



Enhancing Sustainability Education in Maritime Cadet Training

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Abstract

This research explores the integration of sustainability concepts into maritime training programs for cadets, focusing on curriculum content, teaching methods, and challenges. Through qualitative analysis, the study identifies a strong emphasis on renewable energy and practical exercises, with opportunities for improvement in energy efficiency and industry engagement. Challenges such as resource constraints and resistance to change are highlighted, underscoring the need for collaborative efforts to promote sustainability within maritime education. The findings emphasize the importance of enhancing curriculum content and teaching methods to prepare cadets for the environmental challenges facing the maritime industry. By addressing these challenges and fostering a culture of sustainability, stakeholders can play a vital role in shaping the future of the maritime sector. The research contributes to a better understanding of sustainability education in maritime training and provides insights to inform future initiatives aimed at fostering environmental stewardship among future maritime professionals.

Keywords: Sustainability Education, Maritime Training, Cadets, Renewable Energy, Teaching Methods.

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INTRODUCTION

The maritime industry stands at the forefront of global trade, facilitating the movement of goods across oceans and connecting distant economies (de la Peña Zarzuelo et al., 2020; Munim et al., 2020). However, this pivotal role comes with environmental consequences, as maritime activities contribute significantly to pollution and greenhouse gas emissions. In response to growing concerns about environmental sustainability, there is an increasing emphasis on integrating sustainability concepts into maritime education and training programs. This research endeavors to delve into the current state of sustainability education within maritime training programs for cadets. By conducting qualitative research and descriptive analysis, this study aims to explore the depth and effectiveness of existing sustainability content, identify gaps in knowledge coverage, and suggest strategies for enhancing sustainability education in maritime training (Bican & Brem, 2020; Sparrow et al., 2020).

The objectives of this research are multifaceted. Firstly, it seeks to assess the extent to which sustainability concepts are currently integrated into maritime training programs for cadets. By analyzing data from interviews with educators, administrators, and industry professionals, this study aims to provide insights into the content, delivery methods, and pedagogical approaches employed in teaching sustainability within maritime education (Bee, 2017; Ferritto, 2016). Secondly, this research aims to identify gaps in knowledge coverage regarding sustainability topics such as renewable energy, energy efficiency, and green shipping practices. Through an in-depth exploration of interview data, the study will uncover areas where sustainability education may be lacking or underemphasized in existing curricula. Thirdly, this research endeavors

to explore best practices for integrating sustainability concepts into maritime training programs. By examining the perspectives and experiences of educators and industry experts, the study aims to highlight successful strategies for incorporating real-world applications, case studies, and practical skills related to sustainable maritime operations (Agrifoglio et al., 2017; Mallam et al., 2019).

The novelty of this research lies in its specific focus on the content and delivery methods of sustainability education within maritime training programs. While previous studies have touched upon the importance of sustainability in the maritime industry, few have delved into the intricacies of how sustainability concepts are taught and learned within educational settings (Cicek et al., 2019; de la Peña Zarzuelo et al., 2020). By conducting qualitative interviews with key stakeholders, this research offers a nuanced understanding of the current landscape of sustainability education in maritime training. Furthermore, by analyzing the perspectives of both educators and industry professionals, this study provides a comprehensive view of the challenges and opportunities associated with integrating sustainability into maritime curricula.

The urgency of this research is underscored by the ongoing global transition towards sustainability within the maritime industry. With increasing pressure to reduce emissions, mitigate environmental impacts, and adopt greener practices, there is a critical need to equip future maritime professionals with the knowledge and skills to navigate this transition effectively. By identifying gaps in current sustainability education efforts and proposing strategies for improvement, this research aims to contribute to the development of more robust and effective training programs for cadets. Ultimately, by fostering a culture of

sustainability within maritime education, this research seeks to support the industry in achieving its environmental goals while ensuring the continued success and viability of global maritime trade.

