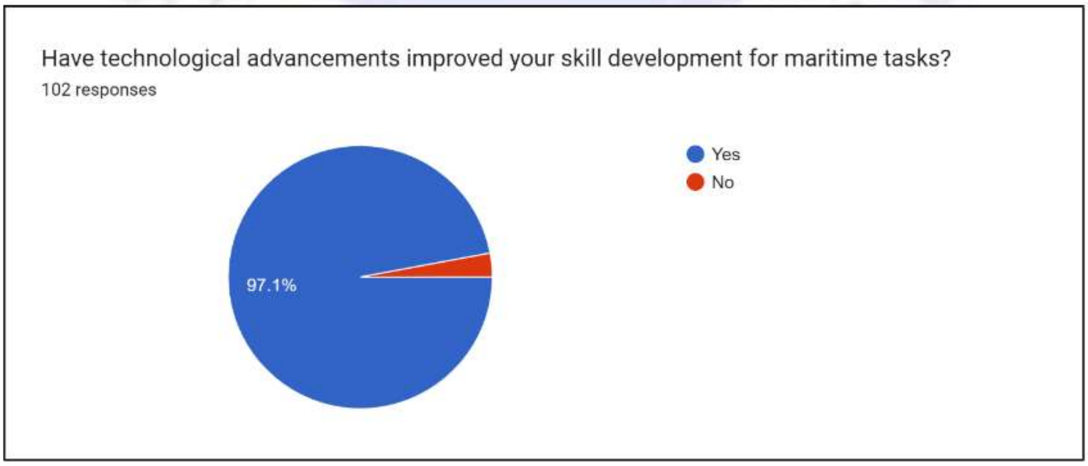


Figure 8

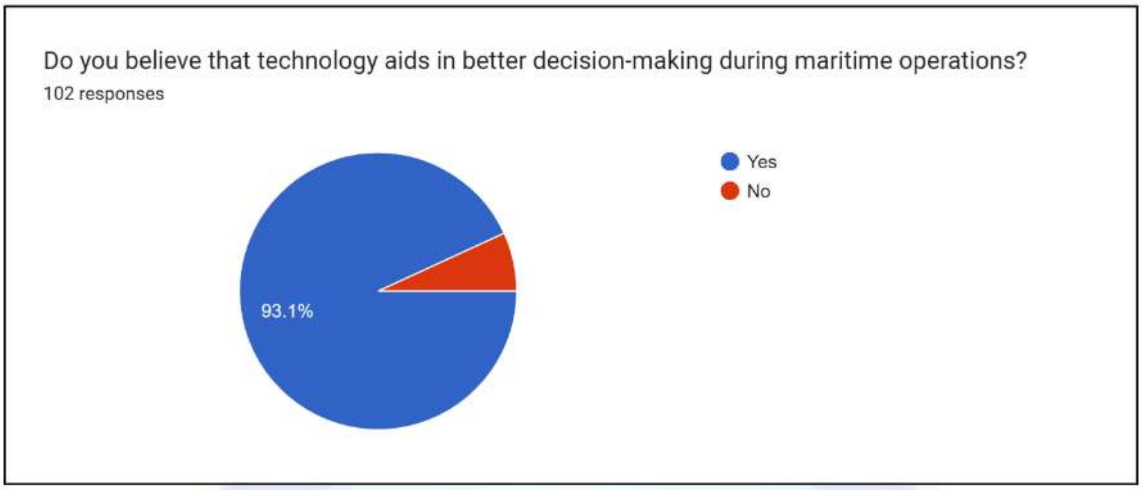
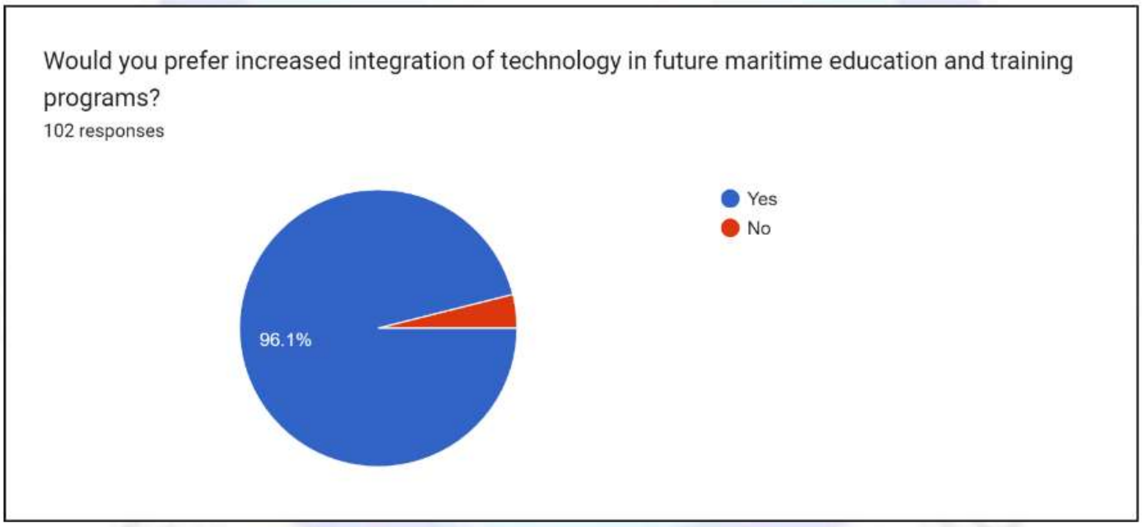


Figure 9



4.3 Areas for Technology Integration in Training

Participants were asked to identify specific areas or skills that they believe technology should focus on to enhance training outcomes. A total of 102 responses were collected through the online survey. The responses were analysed, and the following themes emerged:

- Practical Training: The majority of respondents emphasized the importance of practical training. Terms such as "practical," "practicals," and "practical training" were commonly mentioned, suggesting a strong preference for hands-on learning experiences.
- Simulation and Simulators: Participants highlighted the value of simulation-based training and simulators in enhancing learning outcomes. Terms such as "simulator," "simulation," and

"simulation-based training" were frequently mentioned, indicating a desire for immersive and realistic training environments.

- Technology-Based Learning Tools: Some respondents specifically mentioned the importance of technology-based learning tools, such as phone applications for simulator training. This suggests a recognition of the potential benefits of mobile technology in supplementing traditional training methods.
- Shift Towards Practical Examinations: A notable observation was the call for a shift towards practical examinations and assessments. Participants expressed a desire for the institutes for maritime education to adopt technology more extensively, focusing on practical examinations rather than outdated or unnecessary assessments.
- Real-Time Navigation Simulators: Real-time navigation simulators were highlighted as a specific area for technology integration. This suggests a recognition of the importance of real-world simulation experiences in preparing maritime professionals for the challenges of navigation at sea.

Overall, the responses underscore the importance of incorporating practical, simulation-based training experiences supported by technology. By focusing on these specific areas and skills, training programs can better prepare future maritime professionals for the complexities of their roles in the industry.

4.4 Qualitative Findings

4.4.1 Challenges and Opportunities of Technology Integration

Interviews with instructors, faculties and administrators highlighted several challenges associated with technology integration in maritime education and training. These included:

- High initial cost of acquiring and maintaining technology equipment.
- Lack of standardized guidelines and regulations for technology use in maritime training.
- Need for specialized training for instructors to effectively utilize technology in their teaching.

However, participants also acknowledged significant opportunities associated with technology integration, including:

- Enhanced engagement and motivation among trainees.

- Increased accessibility and flexibility of learning opportunities.
- Improved standardization and consistency in training delivery.
- Greater potential for personalized and adaptive learning experiences.

4.4.2 Trainee Perspectives on Specific Technologies

Focus group discussions revealed that trainees generally valued the immersive and realistic training environments provided by simulators. However, some participants expressed concerns about potential overreliance on simulated scenarios and the need for a balance with the real-world practical training.

Multimedia resources were praised for their ability to provide visual and interactive learning aids, but some participants noted that they could be overwhelming if not presented in a clear and organized manner. Mobile applications were seen as convenient tools for accessing information and completing assessments, but participants highlighted the need for reliable internet connectivity and user-friendly interfaces.

4.4.3 Suggestions for Future Development:

Participants provided several suggestions for improving technology-based learning in maritime education and training:

- Development of more standardized and user-friendly software specifically designed for maritime training.
- Increased investment in training instructors on how to effectively integrate technology into their teaching methods.
- Greater collaboration between technology developers and maritime training institutions to ensure that technology meets specific industry needs.
- Focus on developing technologies that promote critical thinking, problem-solving, and collaborative learning skills.

Overall, the study findings suggest that technological advancements have the potential to significantly enhance maritime education and training by providing more engaging, accessible, and effective learning experiences. However, it is crucial to address the challenges associated with technology integration, such as cost, training, and standardization, to ensure its successful implementation and maximize its positive impact on the maritime industry.

5. DISCUSSION

The following section adds further discussion to the topic explored so far.

5.1 Interpretation of Findings

The study findings reveal a complex and nuanced picture of the impact of technological advancements on maritime education and training. While the quantitative data demonstrate clear positive effects on learning outcomes, the qualitative data highlight the challenges and complexities associated with technology integration.

5.1.1 Convergence with Existing Research

The findings on the effectiveness of simulators and multimedia resources align with existing research emphasizing the value of immersive and interactive learning environments. Similarly, the positive perceptions of mobile applications corroborate research suggesting their potential for improving accessibility and self-paced learning.

5.1.2 Theoretical Frameworks

The study resonates with the constructivist learning theory, which emphasizes the active role of learners in constructing knowledge through interaction with their environment. Technological advancements facilitate this process by providing engaging and interactive learning experiences that promote active engagement and knowledge construction.

5.1.3 Limitations

The study's limitations, such as the relatively small sample size and reliance on self-reported data, should be considered when interpreting the findings. Additionally, the focus on specific technologies may not encompass the full range of technological advancements impacting maritime education.

5.2 Implications for Practice

The findings suggest several practical implications for maritime educators and training providers:

- Invest in technology: Allocate resources for acquiring and maintaining appropriate technology equipment and software.
- Develop training for instructors: Provide instructors with training on how to effectively integrate technology into their teaching practices.
- Utilize a variety of technologies: Implement a diverse range of technologies catering to different learning styles and needs.
- Promote collaborative learning: Encourage the use of technology to facilitate collaborative learning activities and knowledge sharing.
- Ensure accessibility: Address concerns regarding internet connectivity and accessibility for all trainees.
- Prioritize practical training: Balance technology-based learning with real-world practical training to ensure the development of essential skills.

5.2.1 Impact on Standards and Regulations:

The findings support the need for continuous review and update of industry standards and regulations to incorporate technology-based training methodologies. This ensures training programs remain relevant and effective in the evolving technological landscape.

5.3 Contribution to Knowledge

This research contributes to the field of maritime education and training by:

- Providing empirical evidence on the effectiveness of specific technological advancements.
- Exploring the challenges and opportunities associated with technology integration from the perspectives of both instructors and trainees.
- Offering practical recommendations for implementing technology-based learning in maritime training programs.
- Highlighting the need for further research on specific aspects of technology integration and its long-term impact on the maritime workforce.

5.4 Summary

Technological advancements have the potential to revolutionize maritime education and training, offering a pathway to more engaging, accessible, and effective learning experiences. However, successful implementation requires careful consideration of challenges, ongoing support for instructors, and continuous development of innovative technologies that cater to the specific needs of the maritime industry.

By embracing technology and adapting training methodologies, maritime education and training can contribute to a skilled and competent workforce prepared for the complexities and challenges of the future maritime environment.

6. CONCLUSION AND RECOMMENDATIONS

The further section highlights conclusion and recommendations based on the findings.

6.1 Summary of Key Findings

This study has explored the impact of technological advancements on maritime education and training (MET). The findings reveal a positive influence of various technologies, including simulators, multimedia resources, and mobile applications, on learning outcomes and trainee engagement.

6.1.1 On-line Survey Data:

- Trainees reported positive perceptions of technology effectiveness, indicating its value in enhancing learning experiences.
- Pre- and post-training assessments demonstrated significant improvements in knowledge and skill development among trainees who participated in technology-based learning activities.
- A positive correlation was found between trainees' positive perceptions of technology and their learning outcomes.

6.1.2 Qualitative data:

- Instructors, faculties and administrators acknowledged the challenges associated with technology integration, such as cost, training requirements, and lack of standardized guidelines.
- Despite these challenges, they recognized the opportunities offered by technology, including increased engagement, flexibility, and personalization of learning.
- Trainee perspectives highlighted the benefits of specific technologies like simulators for offering realistic environments and multimedia resources for enhancing understanding. However, concerns regarding overreliance on simulation and potential accessibility issues were also raised.

6.2 Conclusions

Technological advancements can significantly enhance MET by providing engaging, accessible, and effective learning experiences. Simulators, multimedia resources, and mobile applications have proven to be particularly effective in improving knowledge acquisition, skill development, and trainee engagement.

However, successful technology integration requires addressing challenges like initial cost, instructor training needs, and lack of standardization. Ongoing collaboration among technology developers, educators, and industry stakeholders is crucial for optimizing technology-based learning solutions and ensuring their alignment with evolving industry demands.

6.3 Scope for Further Work

Further research is recommended to explore the following areas:

- Longitudinal studies: Investigate the long-term impact of technology on trainees' knowledge retention, skill development, and career trajectories.
- Comparative studies: Compare the effectiveness of different technologies and instructional methods to inform optimal practices in MET.
- Cost-benefit analysis: Assess the economic feasibility of integrating new technologies into maritime training programs.

- Investigation of specific skill sets: Explore the impact of technology integration on the development of critical skills like teamwork, communication, and decision-making.
- Ethical considerations: Evaluate the ethical implications of using technology in MET, addressing issues like data privacy, algorithmic bias, and potential job displacement.

6.4 Recommendations for Practice

Maritime educators and training providers should consider the following recommendations:

- Invest strategically: Allocate resources for acquiring and maintaining appropriate technology equipment and software based on training needs and budget considerations.
- Develop instructor training programs: Provide instructors with training on effectively integrating technology into their teaching practices, including instructional design, technology troubleshooting, and effective use of learning management systems.
- Implement a diverse range of technologies: Utilize various technologies like simulators, multimedia resources, mobile applications, and online learning platforms to cater to different learning styles and needs.
- Promote collaborative learning: Encourage the use of technology to facilitate communication, interaction, and knowledge sharing among trainees.
- Ensure accessibility: Address internet connectivity and accessibility concerns to ensure all trainees have equal access to technology-based learning resources.
- Maintain a balance: Integrate technology-based learning with traditional classroom teaching and practical training to ensure holistic development of knowledge, skills, and professional competencies.
- Incorporate continuous improvement: Regularly evaluate the effectiveness of technology-based learning activities, adapt to evolving technologies and pedagogical approaches, and seek feedback from stakeholders for improvement.

6.5 Closing Remarks

This research highlights the significant potential of technology to revolutionize MET. By embracing technological advancements and implementing them thoughtfully, maritime education and training institutions can ensure a skilled, competent, and future-ready maritime workforce equipped to navigate the complexities and challenges of the 21st century maritime industry. This research serves as a foundation for further exploration and collaboration in this dynamic field, thus paving the way for continuous improvement and innovation in maritime education and training.

7. ACKNOWLEDGEMENTS

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NAVIGATING TOWARDS SUSTAINABILITY: A COMPREHENSIVE REVIEW OF GREEN FUELS FOR SUSTAINABLE SHIPPING

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Abstract

The shipping industry, a cornerstone of global trade, is facing increasing pressure to reduce its environmental impact. The investigation of alternative fuels to replace conventional fossil fuels is one important area of research. An extensive analysis of sustainable shipping fuels, such as LNG, ammonia, and hydrogen, is given in this article. Every fuel type is examined for its advancements, benefits, drawbacks, and possible role in lowering emissions in the marine industry. Insights into the prospects and difficulties facing green fuels in transportation are provided in the article's conclusion.

Keywords: Green fuels, sustainable shipping, LNG, ammonia, hydrogen, decarbonization, maritime transport.

1. INTRODUCTION

A considerable amount of the world's air pollution and greenhouse gas emissions are caused by the shipping sector. The need to discover substitute fuels that can power commercial ships with little negative influence on the environment is becoming more pressing as the globe moves towards sustainability. Ammonia, hydrogen, LNG, biofuels, and mixed fuels are examples of green fuels that provide viable ways to lower emissions and advance environmentally friendly transportation methods. This article examines these green fuels' advancements, benefits, drawbacks, and possibilities within the framework of environmentally friendly shipping.

The marine sector is under pressure to decarbonise by the year 2050. The updated International Maritime Organisation (IMO) policy for cutting greenhouse gas (GHG) emissions has established a baseline, and new national regulations—especially those from the European Union—are

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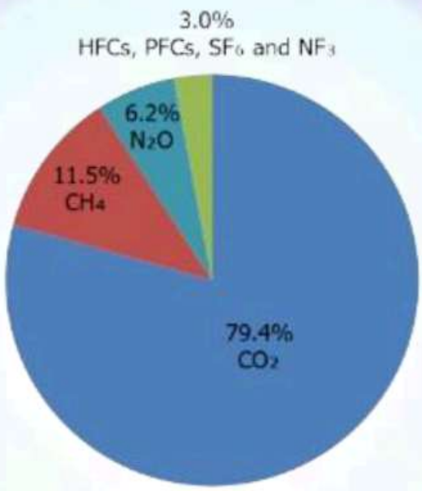
anticipated to drive additional reductions and expenses in emissions. Simultaneously, there is increasing public pressure on financial institutions, consumers, charterers, and other stakeholders to enhance sustainability. Switching to low- and zero-carbon fuels is the largest lever for reducing emissions in the maritime industry. However, the industry's fuel and technology landscape is complicated and becomes more so as numerous new possibilities emerge. A major competitive disadvantage might arise from choosing the incorrect fuel now because of client preferences and laws that are becoming more stringent tomorrow.

Figure 10 - Overview of Greenhouse Gas Emissions



Offshore vessels, due to slow steaming, causes a lot of emissions that needs to be tackled. Although a sizable portion of the fleet is now powered by heavy fuel oil/low sulphur fuel oil (HFO/LSFO), alternative fuels have recently been ordered for key newbuilding projects. To a great part, they are LNG, although methanol has also gained attention. Methanol-powered new structures have already been realised, and a sizable number of vessels are now being ordered. Ammonia is emerging as a third alternative, with initial projects being discussed. We consider the laws, engine and tank technology, bunkering infrastructure and operations, and the financial implications for both new construction and retrofits for each choice.

The transportation of goods by the marine industry has some of the lowest carbon emissions per tonne-kilometre (t.km) of any industry, accounting for only 2.9% of greenhouse gas emissions worldwide. However, as the world's commerce expands, marine shipping will be required to support other industries' low-carbon transitions, such as the transportation of lithium-ion batteries for electric vehicles and wind turbine blades. As a result, maritime emissions are predicted to rise.

The maritime industry must make progress towards decarbonisation in a variety of areas, including port building, the production and distribution of lower-carbon fuels, and the ships themselves, given their essential supply-chain position in relation to global commerce and other industries' net-zero ambitions (DNV, 2024).

Traditional fossil fuels now meet the maritime industry's energy needs satisfactorily. Nonetheless, the International Maritime Organisation (IMO) has imposed strict decarbonisation requirements and targets on the shipping sector as part of the worldwide effort to avert climate change. The shipping industry as a whole is concerned about achieving carbon-free operations nowadays. Alternative fuel solutions are among the newest and most promising possibilities available as a fuel and energy carrier. This article aims to give a useful overview of the current operational and technological information so that shipping industry players may more easily determine which alternative fuels they would like to pursue in the future (Jan Matthé, 2023).

2. AMMONIA: A POTENTIAL GREEN FUEL FOR SUSTAINABLE SHIPPING

Ammonia (NH3), a colourless gas made of hydrogen and nitrogen, is becoming more and more of a viable substitute fuel for the marine industry. Because of its high energy density and carbon-free status when derived from renewable resources, it is especially well suited for long-distance travel. However, because of its intrinsic toxicity and the necessity for cautious handling, storage, and production procedures, ammonia poses special obstacles.

Ammonia is a widely available commodity due to its broad usage as an industrial chemical, fertiliser, and refrigerant. The Haber-Bosch process, which involves the reaction of hydrogen with atmospheric nitrogen, is the main source of its synthesis.

However, the bulk of ammonia produced today is "grey" or "brown" ammonia, which is made with hydrogen from steam methane reforming. This process contributes considerably to global emissions by releasing CO2 into the atmosphere. When compared to conventional marine fuels, using brown or grey ammonia as fuel would actually result in higher well-to-wake CO2 emissions.

True sustainability requires a change in emphasis to "blue" or "green" ammonia. Green ammonia uses hydrogen from water electrolysis, which is fuelled by renewable energy sources, whereas blue ammonia collects and stores the CO2 emitted during steam-methane reforming.

Ammonia has a great deal of promise for use as a green fuel in transportation. It presents a chance to lower maritime activities' SOx and CO2 emissions. But ammonia burning results in the production of NOx and N2O pollutants, which need to be managed carefully.

Ammonia may be used in existing diesel-cycle two-stroke and Otto-cycle four-stroke engines, but due to its weak ignition characteristics, a pilot fuel—typically diesel or biodiesel—must be used. Moreover, ammonia may be cracked to create hydrogen for use in Proton-Exchange Membrane (PEM) fuel cells or utilised directly in Solid Oxide Fuel Cells (SOFC) (DNV, 2024).

2.1 Ammonia's Versatility and Potential as a Hydrogen Carrier

Ammonia (NH_3) is an important industrial product and a commonly traded commodity, typically transported in liquefied form at −33°C and atmospheric pressure. Primarily used to make fertilizers and pharmaceuticals or as a refrigerant, it is also considered a key future storage and long-distance transport medium for hydrogen.

While the liquefaction, storage and transport of pure hydrogen requires enormous energy input and is technically complex, handling ammonia is comparatively simple and established industrial practice. Furthermore, the energy density of liquefied ammonia is higher than that of liquefied hydrogen, making its transport more efficient.

2.2 Green Ammonia: Revolutionizing Decarbonization in Shipping

According to Benjamin Scholz, a DNV expert on alternative fuel systems, "green ammonia is a strong candidate as an alternative, climate-neutral fuel in the energy mix of a future decarbonised shipping fleet since ammonia combustion emits no carbon compounds."

"Green ammonia produced using hydrogen from seawater hydrolysis and renewable energy is expected to play a major role in decarbonising shipping once production capacities have been scaled up."

Diesel-cycle two-stroke engines and Otto-cycle four-stroke engines may both be powered by ammonia. Because ammonia is difficult to ignite, it needs a pilot fuel, usually biodiesel or diesel. Major ship engines manufacturers have recently announced or are developing ammonia-ready dual-fuel engines. Fuel cells can also employ ammonia. (DNV, 2024).

2.3 Engineering Challenges: Storage and Corrosion

Certain steel alloys are prone to stress corrosion cracking because ammonia is corrosive. It is consequently essential to choose the material for the equipment, pipe, and tank carefully. The available tank types differ in terms of design and manufacturing complexity, safety barriers, temperature and pressure tolerance, and space utilisation.

Compared to HFO and LNG, ammonia has a much shorter sailing range per unit of volume due to its lower energy density. Ammonia tanks can be up to four times bigger than tanks for an identical amount of HFO with the same energy content, depending on the fuel containment system selected. But ammonia doesn't need to be stored at cryogenic temperatures like LNG does. The additional room required for fuel storage may not be a major problem on bigger ship types.

Membrane tanks composed of appropriate materials and IMO Types A, B, and C may be utilised. The advice document on alternative fuels goes into detail on each tank type's benefits and drawbacks as well as the criteria for ship design.

2.4 Environmental and Safety Considerations

Ammonia is a dangerous gas that is colourless, corrosive, and extremely poisonous. Scholz notes that because it is flammable fuel, it must comply with the IGF Code and be equipped with special bunkering equipment to reduce ammonia leakage. It also has to be placed in specified safety zones and need additional crew training as outlined in the STCW Code (Seafarers' Training, Certification, and Watchkeeping). The placement of fuel tanks and pipelines must adhere to the rules of leak detection, double barriers, including thermal insulation, and segregation. Furthermore, boil-off gas control is necessary for liquid ammonia.

3. HYDROGEN: CHALLENGES AND OPPORTUNITIES FOR A GREENER MARITIME INDUSTRY

Another clean fuel being investigated for environmentally friendly transport is hydrogen. Its high energy content relative to weight and ability to burn solely create water vapour make it a desirable alternative for ships. However, the present energy-intensive nature of hydrogen generation limits

its environmental advantages as it frequently uses fossil fuels. The development of hydrogen fuel cells and storage options for marine applications is the main focus of research.

Importing and exporting hydrogen is a crucial component of the decarbonisation strategies that world leaders are formulating in the wake of the recent COP26. The World Energy Council states that the number of hydrogen partnerships worldwide is rising and is predicted to do so in the future; global commerce in hydrogen is anticipated to mirror existing trading in conventional fossil fuels. Due in large part to their availability to abundant renewable energy sources or substantial quantities of natural gas and oil, the Middle East, Africa, the United States, South America, and Australia have the greatest potential to become the world's top exporters (Høifødt, 2022).

Decarbonising hydrogen is a necessary step that will take all of our renewable energy resources together. Developing nations may meet this demand by exporting green hydrogen made from their abundant solar and wind energy. To support their decarbonisation plans, Northeast Asia—which includes South Korea, Japan, and Europe—will probably be the region that imports the greatest amounts of hydrogen.

International hydrogen commerce is made feasible in large part by the marine industry, but in order for hydrogen to be a practical substitute that speeds up the shift to clean energy, new ports, supporting infrastructure, and supply chains must be developed. Global hubs for the import and export of hydrogen are anticipated to emerge in areas where they may complement national decarbonisation policies and expand on current trade connections with port terminals (Jan Matthé, 2023).

3.1 Ports: A Catalyst for the Development of Hydrogen Hubs

There are multiple ways to use hydrogen power in shipping and the port industry. Ports can catalyse the development of hydrogen hubs by becoming international centres for hydrogen production, application, import and transport to other countries. Hydrogen hubs can be defined as an area where various users of hydrogen across industrial, transport and energy markets are co-located. Hubs help to minimize the cost of infrastructure and support economies of scale in producing and delivering hydrogen to customers as well as facilitating cross-sector opportunities for innovation and collaboration. The development of hydrogen hubs is gaining momentum worldwide, as indicated by recent collaborative efforts:

3.1.1. In Europe, the Port of Rotterdam plans to use hydrogen imported from places around the globe, such as Latin America, the Middle East, North Africa and Australia, to supply hydrogen to Europe. The Port of Rotterdam Authority and many port-based companies are preparing to build the infrastructure required for a complete system of local and international supply and demand, developing Rotterdam as one of Europe's hydrogen hubs. In neighbouring Belgium, the ports of Antwerp and Zeebrugge signed a Memorandum of Understanding (MoU) with the government of Chile to set up a corridor to speed up green hydrogen flows between South America and Western Europe. Other European ports, such as Hamburg and Valencia, are also forming alliances to promote the use of hydrogen in collaboration and with the support of the European Union.

3.1.2. In North America, Apex Clean Energy, Ares, EPIC Midstream, and PCCA (Port of Corpus Christi) will explore the development of green hydrogen production, including a new pipeline and a green fuels hub at the US Port of Corpus Christi in the state of Texas.