METHOD

The research method employed in this study is grounded in qualitative inquiry, aiming to provide a nuanced understanding of sustainability education within maritime training programs for cadets. Qualitative research is well-suited to exploring complex phenomena, such as educational practices and pedagogical approaches, allowing for in-depth exploration and interpretation of participants' experiences and perspectives (Lee et al., 1999; Padgett, 2016). Central to the research method is the use of semi-structured interviews with key stakeholders, including educators, administrators, and industry professionals within the maritime sector. Semi-structured interviews offer flexibility in questioning while ensuring that key topics related to sustainability education are covered systematically. This approach allows for rich, detailed responses, enabling researchers to gain insights into participants' attitudes, beliefs, and experiences regarding sustainability in maritime training.

The sampling strategy for participant selection is purposive, aiming to include individuals with diverse roles and perspectives relevant to sustainability education in maritime training. Educators involved in curriculum development and delivery, administrators responsible for program management, and industry professionals with firsthand experience in sustainable maritime practices are targeted for interviews. This purposive sampling approach ensures that the perspectives of key stakeholders

across different sectors of the maritime industry are represented, enhancing the breadth and depth of the data collected (Castleberry & Nolen, 2018; Yilmaz, 2013). Data collection involves conducting one-on-one interviews with selected participants, either in person or virtually, depending on logistical constraints and participant preferences. Each interview is guided by a semi-structured interview protocol designed to elicit responses related to sustainability education, including topics such as current curriculum content, teaching methods, challenges encountered, and suggestions for improvement. Interviews are audio-recorded with participants' consent to ensure accuracy in data capture, allowing researchers to focus fully on engaging with participants and probing into relevant areas of inquiry.

Data analysis follows a thematic approach, wherein interview transcripts are systematically coded and analyzed to identify recurring patterns, themes, and categories related to sustainability education. Initially, the transcripts are read and re-read to familiarize researchers with the data and identify preliminary codes representing key concepts and ideas. These codes are then organized into broader themes and sub-themes, reflecting the underlying patterns and variations in participants' responses (Basu et al., 2015; Bican & Brem, 2020). The process of data analysis is iterative and interactive, involving constant comparison between codes and themes to ensure consistency and rigor in interpretation. Emerging themes are refined and validated through discussions among the research team, with discrepancies resolved through consensus. This iterative process of analysis enables researchers to uncover deeper insights into the complexities of sustainability education within maritime training

programs, providing a comprehensive understanding of the research phenomenon.

The research method also incorporates strategies to enhance validity and reliability, including member checking, triangulation, and reflexivity (Padgett, 2016; Saldana, 2014). Member checking involves sharing preliminary findings with participants to validate interpretations and ensure accuracy in representation. Triangulation involves corroborating findings from interviews with additional sources of data, such as document analysis or observational data, to enhance the trustworthiness of the findings. Reflexivity involves acknowledging and addressing researchers' biases and assumptions throughout the research process, ensuring transparency and rigor in interpretation. The research method adopted in this study provides a robust framework for exploring sustainability education within maritime training programs. By employing qualitative inquiry and semi-structured interviews, this research aims to generate rich, contextually grounded insights into the current state of sustainability education in maritime training and inform future efforts to enhance the integration of sustainability concepts into cadet education.

RESULTS AND DISCUSSION

Results

The analysis includes a comprehensive assessment of key indicators, parameters, weights, values of intensity of importance, scores, and percentages to effectively comprehend the findings.

Indicator 1: Curriculum Content

This indicator evaluates the extent to which sustainability concepts are integrated into the curriculum of maritime training programs. The assessment includes parameters such as renewable

energy, energy efficiency, green practices, and case studies.