3.1.3. In Australia, the Port of Newcastle is partnering with Macquarie Group's Green Investment Group and the Commonwealth Government's Australian Renewable Energy Agency (ARENA) to support the development of a green hydrogen hub at the port.

3.1.4. In Japan, the Port of Kobe is exploring the potential of using hydrogen and ammonia under a government strategy to establish itself as a carbon-neutral port by 2050. The port is looking to develop hydrogen import, storage and supply infrastructure for a targeted 2030 start-up as part of efforts to assist the proposed fuel shift inside the port and adjacent areas. Kobe is already accommodating Japan's first hydrogen import terminal with the first international import of liquefied hydrogen occurring in 2021, with hydrogen from Australia being shipped to Kobe LH2 terminal.

Green hydrogen is one of the most promising and mature technologies that can be implemented at a sufficient scale globally and in a timely fashion to move society away from fossil fuels. The largest obstacle to implementation is not having the ability to transport green hydrogen from where it is produced to the end user at the required scale. Today, there is no ready-made solution to ship green hydrogen in the required quantities to where it is needed.

Hydrogen needs to be decarbonized, and this will require the full capacity of our worldwide renewable energy production. Developing countries could respond to this need by exporting green hydrogens produced by the wind and solar energy they possess in abundance. Worldwide maritime trade relationships between net exporters and net importers will need to be established to support this process.

The development of supply chain logistics, supporting infrastructure and new ports will be an essential link to support hydrogen trade. Ports have the opportunity to become the catalyst for the development of hydrogen hubs at both ends—export and import.Potential applications of hydrogen through hydrogen hubs extend across the transport, industrial and energy sectors.

Applications could include import and export of hydrogen and derivatives; storage and distribution through multimodal transport for delivery to customers; production of green hydrogen; hydrogen / ammonia bunkering for ships; implementation of hydrogen fuel cell technology for port vehicles and equipment; hydrogen refuelling stations for local transport, such as cars, trucks and buses; and support for various industries by generating heat, electricity or chemical feedstock (Jan Matthé, 2023).

4. THE ROLE OF LNG IN THE TRANSITION TO A DECARBONIZED MARITIME INDUSTRY

Some merchant ships are currently using LNG as fuel since it emits fewer emissions than conventional marine fuels. Because of its established infrastructure and supply chain, it is a practical solution for lowering air pollution in the maritime sector. Nevertheless, LNG does not completely remove greenhouse gas emissions because it is still a fossil fuel.

LNG has a chance to lower emissions of NOx, PM, and greenhouse gases (GHG). IMO NOx Tier III standards can be met with the use of Selective Catalytic Reactor (SCR) or Exhaust Gas Recirculation (EGR) systems, which can cut NOx emissions by up to 80%, depending on engine technology. Although they are not officially controlled, PM emissions have also significantly decreased. GHG emissions must take into account both CO2 and CH4 (methane), the latter of which is released as a result of incomplete combustion (methane slip). The whole fuel value chain, which includes the manufacture, transportation, and distribution of fuel, has methane leaks that add to the global greenhouse gas footprint. More information and thoughts on these topics are given in the paragraphs that follow.

4.1 100-year vs. 20-year Global Warming Potential

Global Warming Potential (GWP) variables are frequently calculated using two distinct methods when accounting for methane emissions from LNG engines: The usual metric is the 100-year GWP (GWP100). This indicates that methane has 28 times the potency of CO2 as a greenhouse gas. b) The 20-year Greenhouse Gas Potential (GWP20) indicates that methane has 84 times the potency of CO2 as a GHG. Put differently, methane degrades quickly—its estimated mean half-life is 9.1 years—but it has a significantly higher warming impact in the short term. The question of whether to use GWP100 or GWP20 to indicate the effectiveness of lowering GHG emissions is being debated in this context.

The Intergovernmental Panel on Climate Change (IPCC) developed the GWP and uses it to highlight the challenges of comparing components with different physical attributes with a single metric. The GWP100 is currently commonly used as the default measure after being endorsed by the Kyoto Protocol and the UN Framework Convention on Climate Change (UNFCCC). This is because, given the long-term nature of the issue, we ought to focus on finding solutions that will have the greatest overall long-term effects. When accounting for methane emissions, DNV employs the UNFCCC methodology and solely the GWP100 factor of 28 (DNV, 2024).

4.2 Fuel systems and engines

Certain factors are taken into account while bunkering and storing LNG on board as an ultra-cooled liquid, in contrast to standard fuel oil propulsion systems, where LNG is burnt as a gas in the engine. Natural gas has a low flashpoint (below 60°C), which raises a number of safety-related issues and regulations. The International Code of Safety for Ships using Gases or other Low-flashpoint Fuels (IGF Code), which covers regulations for ships utilising low-flashpoint fuel generally, lays out the particular criteria. The laws that cover the functional criteria related to petrol fuel (LNG) are the main emphasis of its present form. The particular functional criteria outlined in Section 3 of the IGF Code may be used to establish the fundamental safety rules that govern the various sections and elements of a gas infrastructure.

Since LNG has a much lower energy density than HFO, a lot more room is needed to carry the requisite amount of fuel on board. This extra volume lowers the amount of cargo space that is accessible. The tank types listed below are designed to transport cryogenic liquid gases and can also be used to fuel petrol:

- Type A
- Type B
- Type C
- Membrane

At the moment, Type B prismatic tanks, Type C tanks, and membrane tanks are the tank types used for LNG fuel. The standard cargo tank designs need to be adjusted for fuel tanks in order to meet the requirements of the IGF Code and take different filling levels into account. The next subsections address the advantages and disadvantages. The advantages of Type B and Type C tanks are combined in new hybrid designs that are becoming close to market ready, such the lattice tank and the Bi-Nut tank. These designs include:

- The good space utilization of prismatic tanks
- The safety concept and higher design pressure of Type C tanks.

Special consideration needs to be given to the different gas fuel tank filling levels. The fill level decreases from the highest (95%) to the least (10%) throughout a cruise. Tank loads are largely affected by the intermediate levels. Particularly when building LNG fuel tanks, sloshing loads must be taken into account as they are highly dependent on the actual fill level.

5. CONCLUSION

The shipping industry is at crossroads, facing the urgent challenge of transitioning from a reliance on fossil fuels to sustainable energy solutions. This comprehensive review has explored the potential of three leading green fuels: ammonia, hydrogen, and LNG, offering a nuanced analysis of their strengths, limitations, and future prospects.

Ammonia presents a compelling case for decarbonization, particularly green ammonia produced using renewable energy. Its high energy density and carbon-free combustion make it well-suited for long-distance shipping, although challenges related to its corrosive nature, toxicity, and established infrastructure require careful consideration.

Hydrogen, while boasting a high energy content and clean combustion, faces significant hurdles in its production and distribution. However, as technologies advance and renewable energy sources become more widely available, green hydrogen could play a crucial role in achieving a decarbonized maritime sector. LNG, already adopted by a growing number of vessels, offers an immediate solution for reducing emissions compared to traditional fuels. However, its reliance on natural gas, a fossil fuel, means it is not a long-term solution for achieving net-zero emissions.

The success of these green fuel hinges on several key factors. Strong policy frameworks, including regulations, incentives, and financial support, are crucial to encourage the adoption of green fuels and create a level playing field for their deployment. Governments and international organizations must prioritize investment in research, development, and infrastructure to pave the way for a widespread shift to sustainable fuels. Continued technological advancements are critical for improving the efficiency, safety, and cost-effectiveness of green fuel production, storage, and utilization. Collaboration between industry players, researchers, and policymakers is essential to address the challenges and capitalize on the opportunities presented by each green fuel.

The transition to a decarbonized maritime sector will not be linear. It will require a concerted effort, a long-term commitment, and a willingness to adapt as technology evolves and new challenges emerge. However, the potential of green fuels to reduce emissions and promote sustainable shipping practices is undeniable. By embracing innovation, fostering collaboration, and implementing sound policies, the maritime industry can navigate a path towards a cleaner, more sustainable future.

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NAVIGATING THE FUTURE: THE IMPACT OF AR AND VR IN MARITIME TRAINING AND EDUCATION

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Abstract

In the ever-evolving world of maritime training and education, technological advancements are revolutionizing how seafarers are prepared for their roles. Augmented Reality (AR) and Virtual Reality (VR) are emerging as powerful tools, offering immersive, interactive, and highly effective training experiences. This paper explores how AR and VR are transforming maritime training by creating enhanced learning environments, improving safety, providing cost-effective training solutions, and enabling remote training and collaboration. Additionally, it delves into various technologies that enhance VR experiences, such as haptic gloves, haptic suits, VR treadmills, eye tracking, motion capture systems, brain-computer interfaces, and spatial audio technology. The integration of these technologies promises to further bridge the gap between virtual experiences and physical sensations, paving the way for more engaging and realistic training applications in the maritime industry. As AR and VR technologies continue to advance, their applications in maritime training and education are expected to expand, ensuring that seafarers are equipped with the necessary skills and knowledge to navigate the challenges of the sea safely and effectively.

Keywords: Augmented Reality (AR), Virtual Reality (VR), Maritime Training, Immersive Technologies, Safety Training & Seafarer Education.

1. INTRODUCTION

In the rapidly advancing field of maritime training and education, technological innovations are significantly enhancing the methods used to prepare seafarers for their demanding roles. Two of the most impactful technologies in this space are Augmented Reality (AR) and Virtual Reality (VR), which provide immersive, interactive, and highly effective training experiences. These technologies are not only transforming traditional training practices but also introducing new

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possibilities for engaging and realistic simulations. Augmented Reality (AR) and Virtual Reality (VR) are both immersive technologies that alter our perception of reality. A brief explanation of each is as follows:

Augmented Reality (AR): AR overlays digital information, such as images, videos, or 3D models, onto the real world. This is typically done through a smartphone, tablet, or AR headset, which uses the device's camera and sensors to detect the user's surroundings and superimpose digital content onto it. AR enhances the user's perception of the real world by adding contextual information or digital objects (Klingenberg, 2022).

Virtual Reality (VR): VR creates a completely immersive digital environment that simulates reality. This is typically achieved through a VR headset, which completely blocks out the real world and replaces it with a computer-generated environment. VR allows users to interact with and navigate through this digital environment as if it were real.

1.1 Enhanced Learning Environments

AR and VR technologies create highly realistic and immersive training environments that simulate real-life scenarios. For maritime students, this means being able to practice skills and navigate through complex scenarios in a safe and controlled environment. VR allows students to experience challenging situations such as adverse weather conditions, emergencies, and navigation challenges without the risks associated with real-world training (Zahira Merchant, 2014).

1.2 Improved Safety and Risk Mitigation

Safety is paramount in the maritime industry, and AR and VR technologies play a crucial role in enhancing safety measures. By providing hands-on training in a simulated environment, these technologies help students develop the skills needed to handle emergencies and critical situations, reducing the risk of accidents at sea.

Moreover, AR can overlay important information, such as navigation data or equipment operation instructions, directly onto the trainee's field of view, enhancing situational awareness and decision-making.

1.3 Cost-Effective Training Solutions

Traditional maritime training methods often require significant resources, including ships, equipment, and facilities. AR and VR offer cost-effective alternatives by providing realistic training experiences without the need for physical resources. This not only reduces training costs but also allows for more frequent and accessible training opportunities, ultimately leading to a more skilled and prepared workforce.

1.4 Remote Training and Collaboration

AR and VR technologies enable remote training and collaboration, allowing maritime students and professionals to participate in training sessions and simulations from anywhere in the world.

This is particularly beneficial for seafarers who may be at sea for extended periods, as it allows them to continue their training and skill development without having to be physically present in a training facility.

2. TECHNOLOGIES THAT WILL ENHANCE VR EXPERIENCES

Enhancing the virtual reality (VR) experience involves integrating various technologies that increase immersion, realism, and interaction capabilities. The following technologies are some of them:

2.1.1. Haptic Gloves: These gloves provide tactile feedback to the user's hands, allowing them to feel virtual objects and textures. This is achieved through mechanisms like vibrations, force feedback, and resistance.

2.1.2 Haptic Suits: Similar to haptic gloves but covering more of the body, haptic suits can deliver sensations like touch, pressure, and temperature across the torso, arms, and legs. These suits are especially useful in VR applications that aim to simulate physical environments realistically, such as training simulations or gaming.

2.1.3. VR Treadmills: These devices allow users to walk or run in any direction while remaining in the same physical space. VR treadmills enhance the sense of movement within the virtual environment, making it more engaging and realistic.

2.1.4. Eye Tracking: By tracking the user's gaze, VR systems can adjust what the user sees more naturally and intuitively. This technology can also enhance interaction within the virtual environment, allowing users to select or manipulate objects just by looking at them.

2.1.5. Motion Capture Systems: These systems track the user’s real-world movements and translate them into the virtual environment. This allows for more accurate and realistic avatar animation, improving the user's sense of presence in the virtual world.

2.1.6. Brain-Computer Interfaces (BCIs): BCIs can detect user intentions based on brain activity, allowing for control of the virtual environment through thought alone. This technology could lead to new levels of immersion and interaction, particularly for users with mobility limitations.

2.1.7. Spatial Audio Technology: Advanced audio processing that mimics the way sound behaves in real environments can greatly enhance the sense of space and presence in VR. Spatial audio helps in determining the direction and distance of sounds, making the virtual environment more convincing.

Each of these technologies plays a role in bridging the gap between virtual experiences and the physical sensations and interactions we expect in the real world. Integrating one or more of these can significantly enhance the quality and engagement level of VR applications (Kuvvetli, 2023).

3. FUTURE PROSPECTS AND INDUSTRY ADOPTION

As AR and VR technologies continue to advance, their applications in maritime training and education are expected to expand. From enhanced simulation capabilities to the integration of artificial intelligence for personalized learning experiences, the future of maritime training looks promising with the integration of these technologies.

In conclusion, AR and VR technologies are transforming maritime training and education by providing realistic, immersive, and cost-effective training solutions. By embracing these technologies, the maritime industry can ensure that seafarers are equipped with the skills and knowledge needed to navigate the challenges of the sea safely and effectively.

Integrating Augmented Reality (AR) and Virtual Reality (VR) into conventional teaching methods can revolutionize the learning experience by making it more engaging, interactive, and effective. In a classroom setting, AR can be used to overlay digital content, such as 3D models or videos, onto physical objects, textbooks, or whiteboards, providing students with a more immersive and interactive learning experience. For example, students studying anatomy can use AR apps to visualize and explore the human body in 3D, enhancing their understanding of complex structures and functions (Abdul-Hadi Ghazi Abulrub, 2011).

Similarly, VR can transport students to virtual environments that simulate real-world scenarios, allowing them to explore concepts in a hands-on and experiential way. For instance, history students can virtually visit ancient civilizations or witness key historical events, providing them with a deeper understanding and appreciation of the subject matter.

Furthermore, AR and VR can personalize learning experiences by catering to individual learning styles and pace. For example, students can interact with virtual simulations that adapt to their responses, providing real-time feedback and guidance based on their performance.

Overall, integrating AR and VR into conventional teaching methods can transform education by making it more engaging, interactive, and personalized, ultimately enhancing student learning outcomes.

Both AR and VR have numerous applications across various fields, including training:

Medical Training: AR and VR are used to simulate medical procedures, surgeries, and anatomy for medical students and professionals. This allows them to practice in a safe and controlled environment before performing procedures on real patients (Jacob Lahti, 2023).

Military Training: AR and VR are used for military training simulations, allowing soldiers to practice combat scenarios, vehicle operations, and mission planning in a realistic virtual environment.

Aviation and Aerospace: AR and VR are used to train pilots and astronauts, simulating cockpit environments, flight scenarios, and space missions to enhance their skills and preparedness.

Engineering and Manufacturing: AR and VR are used to simulate engineering designs, assembly processes, and maintenance procedures, allowing engineers and technicians to visualize and practice tasks in a virtual environment before implementation in the real world.

Retail and Marketing: AR is used in retail for virtual try-on experiences, product visualization, and interactive shopping experiences. VR is used for virtual store tours and immersive brand experiences.

Sports Training: AR and VR are used in sports training to analyse player performance, simulate game scenarios, and enhance coaching techniques (Chiara Bassano, 2020).

Construction and Architecture: AR and VR are used to visualize architectural designs, simulate construction processes, and plan building layouts, improving efficiency and safety in construction projects.

Overall, AR and VR are versatile technologies that are transforming training across various industries by providing realistic, immersive, and interactive learning experiences.

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OUTCOMES-BASED EDUCATION IMPLEMENTATION IN SEAMANSHIP 2 TOWARDS A PROPOSED DETAILED TEACHING SYLLABUS

John Michael D. Mazuela[1]

Abstract

This study was undertaken to explore the implementation of outcomes-based education (OBE) in Seamanship 2 instruction and to assess the student's level of acquired knowledge in the aforementioned course through an examination. Using a Descriptive Research Design through a quantitative approach, the study evaluated the level of the implementation of outcome base education of the Seamanship 2 course based on the collective perspectives of 130 second-year student-respondents taking up Bachelor of Science in Marine Transportation (BSMT) students from the Asian Institute of Maritime Studies who recently completed the Seamanship 2 course during the first trimester of AY 2022-2023, as well as their respective technical instructors. The statistical tools used in this study were frequencies, percentages, Pearson-r product correlation, and T-test of independent means. The study found that both groups of respondents agreed that the course syllabus utilized in the said subject is compliant with the implementation of the key principles and guidelines of the OBE approach, particularly in the areas of course outcomes, learning objectives, teaching and learning, instructional materials, and assessment. The researcher recommends that the proposed Detailed Teaching Syllabus for Seamanship 2 be adopted as this embodies the necessary elements of an OBE-driven course delivery.

Keywords: OBE, Seamanship 2, course syllabus, teaching and learning.

1. INTRODUCTION

The quality of Filipino seafarers depends firstly on their level of competency which includes knowledge, behaviour, attitude as well as the preferred sets of technical skills that will enable them to successfully perform their respective tasks on board and deliver the expectations of relevant stakeholders. These technical skills are manifestation of the Knowledge, Understanding, and Proficiency prescribed in the relevant Tables of Competences of the STCW Code, as

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amended. Seafarers can acquire the fundamental competencies through education and training that foster a balance between theoretical cognition and practical skills acquisition.

To realize such, it is crucial that every Maritime Higher Education Institutions (MHEIs) in the country to adopt and comply with the stipulated principles of the Outcomes-Based Education. Outcomes-Based Education (OBE) is an educational approach that focuses on defining what students should know and be able to do at the end of a learning experience. Instead of traditional methods that emphasize what content is to be taught, OBE gives emphasis on the desired learning outcomes or competencies. This approach is particularly relevant in the field of maritime education, where a sufficient level of practical skills, as underpinned by theoretical knowledge, is crucial in being able to demonstrate a prescribed competence.

The transition in education towards an outcome-based approach bears similarities to the overall quality movement in the maritime field. It reflects the idea that figuring out where cadets are and where they want to be first, then working backward to figure out the best route to get there, is the effective method for people and organizations to get where they want to go. The process of reorganizing curriculum, evaluation, and reporting procedures in education to emphasize high-order learning and mastery rather than the accrual of course credits is a core principle of OBE.

The principle of the OBE is one of the tools employed in the delivery of instructions and assessments as enshrined from the earlier regulatory instruments such as the CMO 67, JCMMC 1 s. 2019 up to the recent regulation named JCMMC 1 s. 2023. This simply means that Maritime Higher Education Institutions (MHEIs) authorized to offer the Bachelor of Science in Marine Transportation (BSMT) must ensure that the delivery of various professional courses in the curriculum should adopt the OBE framework.

While the Commission on Higher Education (CHED) provides the Course Specifications which highlight the Course Outcomes to be realized in each course, every MHEIs in the country can design and develop their courses over and above the minimum requirements.

This means that MHEIs can tailor their detailed teaching syllabus according to the needs of the institution by identifying the teaching-learning activities, material, and assessment and making sure that these elements are constructively aligned to the course and learning outcomes of the subject with due regard to their institutional capacity.

A detailed teaching syllabus is a document that outlines the structure and content of a course. It serves as a roadmap for both instructors and students, providing information about what will be covered during the course, assessment methods, and other important details. Simply put, the detailed teaching syllabus must be carefully crafted with the intent of processing and achieving the desired course or learning outcomes of the subjects and be able to convert these theoretical underpinnings into practical skills that can have a direct application in an on-board setting.

Seamanship 2 having the descriptive title of Trim, Stability, and Stress is one of the significant courses of the BSMT program. This course is per Table A-II/1 of the SCTW Code under the function of Controlling the Operation of the Ship and Care for Persons On-board at the Operational level. The course aims to provide students with the necessary knowledge, understanding, and proficiency that cover the fundamental concepts of ship design, theories, and factors that affect trim and stability, as well as the basic understanding of watertight integrity and the basic procedures to follow in the case of a partial loss of intact buoyancy. The subject entails the principles of OBE as reflected in its detailed teaching syllabus contents, activities, and assessment procedures.

As of this writing, the researcher has only found the article by Singhai, Gargiulo, and Venugopal (2019) which examines the role of outcomes-based education in teaching seamanship skills to beginners. Accordingly, teachers who use an outcome-based approach can help students achieve better levels of comprehension and knowledge while also fostering a more engaging learning environment. They also give instances of how this approach has been effective in teaching novices seamanship skills based on their research. They also go over several difficulties related to putting an outcomes-based approach to teaching seamanship skills into practice. These include the requirement for teachers to be knowledgeable about various learning styles, the time needed to construct outcome-based syllabuses and assessments, and the challenge of evaluating student progress concerning predetermined goals. Additionally, they point out that this technique would need extra supplies or equipment, which might increase costs.

Another interesting article to note is presented by Watson, Smith, and Trenton (2018) wherein it discusses the potential of outcomes-based education in seamanship instruction. According to the authors, outcomes-based education may be a potent tool for raising student engagement, advancing learning goals and enhancing general performance. They also give an example of how this strategy has been effectively applied in a university context based on their study. In addition, they talk about the difficulties in putting such an approach into practice and provide solutions.

Withstanding, the fundamentals and principles of OBE as must be incorporated in the Seamanship 2 course are not thoroughly explored and analysed. Considering that the application of the subject skills and competencies must be processed by the components as used in Detailed Teaching Syllabus. However, its educational approaches in terms of teaching and learning activities, objectives, instructional materials, and assessment procedures in harnessing the knowledge, understanding, and proficiency of the maritime students in various fundamental and advanced topics incorporated in Seamanship 2 course yet remained to be seen. These gaps present the picture of the study wherein if the components of the DTS in the said course are aligned according to the expectations of the OBE key implementing guidelines. Though it is assumed and expected that the said subject must conform with the OBE approach as it is mandated by the Commission, nevertheless, the actual content of the detailed teaching syllabus along with its components are yet to be examined and analysed in the pursuit of the implementation of the OBE.

1.1 Objectives of the Study

This paper aimed to explore the yielding results of implementing an outcome-based education (OBE) approach when teaching Seamanship 2. The researcher investigated the level of implementation of the course in terms of course outcomes, learning outcomes, teaching and learning activities, instructional materials, and assessment. An examination of student-acquired knowledge on the subject area measured their performance according to Course Outcomes. After gathering all necessary information from different sources, conclusions and recommendations for a proposed detailed teaching syllabus for Seamanship 2 would be provided as an output of the study.

1.2 Review of Literature

Joint CHED-MARINA Memorandum Circular (JCMMC) No.1 Series of 2023, contains the amended Policies, Standards, and Guidelines (PSG) created to maintain a quality assurance process for the formation, recognition, and awarding of qualifications to graduates of the Bachelor of Science in Marine Transportation (BSMT) and Bachelor of Science in Marine Engineering

(BSMarE) programs following Philippine Qualification Framework (PQF) Level 6 and international standards.

Additionally, the revised PSG aims to maintain the global competitiveness of BSMT and BSMarE graduates, particularly the Filipino Seafarers working as Officers in charge of Navigational Watch for international shipping, by making the programs more responsive to industry needs and further ensuring compliance of the programs with the relevant requirements of the STCW Convention, 1978, as amended. This PSG brings the change to outcome-based education into practice. Regardless of the type of Higher Education Institution (HEI) a graduate came from, it accepts the skills anticipated of BSMT and BSMarE graduates as stated under the STCW Convention, 1978, as amended. The Joint Circular defines outcomes-based education as a method of education that organizes and focuses the educational system. Once intended results or exit outcomes have been defined, the strategies, methods, and techniques are put in place to reach predetermined targets. This is done by focusing on what is vital for all learners to know, value, and be able to achieve a desired degree of competence. In essence, it is operating backward with the learning-teaching milieu's primary focus being the students.

It is with this thought the Philippine as one of the STCW's signature parties is consequently accountable for complying with the criteria, particularly with regard to guaranteeing that the training and education established by the Convention are in line with each other. Hence, as pointed out on the study of Pabutawan (2023) wherein the researcher investigated the Outcomes-Based Education (OBE) using the Philippine maritime education and training (MET) system. As emphasized in the study, Philippines is one of the STCW's signature parties' convention, hence it is accountable for following the guidelines. MHEIs in the Philippines have integrated the OBE concept into their curricula, along with national laws and the conditions of the STCW Convention. Philippine educational system has changed as a result of the OBE approach's incorporation into several elements, including the creation of curricula, instructional strategies, and evaluations, and the use of equipment. This connection is elucidated in their comprehensive instructional course materials. The OBE methodology emphasizes the creation of learning outcomes that are precisely defined in terms of student competencies, with an emphasis in particular on education motivated by outcomes particularly in making sure that the training and education requirements established by the Convention.

According to Biggs and Tang (2011), the first step in an outcome-based strategy is to create clear and pertinent learning outcomes for any program, course, or even learning material. They believe that learning objectives are statements of what students should be able to perform upon completion of a particular program or course of study and that all teaching, learning, and assessment activities should be directed toward achieving these planned learning goals. The authors add that "the concept of constructive alignment" corresponds to this idea, which is to communicate intended goals with action verbs pointing toward outcomes students may demonstrate.

As such, the course title and the number of hours allocated to deliver the necessary competence, knowledge, understanding, and proficiency for the various functions listed in Table A-II/1 as well as the specific knowledge and understanding listed in Table A-II/2 of the STCW Code that are covered by this program are included in the curriculum map in JCMCC No. 1 Series of 2023. The first method of providing the curriculum for the BSMT program is to go over the information, knowledge, abilities, and competencies that students need to acquire and demonstrate by the end of the course. Thus, MHEIs must follow and adhere to the prescribed structure, teaching methods, and media of delivery, learning activities, and assessments to ensure the achievement of the intended learning outcomes and the prescribed standards of competence under the STCW Convention, 1978, as amended. They must also make sure that the necessary facilities, equipment, and other instructional support are provided and available.

Furthermore, based on the premise of Roxas (2018), on his study on the Outcomes- Based Education Implementation Among Maritime Schools in Region XI, wherein the study was carried out to confirm the level of Outcomes Based Education (OBE) implementation among the Maritime institutions in Region XI. The researcher concluded that the respondents' awareness, comprehension, and knowledge of OBE were lacking. Additionally, a moderate correlation between the implementation's level of awareness and expertise was discovered. As a result, the study suggested that the relevant institutions hold an OBE orientation. Finally, in order to reach a comprehensive knowledge, additional research could be done.