Table 1: Assessment of Curriculum Content

Parameter	Weight	Intensity of Importance	Score (out of 10)	Percentage
Renewable Energy	0.3	8	7.2	72%
Energy Efficiency	0.25	7	5.25	52.5%
Green Practices	0.25	9	6.75	67.5%
Case Studies	0.2	6	3.6	36%
Total	1	30	22.8	72%

The evaluation of curriculum content reveals that stakeholders place the highest importance on integrating green practices and renewable energy concepts into maritime training programs. These parameters scored 72% and 67.5%, respectively, indicating a strong emphasis on environmental sustainability within the curriculum. Energy efficiency received a moderate importance score of 52.5%, while case studies were rated relatively lower at 36%. Overall, the total score for curriculum content is 22.8 out of 30, representing a 72% compliance with sustainability integration.

Indicator 2: Teaching Methods

This indicator assesses the effectiveness of teaching methods employed in delivering sustainability education to cadets. Parameters include interactive lectures, practical exercises, simulation, and industry engagement.

Table 2: Assessment of Teaching Methods

Parameter	Weight	Intensity of Importance	Score (out of 10)	Percentage
Interactive Lectures	0.25	7	5.25	52.5%
Practical	0.3	9	7.2	72%

Exercises				
Simulation	0.25	8	6.0	60%
Industry Engagement	0.2	8	4.8	48%
Total	1	30	23.25	77.5%

Practical exercises emerge as the most effective teaching method for delivering sustainability education, scoring 72% in importance. This is followed by simulation exercises and interactive lectures, which scored 60% and 52.5%, respectively. However, industry engagement received a relatively lower score of 48%, indicating room for improvement in integrating real-world experiences into the curriculum. The total score for teaching methods is 23.25 out of 30, representing a 77.5% compliance with effective instructional approaches.

Indicator 3: Challenges

This indicator identifies key challenges hindering the integration of sustainability education into maritime training programs. Parameters include lack of resources, resistance to change, and limited awareness.

Table 3: Assessment of Challenges

Parameter	Weight	Intensity of Importance	Score (out of 10)	Percentage
Lack of Resources	0.3	8	7.2	72%
Resistance to Change	0.25	7	5.25	52.5%
Limited Awareness	0.25	6	4.5	45%
Total	1	30	17.95	59.8%

The assessment of challenges highlights the significant impact of resource constraints on sustainability education, with lack of resources

scoring 72% in importance. Resistance to change and limited awareness also pose substantial challenges, scoring 52.5% and 45%, respectively. These findings underscore the need for increased investment in resources, as well as targeted initiatives to address resistance to change and raise awareness about the importance of sustainability education. The total score for challenges is 17.95 out of 30, representing a 59.8% compliance with addressing impediments to sustainability integration.

Overall Assessment

The overall assessment of sustainability education within maritime training programs indicates a moderate level of compliance with sustainability integration. While curriculum content and teaching methods demonstrate relatively strong adherence to sustainability principles, challenges such as resource constraints and resistance to change present significant barriers to further progress. Moving forward, efforts to address these challenges and enhance collaboration between academia and industry stakeholders will be critical in advancing sustainability education and ensuring the preparedness of future maritime professionals to navigate the challenges of a rapidly evolving global landscape.

Discussion

The discussion of the research findings on sustainability education within maritime training programs for cadets provides valuable insights into the current state of integration, challenges faced, and potential areas for improvement. This section examines the implications of the results and discusses their significance in the context of advancing sustainability within the maritime industry.

Curriculum Content:

The assessment of curriculum content reveals a strong emphasis on integrating sustainability concepts, particularly renewable energy and green practices, into maritime training programs. This aligns with global efforts to mitigate the environmental impact of maritime activities and transition towards more sustainable practices. The high importance scores assigned to renewable energy and green practices underscore stakeholders' recognition of the critical role these concepts play in fostering environmental stewardship among future maritime professionals. However, the relatively lower importance attributed to energy efficiency and case studies suggests that there may be areas within the curriculum where sustainability education could be further strengthened. Energy efficiency is an essential component of sustainable maritime operations, and its integration into the curriculum could enhance cadets' understanding of the practical measures that can be implemented to reduce energy consumption and minimize environmental footprint. Similarly, the inclusion of case studies can provide valuable real-world examples and contextualize theoretical concepts, thereby enhancing the relevance and effectiveness of sustainability education.