In the course, Seamanship 2 (Basic Stability), an exploration of strategies, instructional materials, and assessment has been conducted to understand the level of implementation. Strategies employed have included theoretical learning approaches such as lectures and computational tasks. These strategies allow students to gain a thorough understanding of the material being learned. Instructional materials used include textbooks, videos, online resources etc., that are designed to provide relevant information and aid in student comprehension of the topics covered within stability theory. Assessment activities include written tests, practical exams, and group work assessments among others which evaluate student knowledge on different aspects related to basic stability theory. All these components are essential for the successful implementation of this course as they ensure that students receive sufficient instruction to build mastery over their subject matter (Somayaji, 2019).

Related research has indicated that there is a positive correlation between student performance and the implementation of instructional materials and assessment activities (Anderson et al., 2009; Chang et al., 2018; Kim & Lee, 2019). This suggests that there may be room to improve upon existing course syllabi to better equip students with the knowledge necessary for success in Seamanship 2 (Basic Stability). The purpose of this study, therefore, is to propose a detailed teaching syllabus based on research findings, with a focus on improving the effectiveness of teaching strategies employed during the Seamanship 2 course.

2. RESEARCH DESIGN

The study utilized the descriptive design to evaluate the level of the implementation of outcome-based education in the Seamanship 2 course and to present the student's level of acquired knowledge in the aforementioned course through a written examination.

The study also employed a quantitative approach in the sense that the data collected using questionnaires and written examination tests are numerical in character and were analysed using appropriate statistical tools.

2.1 Participants

The researcher selected second-year students who have already taken and completed the Seamanship 2 course for the SY 2022-2023. In determining the total number of student-respondents, a total of 130 students-respondents was established. Employing a quota sampling technique, this accounted for 10 students from each of the 13 sections.

On the part of the teacher-respondents, the researcher chose the whole population of technical instructors who were able to handle the said subject. There are a total of 12 Technical Instructors who responded to the data-gathering instruments.

2.2 Instrument

The researcher utilized two (2) primary research instruments employed in the present study:

i. First, to determine the level of implementation of the OBE principles in the instructional delivery of the Seamanship 2 course based on the viewpoint of the respondents, a researcher-made survey questionnaire composed of a total of 25 questions was used. Each OBE principle has a total of five (5) statement indicators.

ii. On the other hand, to determine how student respondents performed in the course Seamanship 2 vis-à-vis the prescribed course outcomes, a written examination or test was provided to the respondents. The written examination or test is composed of 30 multiple choice questions on the foundational and theoretical stability knowledge and four (4) situational and computational problems requiring analysis and application of underpinning knowledge.

2.3 Data Analysis

A quantitative analysis was facilitated to identify trends or patterns between different strategies, instructional materials, assessments, and course outcomes. The statistical tools used in the current study were Mean and Standard Deviation in presenting the level of implementation of the OBE Principles in the following areas of instructional delivery of the Seamanship 2 course.

Frequency, Percentage, Mean, and Standard Deviation to show the student-respondent's performance in the course Seamanship 2 in terms of its Course Outcomes.

Independent Sample T-Test to show the difference between the assessment of the two groups of respondents on the level of implementation of the OBE Principles in the instructional delivery of the Seamanship 2 course as well as the corresponding significance, and Pearson-r correlation to show the degree of relationship that exists between the level of implementation of the OBE Principles and the student performance in Seamanship 2.

2.4 Data Gathering Procedure

To ensure the integrity of the responses, surveys and examinations were administered during face-to-face classes only.

The researcher explained the content of the questionnaire to the respondents upon distribution and gave them one hour to answer the test questions. After completing the test, they were provided with survey questions which must be answered within a maximum of 20 minutes. This procedure was conducted per section - from one classroom to another - until a target number of respondents was reached. The researcher then checked each completed test and scored students' performance according to a zero-base grading system.

3. RESULTS AND DISCUSSION

The researcher explained the content of the questionnaire to the respondents upon distribution and gave them one hour to answer the test questions. After completing the test, they were provided with survey questions which must be answered within a maximum of 20 minutes. This procedure was conducted per section - from one classroom to another - until a target number of respondents was reached. The researcher then checked each completed test and scored students' performance according to a zero-base grading system.

Table 1 - The Level of Implementation of the OBE Principles in terms of the Course Outcomes of the Seamanship 2 Course

Statement Indicators	Instructors		Students		Group	
	Mean	Int.	Mean	Int.	Mean	Int.
1. The instructor explicitly communicates the expected Course Outcomes in terms of its components such as the course coverage, expected skills, and STCW learning competencies during the course orientations.	3.17	Implemented	3.45	Implemented	3.31	Implemented
2. The instructor ensures that the Course Outcome statements are aligned to the KUP (Knowledge, Understanding, and Proficiency) that the course aims to address.	3.33	Implemented	3.33	Implemented	3.36	Implemented
3. The instructor explains the meaning and purpose of the course outcome based on the requirements of the STCW before the start of class discussion.	3.08	Implemented	3.40	Implemented	3.24	Implemented

4. The instructor checks the objectives of the lesson prior to the start of the class discussion in order to align the expected skills of the topic to the STCW.	3.42	Implemented	3.38	Implemented	3.40	Implemented
5. The instructor ensures that the students can be able to demonstrate the expected learning in the IMO standard of competencies.	3.33	Implemented	3.43	Implemented	3.38	Implemented
The Level of Implementation of the OBE Principles in terms of the Course Outcomes of Seamanship 2	3.27	Implemented	3.41	Implemented	3.34	Implemented

LEGEND: 1.00 – 1.49, Not Implemented; 1.50 – 2.49, Slightly Implemented; 2.50 – 3.49, Implemented; 3.50 – 4.00, Thoroughly Implemented

Reflected in Table 1 is the respondent's response on the level of implementation of the OBE Principles in instructional delivery of the Seamanship 2 course in terms of Course Outcome. Accordingly, the result indicates that both groups of respondents indicated Mean=3.34 that the level of implementation was carried out accordingly adhering to the premise and fundamentals which the instructor of the subject, explicitly explained the expected course outcomes that are directly aligned with the STCW course requirements and KUP (Knowledge, Understanding, and Proficiency). This can be seen in the responses of the respondents in statement no. 4 which states "The instructor checks the objectives of the lesson before the start of the class discussion to align the expected skills of the topic to the STCW" having the highest mean rating of 3.42 (SD=0.67) and 3.38 (SD=0.67) as indicated by the instructor and student-respondents, respectively, all indicative of the implementation of the OBE principles in the subject.

This implies that, both of the respondents believed that the instructor of the Seamanship 2 Course has implemented the principles of the OBE by considering the course extent, scope, and coverage of the topic prior hand as to align the KUP (Knowledge, Understanding, and Proficiency) that the course aims to address. By doing such, the students of the subject are fully aware of the expected skills, and STCW learning competencies they need to acquire and demonstrate at the end of the course outcomes. Thus, both the instructor and the students of the course have a sense of clear directions on what are the expectations, duties, and responsibilities towards the learning success of the subject matter.

This notion conforms to the study of Damit et al., (2021) emphasizing that if the students understood the concepts of the course outcomes, the OBE principles will eventually be manifested in the specific content of the lesson fostering greater flexibility and adaptability in courses and programs ensuring they align with industry standards and regulatory requirements while maintaining quality.

Table 2 - The Level of Implementation of the OBE Principles in terms of the Learning Outcomes of the Seamanship 2 Course

Statement Indicators	Instructors		Students		Group	
	Mean	Int.	Mean	Int.	Mean	Int.
1. The instructor focuses on the actual performance as required on the STCW in maintaining the quality of learning.	3.42	Imple mented	3.41	Imple mented	3.41	Impleme nted
2. The instructor unlocks students' interdependency skills according to their level of interest which is covered by the Course outcomes.	3.42	Imple mented	3.38	Imple mented	3.40	Impleme nted
3. The instructor holistically integrates the lesson based on outcomes-based principles which are congruent with learner's needs and maritime industry demands.	3.42	Imple mented	3.39	Imple mented	3.40	Impleme nted
4. The instructor carefully examines the content of the learning outcomes along with essential KUP requirements set out in STCW prior with the utilization of the course syllabus.	3.42	Imple mented	3.38	Imple mented	3.40	Impleme nted
5. The instructor ensures that the learning outcome is specific and comprehensive for students to demonstrate the standard skills and competencies of the STCW.	3.42	Imple mented	3.41	Imple mented	3.41	Impleme nted
The Level of Implementation of the OBE Principles in terms of the Course Outcomes of Seamanship 2	3.42	Imple mented	3.39	Imple mented	3.41	Impleme nted

LEGEND: 1.00 – 1.49, Not Implemented; 1.50 – 2.49, Slightly Implemented; 2.50 – 3.49, Implemented; 3.50 – 4.00, Thoroughly Implemented

Discussed in Table 2 is the level of implementation of the OBE principles in terms of the Learning Outcomes. It must be noted that both of the respondents firmly believed that the instructor was able to communicate the desired learning outcomes of the course, hence, the premise of the OBE principles was thoroughly implemented accordingly. This uniform agreement is seen in the three statements which attained a similar mean rating of 3.41. This agreement is reflective of the weighted mean the respondents gave in the fifth indicator which states: "The instructor ensures that the learning outcome is specific and comprehensive for students to demonstrate the standard skills and competencies of the STCW" having a mean rating of 3.42 for teacher-respondents while a mean rating of 3.41 for student, respectively. Collectively, this fifth statement has a mean rating of 3.41 which is interpreted as "Implemented".

Similar statement affirms that the instructor of the subject does implement the OBE principles essentially with the learning outcomes along with essential KUP requirements set out in STCW prior to the utilization of the course syllabus. This can be seen in the first statement which states: "The instructor focuses on the actual performance as required on the STCW in maintaining the quality of learning" having a mean rating of 3.42 for teacher while 3.41 for student-respondents, respectively. Collectively, it has attained a mean rating of 3.41 which is verbally interpreted as "Implemented".

Overall, the result indicates a mean rating of 3.41 wherein both of the groups of respondents agree that OBE Principles in terms of the Learning Outcomes of the Seamanship 2 Course have been carefully and meticulously implemented. This simply implies that the syllabus of the said subject is congruent with the learner's needs and maritime industry demands as it was examined by the instructor in charge ensuring that the process and implementation of the OBE key guidelines conform with acceptable international standards of competencies.

Table 3 - The Level of Implementation of the OBE Principles in the Teaching and Learning Activities of the Seamanship 2 Course

Statement Indicators	Instructors		Students		Group	
	Mean	Int.	Mean	Int.	Mean	Int.
1. The instructor adopts variety of instructional activities that are highly engaging and interactive in nature which elicits students' interest to participate.	3.50	Imple mented	3.32	Imple mented	3.41	Impleme nted
2. The instructor utilizes wide range on the selections and variations of the activities as to process student's different learning needs.	3.33	Imple mented	3.35	Imple mented	3.34	Impleme nted
3. The instructor ensures that the learning activities are rich, interactive, and fun that process the practical application of the lesson.	3.33	Imple mented	3.40	Imple mented	3.37	Impleme nted
4. The instructor employs effective teaching style which tailors to the lessons in addressing each student's individual interests, needs, and strengths allowing the students the flexibility on how they learn.	3.42	Imple mented	3.32	Imple mented	3.37	Impleme nted
5. The instructor considers the objectives of a lesson, then provides students with flexible learning options about the content as to satisfactory meet the KUP and course outcomes.	3.33	Imple mented	3.35	Imple mented	3.34	Impleme nted
The Level of Implementation of the OBE Principles in terms of the Course Outcomes of Seamanship 2	3.38	Imple mented	3.35	Imple mented	3.36	Impleme nted

LEGEND: 1.00 – 1.49, Not Implemented; 1.50 – 2.49, Slightly Implemented; 2.50 – 3.49, Implemented; 3.50 – 4.00, Thoroughly Implemented

Manifested in Table 3 is the respondent's indication of the level of implementation of the OBE Principles in instructional delivery of the Seamanship 2 course in terms of Teaching and Learning activities. Accordingly, the result indicates that both groups of respondents agreed Mean=3.36 that the instructor of the aforementioned subject consider the series of activities that will facilitate the learning process which, based on effective delivery of instructions, are fun and practical encompassing the skills need to be acquired in Seamanship 2. This is supported by the third statement which states: "The instructor ensures that the learning activities are rich, interactive, and fun that process the practical application of the lesson" having the highest mean rating of 3.33 and 3.40 as indicated by the instructor and student-respondents, respectively, all indicative of the implementation of the OBE principles in the field of discipline. Similar results can be seen from other statements wherein the students' needs, interests, cognitive level, and other pertinent factors that may affect the academic performance of the learners are taken into consideration by the instructor to satisfy the key components of the OBE implementing guidelines.

This connotes, in the homogeneity of all indicative responses, both of the respondents believed that the instructor of the Seamanship 2 Course has implemented the principles of the OBE by making the lessons interactive and interesting through instructional learning activities that are highly engaging and interactive which elicits students' interest to participate. This ensures that the process conforms to the features and characteristics of the OBE wherein the learning activities did not only meet the target objective and course competencies but essentially students have fun in the learning process since the theoretical implications of the lessons were converted into practical application making it more comprehensive, highly engaging and interactive which elicits students' interest to participate. As a result, both of the respondents were able to meet the needs of the subject matter considering that there is a wide range of variety of instructional materials which cater to various intellectual and personal needs of the students.