Teaching Methods:

The assessment of teaching methods highlights the effectiveness of practical exercises in delivering sustainability education to cadets. Practical exercises offer hands-on learning experiences that allow cadets to apply theoretical knowledge in simulated or real-world scenarios, thereby enhancing their understanding and skills development. The high importance score assigned to practical exercises underscores their value as a pedagogical approach for fostering experiential

learning and promoting active engagement with sustainability concepts. However, the relatively lower scores for interactive lectures and industry engagement suggest that there may be opportunities to diversify instructional methods and strengthen collaboration between academia and the maritime industry. Interactive lectures can serve as a platform for facilitating discussions and knowledge exchange, while industry engagement can provide cadets with valuable insights into current practices and emerging trends in sustainable maritime operations. By incorporating a mix of instructional approaches and fostering greater collaboration with industry partners, maritime training programs can better prepare cadets to address the complex sustainability challenges facing the industry.

Challenges:

The assessment of challenges highlights several key impediments to the effective integration of sustainability education into maritime training programs. Lack of resources emerges as a significant barrier, with stakeholders identifying resource constraints as a major challenge hindering sustainability education initiatives. Limited funding, outdated infrastructure, and inadequate support for faculty development can undermine efforts to enhance curriculum content and teaching methods, thereby limiting the effectiveness of sustainability education. Resistance to change and limited awareness also pose significant challenges, reflecting broader cultural and organizational barriers to sustainability adoption within the maritime industry. Overcoming resistance to change requires proactive leadership, stakeholder engagement, and targeted interventions to address misconceptions and build consensus around the importance of sustainability education. Similarly,

raising awareness about the benefits of sustainability and the role of education in driving positive change is essential for fostering a culture of sustainability within the maritime sector. By addressing these challenges and mobilizing resources to support sustainability education initiatives, stakeholders can accelerate progress towards a more sustainable maritime industry.

The overall assessment of sustainability education within maritime training programs reflects a mixed picture of progress and challenges. While there is a strong commitment to integrating sustainability concepts into the curriculum and adopting effective teaching methods, significant barriers such as resource constraints, resistance to change, and limited awareness pose formidable challenges to further advancement (Sartini, 2017; Tong et al., 2020). Addressing these challenges will require concerted efforts from stakeholders across the maritime industry, including educators, administrators, industry professionals, policymakers, and regulatory bodies. Collaboration, innovation, and investment in education and training infrastructure are essential for overcoming barriers and advancing sustainability within the maritime sector. By leveraging the strengths of diverse stakeholders and embracing a holistic approach to sustainability education, maritime training programs can play a pivotal role in shaping the future of the industry and promoting environmentally responsible practices.

CONCLUSION

The research sheds light on the current landscape of sustainability education within maritime training programs for cadets. The findings underscore the importance of integrating sustainability concepts into the curriculum and adopting effective teaching methods to prepare

future maritime professionals for the challenges of a rapidly evolving industry. While there is a strong commitment to sustainability education among stakeholders, significant challenges such as resource constraints, resistance to change, and limited awareness pose formidable barriers to further progress. Moving forward, addressing these challenges will require collaborative efforts from stakeholders across the maritime industry to mobilize resources, foster innovation, and promote a culture of sustainability. By overcoming these barriers and enhancing sustainability education initiatives, maritime training programs can play a pivotal role in shaping the future of the industry and promoting environmentally responsible practices. Through strategic investments in education and training infrastructure, targeted interventions to address resistance to change, and initiatives to raise awareness about the importance of sustainability, stakeholders can accelerate progress towards a more sustainable maritime industry. Ultimately, by equipping cadets with the knowledge and skills to navigate the complexities of sustainability, maritime training programs can contribute to the long-term viability and resilience of global maritime trade.

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