Table 4 - The Level of Implementation of the OBE Principles in the Instructional Materials of the Seamanship 2 Course

Statement Indicators	Instructors		Students		Group	
	Mean	Int.	Mean	Int.	Mean	Int.
1. The instructor meticulously selects learning materials such as textbooks, reference books, supplementary reading materials, and the like which the content is carefully examined to be aligned to the content of the course outcomes and prescribed skills of STCW Conventions.	3.42	Implemented	3.28	Implemented	3.35	Implemented
2. The instructor provides substantial and adequate learning materials to aid and process	3.42	Implemented	3.27	Implemented	3.34	Implemented

the content of the course program towards the full implementation of OBE course design.						
3. The instructor utilizes wide array of instructional learning materials which ranging from printed to digital platforms that accommodates students' various learning needs.	3.50	Imple mente d	3.30	Imple mente d	3.40	Impleme nted
4. The instructor regularly monitors, inspects, and recalibrates outdated learning materials as to meet the demand of the subject learning area.	3.42	Imple mente d	3.32	Imple mente d	3.37	Impleme nted
5. The instructor ensures that learning materials utilized in every topic/lesson are relevant to the objectives and KUP of the subject towards the realization of the course outcomes.	3.25	Imple mente d	3.35	Imple mente d	3.30	Impleme nted
The Level of Implementation of the OBE Principles in terms of the Course Outcomes of Seamanship 2	3.40	Imple mente d	3.31	Imple mente d	3.35	Impleme nted

LEGEND: 1.00 – 1.49, Not Implemented; 1.50 – 2.49, Slightly Implemented; 2.50 – 3.49, Implemented; 3.50 – 4.00, Thoroughly Implemented

Manifested in Table 4 is the respondent's indication of the level of implementation of the OBE Principles in instructional delivery of the Seamanship 2 course in terms of instructional materials. Based on the results, the instructor-respondents affirmed that the instructional materials utilized are consistently monitored and updated to serve their purpose having a mean rating of 3.42 while the student-respondents also confirmed that the instructor manages to use a wide array of instructional materials ranging from various learning needs and interest of the students which attained a mean rating of 3.32.

Furthermore, the type of content, the given examples, and the quality of the activities as well are considered by the instructor in selecting, modifying, and adapting a localized wide array of instructional learning materials which range from printed to digital platforms that accommodate students' various learning needs.

This connotes, in the homogeneity of all indicative responses, both of the respondents believed that the instructor of Seamanship 2 Course has implemented the principles of the OBE by selecting relevant materials such as textbooks, reference books, supplementary reading materials in all of which, are aligned to the content of the course outcomes and prescribed skills of STCW Conventions. As a result, there a substantial and adequate learning materials to aid and process the content of the course program towards the full implementation of OBE course design.

This result attests to the study of Biggs and Tang (2011), where the first step in an outcome-based strategy is to create clear and pertinent learning outcomes for any program, course, or even learning material. They believe that learning objectives are statements of what students should be able to perform upon completion of a particular program or course of study, and that all teaching, learning, and assessment activities should be directed toward achieving these planned learning goals. The authors add that "the concept of constructive alignment" corresponds to this idea, which is to communicate intended goals with action verbs pointing toward outcomes students may demonstrate.

Table 5 - The Level of Implementation of the OBE Principles in the Assessment of the Seamanship 2 Course

Statement Indicators	**Instructors**		**Students**		**Group**	
	Mean	**Int.**	**Mean**	**Int.**	**Mean**	**Int.**
1. The instructor utilizes formative assessment to determine the progress of the students based on the lesson's objectives and course learning outcomes in order to improve students learning.	3.58	Implemented	3.32	Implemented	3.45	Implemented
2. The instructor conducts remedial intervention in order to monitor and address student's learning needs and weaknesses.	3.17	Implemented	3.22	Implemented	3.19	Implemented
3. The instructor utilizes variety of assessment methods in order to process and accommodate the diversity of the students as to ensure that the scope and competencies of the course outcomes and STCW conventions are essentially covered in the assessment.	3.33	Implemented	3.32	Implemented	3.33	Implemented
4. The instructor comprehensively employs standard rubrics in assessing the specific skills, knowledge, and attitude in order to ensure that these domains are matched with the STCW requirements.	3.25	Implemented	3.31	Implemented	3.28	Implemented
5. The instructor objectively assess the students based on the coverage and criteria of the course outcomes starting from the least learned competencies to the most essential skills to acquire.	3.58	Implemented	3.35	Implemented	3.46	Implemented
The Level of Implementation of the OBE Principles in terms of the Course Outcomes of Seamanship 2	3.38	Implemented	3.30	Implemented	3.34	Implemented

LEGEND: 1.00 – 1.49, Not Implemented; 1.50 – 2.49, Slightly Implemented; 2.50 – 3.49, Implemented; 3.50 – 4.00, Thoroughly Implemented

As manifested on Table 5 is the level of implementation of the OBE principles in terms of the Assessment. It can be noted that both of the respondents clearly indicated that in order to achieve and process the expected skills and competencies, clear procedures through formative and summative assessment should be untaken in order to measure the baseline level of the students itself and the intended direction as to mitigate any learning gap towards the desired outcomes of the course syllabus. This agreement on the level of implementation was evident in the fifth statement which states: "The instructor objectively assess the students based on the coverage and criteria of the course outcomes starting from the least learned competencies to the most essential skills to acquire" having a mean rating of 3.58 indicated by the instructor-respondents while mean rating of 3.35 for student-respondents, respectively. Combining these results attained a group mean rating of 3.46 which has the highest rating for the assessment criteria.

Similar indicative result can be seen on the second statement which states: "The instructor conducts remedial intervention in order to monitor and address student's learning needs and weaknesses" having a mean rating of 3.17 for teacher-respondents, while a mean rating of 3.22 for student, respectively. This statement attained a group mean rating of 3.19 which is verbally interpreted as "Implemented". This implies that statement manifested is indicative of the agreement on the level of OBE implementation focusing on the assessment tools, procedures, and objectives to address any gaps in the learning process considering that the data from these assessments serve as a baseline for any learning intervention.

Overall, the result indicates a mean rating of 3.34 wherein both groups of respondents agreed on the level of Implementation of the OBE Principles in terms of the Assessment of the Seamanship 2 Course has been methodically implemented. This connotes, that the instructor objectively assesses the students based on the coverage and criteria of the course and learning outcomes covering all the essential KUP of the applicable competencies. This further implies that whether the assessment is individual, pair, group, or collaborative tasks, formative or summative, the results of which are essential in crafting action plan or modification in further improving the syllabus with the end goal of assisting the students in their knowledge and skills development.

This conforms to the study of Somayaji (2019), where Assessment activities include written tests, practical exams, group work assessments among others which evaluate student knowledge on different aspects related to basic stability theory. All these components are essential for the successful implementation of this course as they ensure that students receive sufficient instruction to build mastery over their subject matter. This related research also indicated that there is a positive correlation between student performance and the implementation of assessment activities.

Table 6 - Summary of the level of implementation of the OBE Principles in the instructional delivery of the Seamanship 2 course

Instructional Delivery Areas	**Instructors**			**Students**			**Group**		
	Mean	**SD**	**Int.**	**Mean**	**SD**	**Int.**	**Mean**	**SD**	**Int.**
Course Outcomes	3.27	0.70	Implemented	3.41	0.60	Implemented	3.34	0.61	Implemented

Learning Outcomes	3.42	0.70	Implemented	3.39	0.59	Implemented	3.41	0.60	Implemented
Teaching and Learning Activities	3.38	0.76	Implemented	3.35	0.66	Implemented	3.36	0.66	Implemented
Instructional Materials	3.40	0.56	Implemented	3.31	0.61	Implemented	3.35	0.61	Implemented
Assessment	3.38	0.62	Implemented	3.30	0.61	Implemented	3.34	0.61	Implemented
Overall Level of Implementation of the OBE Principles in the Instructional Delivery of Seamanship 2	3.37	0.62	Implemented	3.35	0.58	Implemented	3.36	0.58	Implemented

LEGEND: 1.00 – 1.49, Not Implemented; 1.50 – 2.49, Slightly Implemented; 2.50 – 3.49, Implemented; 3.50 – 4.00, Thoroughly Implemented

Reflected in Table 6 is the Summary of Respondents' level of implementation of the OBE Principles in the instructional delivery of the Seamanship 2 course. It indicates that both groups of respondents agreed that the entire process and nature of the course instructional delivery were aligned and adoptive of the key principles of Outcomes-Based Education (OBE).

Moreover, the explicit course outcomes, learning outcomes, teaching and learning activities, instructional materials, and assessment process, are holistically aligned and integrated into the course syllabus to assist the learners in acquiring the required Knowledge, Understanding, and Proficiency for the applicable competence being developed in the course Seamanship 2 based in STCW 1978, as amended.

These aforementioned components of the course syllabus are clearly demonstrated by the instructor. Likewise, both group of respondents agreed that teaching and learning activities were attuned to characteristics of the OBE approach. The needs, interests, and individual needs of the students are highly considered enabling the learning process to be student centred. As a result, both of the respondents agreed that the instructional learning materials are carefully identified, selected, and even modified just cater the various learning materials particularly the obsolete ones towards the full implementation of OBE course design.

Thus, the assessment procedures are comprehensively utilized as to accommodate the diversity of the students' needs as to ensure that the scope and competencies of the course outcomes and STCW conventions are essentially covered in the assessment and matched with the STCW requirements. The main purpose of assessment is to identify, monitor, and address student's learning needs and weaknesses as a basis for remedial intervention for a continuous cycle of improvement.

The overall mean rating for the level of implementation of the OBE principles in the instructional delivery of Seamanship 2 attained 3.37 for instructor-respondents while 3.35 for the student-respondents, comprising the overall group rating of 3.36 which is interpreted as Implemented.

Table 7 - Student-respondents' Performance in the course Seamanship 2

Course Outcome Statement	Score Ranges	Description	Frequency	Percentage
Calculate ship stability in compliance with the IMO intact stability criteria under all conditions of loading.	26 – 34	Passed	103	79%
	Below 26	Failed	27	21%
Mean Score			27.06	
Standard Deviation			3.36	
Interpretation			PASSED	

LEGEND: Total Items is 34, Zero-based grading is applied, 26/34 or 76% is the passing mark.

Indicated in Table 7 is the performance of the student-respondents in the course Seamanship 2 in terms of its Course Outcomes. Accordingly, students need to calculate ship stability in compliance with the IMO intact stability criteria under all conditions of loading. A 34-item examination was administered with a passing rate of 76% or a raw score of 26. Furthermore, the scores obtained by the students in the written examination are designed and administered to measure their ability to meet the foundational knowledge and computational requirements of the course outcome statement of Seamanship 2.

Based on the result, there were 103 students, or 79% who obtained range scores of 26 – 34 and passed the examination that contains questions relevant to foundational trim, stability, and stress knowledge as well as questions that reflect situation or word problems that require computational skills acquired in the said subject area. This implies that the course outcomes were articulated and delivered effectively covering all components of the syllabus. As a result, the majority of the student-respondents were able to meet the expectations and convert into their performance in the subject. However, there were only 27 students, or 21% who were not able to get a passing score of 26.

Overall, student respondents' performance in the course Seamanship 2 attained a mean rating of 27.06 which is interpreted as Passed. However, this passing rate cannot only be attributed primarily on the instructional delivery of Seamanship 2 as the main indicator. Instead, this can be on the characteristic of the OBE considering that it is spiral in approach, this academic performance of the students can also be attributed to the reality that at the time of this written examination, one year had already passed since the student-respondents took Seamanship 2 and therefore, they are now in a more advanced year level and exposed to more seamanship courses that possibly augments the learnings they acquired when they were students in Seamanship 2.

Table 8 - T-Test of Significant Difference between the assessment of the two groups of respondents on the level of implementation of the OBE Principles in the instructional delivery of the Seamanship 2 course.

Instructional Delivery Areas	Instructor		Students		Computed t-value	p-values	Decision If p = or < 0.05, reject Ho	Interpretation
	Mean	SD	Mean	SD				
Course Outcomes	3.27	0.70	3.41	0.60	-0.779	0.437	Accept Ho	NOT SIGNIFICANT
Learning Outcomes	3.42	0.70	3.39	0.59	0.127	0.899	Accept Ho	NOT SIGNIFICANT
Teaching and Learning Activities	3.38	0.76	3.35	0.66	0.185	0.853	Accept Ho	NOT SIGNIFICANT
Instructional Materials	3.40	0.56	3.31	0.61	0.510	0.611	Accept Ho	NOT SIGNIFICANT
Assessment	3.38	0.62	3.30	0.61	0.444	0.658	Accept Ho	NOT SIGNIFICANT
Overall Level of Implementation of the OBE Principles in the Instructional Delivery of Seamanship 2	3.37	0.62	3.35	0.58	0.106	0.916	Accept Ho	NOT SIGNIFICANT

In terms of the overall level of implementation of the OBE Principles in the Instructional Delivery of the Seamanship 2 course, the assessments of the instructor group and Student group are not statistically significantly different from each other (t= 0.106, p=0.916). This means that the respondents have given a homogeneous assessment of how OBE principles are applied in providing instructions relative to the Seamanship 2 course. Both the teacher and student groups attested that OBE principles are implemented and generally observable across all areas of instructional delivery. However, the non-statistical significance of difference suggests that these findings are only true to the chosen respondents and may vary when the population is considered or at least when the sample size is increased. It is also observed that the assessments given by the two groups of respondents in each instructional delivery area are also not statistically significantly different from each other. Both groups of respondents afforded synonymous appreciation that the OBE Principles are implemented and observable in each instructional delivery area.

Table 9 - Test of Significant Relationship between the performance of the students in the Seamanship 2 course and their assessment of the level of implementation of the OBE Principles in the course's instructional delivery

Paired Variables		**The computed value of r**	**Strength of relationship**	**The computed value of r**	**Tabulated value of r at alpha = 0.05**	**p-value**	**Decision If p < or = to 0.05, reject Ho**	**Interpretation**
Instructional Delivery Area	**Student Performance**							
Course Outcomes	Student Performance in Seamanship 2 course	-0.054	Very Small Negative Correlation	-0.054	-0.175	0.539	Accept Ho	NOT SIGNIFICANT
Learning Outcomes		-0.087	Very Small Negative Correlation	-0.087	-0.175	0.326	Accept Ho	NOT SIGNIFICANT
Teaching and Learning Activities		-0.103	Very Small Negative Correlation	-0.103	-0.175	0.243	Accept Ho	NOT SIGNIFICANT
Instructional Materials		-0.112	Very Small Negative Correlation	-0.112	-0.175	0.204	Accept Ho	NOT SIGNIFICANT
Assessment		-0.096	Very Small Negative Correlation	-0.096	-0.175	0.277	Accept Ho	NOT SIGNIFICANT
Overall Level of Implementation of the OBE Principles in the Instructional Delivery of Seamanship 2		-0.096	Very Small Negative Correlation	-0.096	-0.175	0.277	Accept Ho	NOT SIGNIFICANT

LEGEND FOR STRENGTH OF RELATIONSHIP = 0, No correlation; 0.01 – 0.25, Very small positive correlation; 0.26 – 0.50, Moderately small positive correlation; 0.51 – 0.75, High positive correlation; 0.76 – 0.99, Very high positive correlation; 1.00, perfect positive correlation (for negative correlation, same ranges only with negative sign)

As shown in Table 9 above, there is a very small negative correlation between the overall level of implementation of the OBE Principles in the Instructional Delivery of Seamanship 2 and the performance of students in the written examination that covers both foundational knowledge and computational requirements of the course outcome statement of the aforementioned course or subject area (r= -0.096). This means that while there is an upward trend was observed in the student's appreciation that the OBE principles are "implemented" in the delivery of the course, an opposite movement was noticed in their performance in the written examination prepared and provided to them as a measure of their ability to realize the course outcome. However, it is important to note that this negative correlation was also found to be not statistically significant which means that it is not enough evidence to make a reasonable conclusion that the phenomenon is also true concerning the population where the sample respondents are drawn from.

This implies that though the implementation of the OBE principles was undoubtedly implemented and employed in the subject area as it covers the learning competencies, instructional learning materials, and assessment protocols, the written performance result of the students can't undermine the agreed level of OBE application. In other words, the essence and nature of such phenomenon are independent of each other, though future research needs to be conducted to affirm/deny such conditions.

This reaffirms the study of Er et al., (2019) where the researchers found teaching OBE encompassed more than an educational ideology, but most importantly instructing students in line with clear goals, developing the course syllabus that aligns with the curriculum standard to achieve desired results, encouraging a culture of continuous learning and a readiness to take on new challenges in the classroom, and expanding learning opportunities to help students reach higher levels of performance encompass teaching aligned with well-defined objectives, shaping the curriculum in accordance with desired outcomes, fostering a culture of ongoing student advancement and willingness to embrace educational challenges, and broadening learning avenues to enable students to attain elevated levels of achievement.

4. CONCLUSIONS AND RECOMMENDATIONS

Following section discusses the conclusion and recommendations in detail.

4.1 Conclusions

The instructional delivery in the subject Seamanship 2 was guided by the key OBE principles of course outcomes, learning outcomes, teaching and learning activities, instructional materials, and assessment procedures.

The majority of the students acquired the fundamental knowledge and computational requirements of the course outcome statement of Seamanship 2 which the other technical subjects augmented their learning process resulting in the passing of the written exam.

Both group of the respondents have the same perspective that the Instructional Delivery of the Seamanship 2 course are aligned to the OBE principles.

The level of appreciation of the student-respondents on how well the OBE principles were adopted in the instructional delivery in the Seamanship 2 course does not necessarily relate to their academic performance as the latter, at the time of taking the written assessment, were already in a higher year level and were exposed to advance seamanship courses which also tackles fundamental topics related to Seamanship 2.

4.2 Recommendations

A proposed detailed teaching syllabus as attached to this study may be used by the Maritime Higher Education Institutions (MHEI) and must also conduct a thorough review and orientation on the fundamentals of OBE particularly how this education system would affect an individual's work ethos in the context of school policies, curriculum, and assessment in analyzing possible limitations of its implementation.

Instructors must be exposed to various fora and training to further enhance their awareness and skills on how OBE would be customized to fit the needs of their students/learners with the in-view of making them conform to the required expectations of the industry.

Curriculum planners should revisit existing practices in the implementation of OBE in various maritime courses for professors to recalibrate instructional methods, strategies, and techniques toward a more inclusive maritime curriculum.

Strengthen the educational practices in terms of OBE assessment procedures to fully determine the immediate needs of the students and tailor the teaching approaches according to the feedback and result of students' output and performance evaluation.

Conduct further and related studies using a greater number of respondents and unexplored variables and/or factors such as the teacher factor, condition of the student during the conduct of the assessment, and the like. Moreover, conducting similar and related studies on other maritime subjects is strongly recommended.

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MENTAL AND EMOTIONAL PREPARATION FOR SEAFARERS

Dr Poonam Kapoor[1]

Abstract

Working in the Merchant Navy can be rewarding, but also demanding. Seafarers face unique challenges that can affect their mental and emotional health, such as isolation, stress, fatigue, and culture shock. To deal with these challenges effectively, seafarers need to be mentally and emotionally prepared before and during their voyage. This article highlights the need for such preparation, not only for the youngsters but also to experienced officers and crew members on board.

Keywords: Merchant Navy, Seafarers, Mental health, Emotional health, Well-being, Work performance, Interpersonal relationships.

1. INTRODUCTION

The Merchant Navy is a vital part of global trade and offers attractive career prospects for individuals. It involves extensive travel, exposure to diverse culture, high pay, tax-free income, and chances to visit new places, makes it a desirable option for many. However, it also comes with challenges, some of them are:

1. Spending long periods away from friends and family,
2. Having limited social and recreational activities with peers,
3. Continuous studies and need to clear various written and oral examinations from time to time,
4. Facing risky and dangerous situations like piracy, storms, accidents, fires, etc,

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5. Clearing medical fitness requirements and certain criteria of physical health.

Like any other career, the merchant navy has its benefits and challenges. To work in any department of the merchant navy, one has to complete specific education and training, and pass the selection processes of the employer company. This ensures that the seafarer has the necessary education, knowledge, and skill for a certain rank on board a ship. However, the industry still faces problems related to the mental and emotional well-being of its sailing staff. The industry needs to improve its preparedness to deal with the wellbeing issues of seafarers. It is vital for every seafarer to have sound mental and emotional health, and to be ready mentally and emotionally before joining a vessel. The biggest advantage of using battery and motors instead of Internal Combustion Engines is the high efficiency of power conversion from electric to mechanical through the electric motor. Secondly, the need to reduce carbon footprint has encouraged governments to support and subsidize EVs rather than conventional IC Engine driven vehicles.

2. MENTAL AND EMOTIONAL HEALTH:

Before we go further, let us understand what mental health and emotional health mean. They refer to the well-being of a person's psychological and emotional state. They are influenced by many factors, such as thoughts, feelings, emotions, behaviours, and social interactions. Mental health covers the cognitive and behavioural aspects of a person's mental state.

It includes various conditions, from depression, anxiety, to normal changes in mood, stress, and rational function. Emotional health covers the ability of a person to understand, recognize, and manage his/her emotions in a healthy and appropriate way. It involves being aware of one's emotions, regulating and expressing them in a way that does not harm oneself or others.

Mental and emotional wellbeing are related concepts that affect how we feel, think, react and act. Both are interconnected and important for overall well-being. A person's mental and emotional health can affect his/her physical health, relationships, and quality of life. It can also affect an individual's performance and productivity at work. Let us examine how and why mental and emotional health play such crucial role in a professional life of a person:

1. Performance and Productivity: When a person is mentally and emotionally balanced, he/she is better able to focus, think critically, and make sound decisions, translating into motivation, engagement, innovation, and higher productivity.

2. Resilience and Stress Management: A healthy mental and emotional state can enhance an individual's ability to cope with stress and setbacks in the workplace. It helps them bounce back from challenges, adapt to changes, and maintain a positive outlook. This prevents burnout, reduce absenteeism, and promote overall well-being in a professional setting.

3. Interpersonal Relationships: Mental and emotional health also influence a person ability to interacts. A state of mental and emotional well-being leads to better communication, collaboration, and conflict resolutions, which are essential for positive and effective interpersonal relationships in any work setting.

4. Decision Making and Problem Solving: Sound mental and emotional health gives an ability to avoid impulsive or irrational reactions and gives an ability to look for solutions in difficult situation. With the mental and emotional wellbeing comes ability to think critically, consider different perspectives, and make a thoughtful decision.

3. SOURCES OF STRESS AND ANXIETY FOR SEAFARERS: UNDERSTANDING THE CHALLENGES ON BOARD A SHIP:

Joining the Merchant Navy means being away from family, friends, and comfort zone for extended periods, which brings feelings of homesickness and isolation. This can lead to various psychological challenges such as stress, depression, and anxiety (Bhatia et al., 2019; Roberts & Marlow, 2016). Studies have shown that voyage duration, job demands, job satisfaction and turnover intentions, can significantly impact the mental well-being of seafarers (Hansen & Jensen, 2017; Kalantonis & Bohlmann, 2016; Lee & Cho, 2017).

Interpersonal issues on board, communication gaps, and stressful situations at home can also increase the anxiety and stress of seafarers. A young cadet may feel disillusioned on board a vessel as his perception of life on board is different than what he or she experiences. Some more issues faced by sea fearers on board a ship can be listed as follows:

1. Workload and work-life balance: Maintaining a healthy work-life balance can be challenging for sailing staff on board ships. Balancing work responsibilities with personal time and recreational activities can be difficult, leading to stress and reduced job satisfaction.

2. Working hours and fatigue: Sailing staff on board ships often work long hours, sometimes there may be exceeding the standard working hours, which can lead to fatigue and in some cases may impact their performance, and well-being.

3. Crew dynamics: Living and working in close quarters with a diverse crew can sometimes lead to conflicts, differences in opinions, and personality clashes.

4. Career development and growth opportunities: Limited career growth prospects and monotony on board a ship may sometimes impact the motivation and job satisfaction.

5. Uncertainty about signing off: This can be a significant source of stress for seafaring personnel. Seafarers may experience uncertainty about when they will be able to sign off due to contract extensions or delays in crew changes. This can disrupt their plans and personal commitments and create stress and anxiety.

6. The stigma: The stigma associated with mental health also pose challenges. Seafarers may hesitate to seek help due to fear of repercussions, such as losing their job or being seen as unfit for duty. This can hinder their access to counselling and support services, leading to untreated mental health issues.

7. Weather Conditions: Adverse weather conditions, like too much rolling, pitching or storm makes life on board challenging.

8. Gap in the level of competency: Sailing staff require continuous training and development to maintain their competency and comply with industry regulations. Non availability of adequate training resources, opportunities for skill enhancement, and recognition of their expertise can impact their job satisfaction and performance.

9. Access to information and communication: Clear communication channels and access to relevant information are essential for sailing staff to perform their duties effectively.

Challenges related to language barriers, communication breakdowns, and limited access to up-to-date information can cause confusion and anxiety.

4. FACTORS ADDING STRESS AND ANXIETY TO SAILING STAFF ON BOARD A SHIP:

In today's digital age, internet and connectivity have become an integral part of our lives, including the maritime industry. With the advent of satellite communications, sailors on merchant ships have access to the internet, allowing them to stay connected with their families and friends back home. However, while internet and connectivity offer numerous benefits, it also impacts the mental and emotional health of sailors at sea. It has been experienced that internet and connectivity aboard ships sometimes create additional stress and challenges for sailors, rather than providing a balance between work and personal life. The constant need to be connected impede the ability to unwind and disconnect from stressors. Additionally, connectivity brings some other issues such as:

1. Information Overload: With the internet readily available, sailors are bombarded with news, social media updates, and other information from the outside world. This constant stream of information can create feelings of overwhelm and anxiety, as sailors may be exposed to negative news or personal issues from home that they are unable to address while at sea. This information overload can contribute to heightened stress and emotional distress among sailors, affecting their mental well-being.

2. Social Isolation: Paradoxically, despite being connected to the virtual world, sailors may experience social isolation onboard. The reliance on virtual communication may not fully substitute for face-to-face interactions with loved ones, leading to feelings of loneliness, homesickness, and disconnection from social support networks. This sense of isolation can have a significant impact on the mental and emotional health of sailors, contributing to feelings of depression and anxiety.

3. Distractions and Negative Influences: Internet and connectivity can also expose sailors to various distractions and negative influences. Access to social media, online gaming, and other online activities can consume valuable time and attention, affecting sailors' focus on

work, sleep, and self-care. Moreover, exposure to online negativity, cyberbullying, or other harmful content can further contribute to stress and emotional distress among sailors.

4. Reduced Social Interaction among Sailing Officers: Before the boom of internet sailing officers and crew used to engage in group activities and interactions in smoke rooms and other common areas, which helped them cope with the stress and loneliness of their profession. However, with the advent of personal devices that provide internet access, sailing officers now have their own means of entertainment and communication which has considerably reduced time and opportunity for social interaction among seafarers. Resulting in aloofness, which increases the chances of depression and anxiety.

Clearly the constant connectivity creates challenges in achieving a healthy work-life balance for seafarers on board. It is essential to acknowledge and address the potential impact of internet and connectivity on the mental and emotional health of seafarers.

We all know that in the realm of technical troubleshooting, it is often said that knowing the problem is key to finding the solution. However, when it comes to human resources (HR) issues, simply knowing the problem is never enough. In HR, understanding the issue is crucial, but it is just the first step in a complex and multifaceted process. HR issues involve people and their emotions, perceptions, and motivations, which adds layers of complexity, and it require more than just knowledge to navigate effectively. Unlike technical problems, HR issues often involve interpersonal dynamics, communication challenges, and diverse perspectives. They may be rooted in deep-seated beliefs, biases, or cultural norms, making them intricate and sensitive to handle. Merely knowing the issue won't necessarily lead to resolution; it's just the tip of the iceberg.

5. HUMAN RESOURCE MANAGEMENT IN SHIPPING INDUSTRY:

Human resource management (HRM) is the process of managing people and their work within an organization, it involves planning, acquiring, developing, motivating, and retaining employees to achieve organizational goals. HRM in the shipping industry is challenging and complex. The shipping industry is dynamic in nature, and it operates in a global and competitive environment. In the industry various companies may employ seafarers from different countries and cultures, who have different expectations and preferences, this coupled with the need to spend long periods out at sea, away from their families and social networks creates issues of isolation, stress, and anxiety. In addition to these issues HRM in shipping also deals with the issues related to health, and safety for seafarers. HRM faces challenges because of shortages of qualified seafarers for certain ranks, high turnover rates, and lack of skilled personnel etc. The process of recruitment, retention, and career development, training requires attention to every detail.

Addressing or resolving human resource issues requires empathy, active listening, effective communication, and conflict resolution skills. It involves understanding the nuances of human behaviour, managing emotions, building relationships, and fostering a positive work culture. Furthermore, HR issues are often ongoing and require continuous effort to address and resolve. The issues faced by seafarer are well known and players in the industry are involved in various practices on a regular basis such as:

1. Careful Selection and Recruitment: Organizations understand that hiring the right seafarer is crucial for the smooth functioning of a ship. All companies have proper recruitment processes in place, including screening, competency examination, psychometric testing, interviewing, verifying qualifications, for selecting the qualified and competent sea farers.

2. Training and Development: Ship and crew management companies provides training and development opportunities to its seafarers and put them through various training programmes to make them competent and compliant with industry regulations. Many companies also have on-board training programmes.

3. Retention and Motivation: Retaining seafarers is critical for the efficient operation of a ship. HR management try to address factors like challenging living conditions, uncertainty related to joining and signing off, compensation-related issues, they also provide incentives, recognition, etc. to motivate and retain sea farers.

4. Discipline and Conflict Resolution: Conflicts or disciplinary issues among seafarers can arise on board ships due to various reasons, such as cultural differences, personality clashes, and work-related stress. Generally, companies have established policies and procedures for conflict resolution, disciplinary action, and grievance handling to maintain a harmonious work environment and resolve issues on board a ship.

5. Diversity and Inclusion: Ships sometimes have a diverse crew from different nationalities, cultures, and backgrounds. Companies through its policies ensure that diversity and inclusion are promoted on board, and discrimination or harassment based on race, gender, religion, or other protected characteristics are not tolerated. Some companies also organize training and workshops related to diversity awareness, inclusion, and equal and fair opportunity for all.

6. Compliance with Regulations: Ships are subject to various regulations related to labor laws, safety, and security, including the International Labor Organization's Maritime Labor Convention (MLC) and International Maritime Organization (IMO) conventions. Companies ensure that the ship and its officers and crew are compliant with these regulations, including issues such as employment contracts, wages, working hours, and crew certification requirements.

7. Emergency Response and Crisis Management: Ships can face emergencies such as accidents, piracy, or natural disasters that require effective crisis management and emergency response. Companies have well established policies and procedures for emergency drills, communication protocols, and officers and crew training to ensure that all seafarers are prepared to handle such situations effectively.

8. Pre-Joining Briefing: The pre-joining briefing is a standard practice in the maritime industry aimed at ensuring that seafarers are adequately prepared for their contracts. Prior to boarding a vessel, the respective shipping company or manning agency conducts a comprehensive briefing to equip seafarers for their upcoming voyage. This briefing typically covers crucial areas such as:

    i. Vessel details: The seafarer is briefed about the vessel's specifications, including its size, type, and cargo carrying capacity.

    ii. Voyage details: The seafarer is informed about the planned route, the expected duration of the voyage, and the ports of call.

    iii. Safety and emergency procedures: The seafarer is trained on the vessel's safety procedures, including evacuation drills, firefighting, and first aid.

iv. Crew duties and responsibilities: The seafarer is informed about their duties and responsibilities, including their role in the vessel's operations and their watchkeeping duties.

v. Compliance requirements: The seafarer is briefed on the compliance requirements of various regulatory bodies, including the International Maritime Organization (IMO), the International Labour Organization (ILO), and the Maritime Labour Convention (MLC).

9. Post-Sign Off Debriefing: When a seafarer completes their contract and signs off the vessel, they typically undergo a post-sign off debriefing.

   This debriefing is conducted by the shipping company or the manning agency and aims to evaluate the seafarer's performance and gather feedback. The debriefing usually covers the following areas:

   i. Performance evaluation: The seafarer's performance during their contract is evaluated, including their technical skills, teamwork, and adherence to safety procedures.

   ii. Feedback gathering: The seafarer is given the opportunity to provide feedback on their experience, including any concerns or suggestions they may have.

   iii. Documentation and paperwork: The seafarer is briefed on the paperwork and documentation required for their sign off, including their contract, discharge book, and other relevant documents.

   iv. Future opportunities: The seafarer is informed about future job opportunities and provided with guidance on how to secure their next contract.

Overall, pre-joining briefing and post-sign off debriefing are essential components of a seafarer's journey in the merchant navy. They help to ensure that seafarers are well-prepared for their contracts and that their performance is evaluated and documented for future opportunities.

Above explanation demonstrates that industry recognizes the importance of effective human resource management on board ships for maintaining competent, motivated, and healthy seafarers, ensuring compliance with regulations, and promoting a safe and harmonious work environment.

However, despite having these measures in place, the industry still faces challenges with the mental and emotional wellbeing of seafarers.

The existing international regulations and policies are not enough to address this problem. There is a clear need for more vigilance and proactivity in managing and mitigating issues related to the overall wellbeing of seafarers.

6. ANCHORING WELLNESS, ADDRESSING MENTAL AND EMOTIONAL HEALTH CHALLENGES AMONG SAILORS:

The health and happiness of seafaring personnel are vital for the safe sailing and the protection of life and cargo at sea. It is time to give priority to the overall wellbeing of sailors on board and create a culture that supports their wellness. We will examine the significance of wellness as an anchor and discuss strategies to cope with mental and emotional health challenges that affect seafarers. We will also explore ways to foster a supportive work environment, promote self-care, and build resilience among sailors at sea.

Shipboard Leadership: Shipboard leadership is a crucial factor for the wellbeing and performance of seafarers. As discussed earlier, seafaring is a challenging and stressful profession that exposes seafarers to various physical and psychological hazards. Seafarers need strong and sensitive leaders on board who can provide them with guidance, support, feedback, recognition, and empowerment. Good leader is one who can keep his/her personal biases and preferences aside to create an environment for inclusion. Shipboard leaders can influence the mental health, resilience, job satisfaction, motivation, safety culture and teamwork of seafarers. Some of the key aspects of shipboard leadership that can help create a conducive environment for seafarers are:

1. Coaching and mentoring: Shipboard leaders should adopt a coaching style that helps seafarers develop their skills, confidence, and potential. Leaders should also provide mentoring and guidance to seafarers, especially to the cadets and junior officers.

2. Communication and feedback: Shipboard leaders should communicate and provide constructive feedback frequently to seafarers, The communication must be effective, clear, and respectful.

3. Recognition and empowerment: Shipboard leaders should from time to time recognize and appreciate the efforts and achievements of seafarers, both individually and as a team.

4. Delegation: Shipboard leaders should also empower seafarers by delegating tasks, giving them autonomy and involving them in decision-making.

5. Support and care: Shipboard leaders should show empathy and compassion to seafarers, especially during difficult times such as emergencies, accidents, or personal issues.

6. Diversity and inclusion: Shipboard leaders should respect and value the diversity of seafarers in terms of their nationality, culture, religion, gender, age, and personality. Leaders should also foster an inclusive culture on board that promotes mutual understanding, cooperation, and respect among seafarers.

Pre-Joining Briefing and Post Sign Off De-Briefing in presence of a counsellor: The mental and emotional well-being of seafarers is paramount in the maritime industry, and it is vital that their needs are addressed during routine practices of pre-joining briefing and post-sign off debriefing. In this regard, the presence of an independent counsellor would be important to ensure that seafarers receive adequate mental and emotional support.

The counsellor’s role in pre-joining briefing will provide seafarers the essential coping mechanisms, help them understand the emotional impact of the job, and equip them with techniques to maintain their mental and emotional well-being while on board. This can go a long way in mitigating the unique challenges faced by seafarers such as isolation, long working hours, and homesickness.

Similarly, during post-sign off debriefing, the counsellor can help seafarers process their experiences, manage negative emotions, and provide support for their transition back to shore life. Seafarers often face challenges readjusting to life on land, and the counsellor’s presence can facilitate this transition and help them cope with any challenges that may arise.

Preparing for the challenges of life on board: young seafarers should be aware of the unique challenges that they may encounter while living and working on a ship. These challenges may include long periods of separation from home, limited social interaction, and different cultures and working conditions. By understanding these challenges, youngsters can mentally prepare themselves and develop coping mechanisms.

Developing effective communication and interpersonal skills: Effective communication and interpersonal skills are crucial for success in any career, including the Merchant Navy. All sea farers need to learn how to communicate effectively with their fellow crew members, superiors, and other stakeholders on board. This includes understanding the importance of teamwork, conflict resolution, and building positive relationships with colleagues from diverse backgrounds.

Managing stress and fatigue: Working on a ship can be physically and mentally demanding, with long working hours, and unpredictable workloads. seafarers need to learn how to manage stress and fatigue effectively to maintain their physical and mental well-being. This can include techniques such as time management, relaxation exercises, and getting adequate rest.

Coping with homesickness and isolation: Being away from family, friends, and familiar surroundings for extended periods can result in homesickness and isolation. Seafarers need to learn how to cope with these emotions and develop strategies to maintain their mental and emotional well-being. This can include staying connected with loved ones through regular communication, engaging in hobbies or activities that provide comfort, and seeking support from fellow crew members or professionals on board.

Developing resilience and adaptability: Life at sea can be unpredictable, with challenges and emergencies that may require quick thinking and decision-making. Seafarers need to develop resilience and adaptability to cope with unforeseen situations. This can include problem-solving skills, decision-making abilities, and the ability to stay calm and composed in challenging situations.

Internet and Connectivity: Shipowners, management and manning companies and maritime authorities should prioritize the well-being of sailors at sea by implementing policies and practices that promote healthy internet and connectivity use, provide opportunities for rest and relaxation, and facilitate meaningful social connections. By recognizing and addressing the dark side of connectivity, we can support the mental and emotional well-being of sailors, ensuring a healthier work environment onboard merchant ship.

Role of Counsellor; Sessions with a counsellor can play a vital role in ensuring the mental and emotional well-being of seafarers. The sessions with an independent counsellor provide a safe space for seafarers to express their thoughts and feelings without the fear of judgment. Counsellors can assist seafarers in developing coping strategies, improving emotional resilience, and managing stress and anxiety (Williams, 2015). Moreover, these sessions can also promote positive qualities such as empathy, active listening, and cooperation among officers, leading to better teamwork and communication on board. These skills can help seafarers build positive relationships with their fellow crew members, superiors leading to better teamwork and conflict resolution (Lloyd et al., 2020). Moreover, counsellors can also provide support and share ways to manage stress and fatigue (Bhatia et al., 2019). This session can also address issues such as homesickness and isolation, (Lloyd et al., 2020).

Educate and Raise Awareness: Educating employees about mental health and emotional well-being can help reduce stigma and increase awareness. Companies must provide training, workshops, and seminars on topics related to mental health, stress management, emotional intelligence, and self-care. This can empower employees to recognize signs of mental health concerns in themselves and their colleagues and seek appropriate support.

Availability of Resources for Holistic Wellbeing: Companies can consider having an independent dedicated resources to support seafarers mental and emotional wellbeing. This can include providing access to confidential counselling services (CCS), employee assistance programs (EAPs), mental health hotlines. These resources can provide employees with professional support and guidance when dealing with mental health challenges and can help reduce barriers to seeking help. Although some institutions and organizations offer these services, they need to be more effective and responsive.

Facilitate the Culture of Self-Care and Wellness: Shipping companies need to create a culture of self-care and wellness by providing resources and opportunities for employees to take care of their physical, mental, and emotional health. This can include wellness programs, mindfulness activities, exercise facilities, and access to healthy food options. Encouraging self-care and wellness can help employees develop healthy habits that support their mental and emotional well-being.

Role of family for a stress-free seafarer: Family members of seafarers play a vital role in supporting their wellbeing and performance. They should understand the challenges and demands of the profession and provide them with time and space to focus on their work. They should also avoid sharing too much stressful information that might distract or worry them. They should create a positive and confident environment at home that reassures their family person on board a ship.

7. CONCLUSION:

While the Merchant Navy offers exciting career prospects, it also presents unique challenges that can have a significant impact on the mental and emotional well-being of seafarers. It is imperative to acknowledge the importance of mental and emotional preparation for seafarers, regardless of their age or experience, before they embark on a voyage. Adequate mental and emotional preparation, including counselling sessions, connectivity with counsellors while on board, support groups, and understanding and empathy from family, can equip seafarers with the tools to manage the challenges they may encounter at sea.

Prioritizing the mental and emotional health of seafarers is essential for creating a more robust and resilient workforce in the maritime industry. By taking these necessary steps, seafarers will be better equipped to thrive in their roles and make meaningful contributions to the industry. A healthy and productive maritime industry is one that values the well-being of its workers and recognizes the unique challenges they face, both on board and in their personal lives. In conclusion, prioritizing the mental and emotional health of seafarers is not only beneficial for them, but it also contributes to a thriving and sustainable maritime industry.

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