MASSACHUSETTS MARITIME ACADEMY

IAMU | AGA24

The International Association of Maritime Universities (IAMU) Conference Book

IAMU
International Association of Maritime Universities

THE NIPPON FOUNDATION

24TH ANNUAL
GENERAL ASSEMBLY
9-12 OCTOBER 2024

The International Association of Maritime Universities (IAMU)

Conference Book

Buzzards Bay, MA, USA

10 - 11 October 2024

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Preface

Welcome to the 2024 IAMU Conference

Protecting Our Mariners – Promoting Our Industry – Providing for the Future

As Chair of the International Program Committee and Program Editor, I am honored to welcome you to this year's International Association of Maritime Universities (IAMU) Conference, held at Massachusetts Maritime Academy on Cape Cod, USA. This year's theme, *"Protecting Our Mariners – Promoting Our Industry – Providing for the Future,"* reflects the dynamic and interconnected challenges facing the global maritime sector as we chart the course toward sustainable growth into the future.

This year's conference illustrates a healthy and thriving community of academic scholarship within the broader maritime education and training (MET) community that shapes the talent of future global maritime professionals.

- A record 159 abstracts (from a total of 400+ authors across 45 IAMU members) were submitted for consideration. 336 reviews were completed by 100 reviewers. 40.9% of abstracts were accepted for oral presentations. At time of the conference book publication, there will be 39 oral presentations clustered by topic and spread across three parallel technical sessions.
- 71 full papers were submitted for consideration. 174 reviews were completed and 28.2% of the full papers were initially accepted for publication in the conference proceedings. Most of the papers not initially accepted were returned for revision and resubmission based upon extensive feedback to the authors. Of those resubmitted, a further 32.1% were accepted and 49 papers will be published in the conference proceedings.

On behalf of the IAMU and the International Program Committee, I extend my deepest thanks to our authors, reviewers, presenters, and participants for your commitment to advancing maritime knowledge and practice. As a community, we are working toward enhancing the quality of academic scholarship within the MET community. It is through our collective efforts that we will protect our mariners, promote our industry, and provide for the future. I am also deeply indebted to my colleagues on the International Program Committee, the staff at the Massachusetts Maritime Academy, and the IAMU Secretariat for their support, direction, and contributions to making this conference as successful as it can be. Thank you, and I look forward to an inspiring and productive conference.

Sincerely,
Paul S. Szwed, DSc, PMP
Chair, International Program Committee & Program Editor for IAMUC 2024

Theme

Protecting Our Mariners

Our mariners are the lifeblood of global trade, and ensuring their safety, well-being, and professional development is paramount. From enhancing training and education programs to integrating advanced technologies, the maritime community must continue to innovate in creating safer and more secure working environments. This conference brings together experts who will explore new approaches to health, safety, and skills development, while addressing the evolving risks that our seafarers face in an increasingly complex world.

Promoting Our Industry

The maritime industry is at the heart of global commerce, responsible for the transportation of over 80% of the world's goods. To remain competitive and relevant, we must embrace innovation, foster collaboration, and advocate for the critical role the industry plays in the global economy. This conference provides a unique platform to highlight cutting-edge research, exchange best practices, and shape policies that will drive the maritime industry forward. By fostering partnerships and innovation, we can ensure the continued success and global leadership of the maritime sector.

Providing for the Future

Our future hinges on how well we prepare the next generation of maritime professionals. With the rise of digitalization, decarbonization, and diversity, the demands on our workforce are changing rapidly. This conference will explore strategies to enhance maritime education and training, equipping our students and professionals with the skills they need to thrive in the maritime careers of tomorrow. We will also examine the environmental, economic, social, and policy challenges that lie ahead, ensuring that our industry remains both resilient and responsible.

Local Executive Committee (LEC)

RADM Francis X. McDonald
Lead of LEC

CMDR Brigid Pavilonis
Provost / General Chair LEC

Professor Paul Szwed
Scientific Programme Chair

Professor Madhubani Ghosh and Michael Ortiz
Student Program Chairs

Linda Trombly
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Deepa Rajesh Academy of Maritime Education and Training University (India)	**Sara Elzarka** Arab Academy for Science, Technology & Maritime Transport (Egypt)

Reviewers

Arica, Nafiz | Asyali, Ender | Baer, Steven | Baldauf, Michael | Barahona-Fuentes, Claudis

Barlis Jr., Jose M | Baylon, Angelica | Belle, John | Benton, Graham | Bezhanovi, Zurab | Bohdan, Yurii

Brčić, David | Castells-Sanabra, Marcella | Čović, Maja | Czarnowski, Ireneusz | Dasgupta, M

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Dlabač, Tatijana | Dolidze, Tamari | Drodge, Kristopher | Drzewieniecki, Jan | Đurović, Zorica

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Sasilatha, T | Savelieva, Iryna | Savov, Ognyan | Shah, Yogesh | Sirbu, Anca | Spasova, Veselina

Svilicic, Boris | Tarrant, Stephen | Thangalakshmi, S. | Thiruvasagam, G. | Tian, Zhen | Treichel, Piotr

Tsitskishvili, Givi | Tsvetkov, Miroslav | Tugushi, Maia | Uğurlu, Özkan | Varsami, Corina

Vettriselvan, R | Vujičić, Srđan | Włodzimierz, Kamiński | Yilmaz, Huseyin | Zaitseva-Pärnaste, Inga

Zhang, Ruolan | Žuškin, Srđan

Venue

Massachusetts Maritime Academy
Buzzards Bay, MA, USA

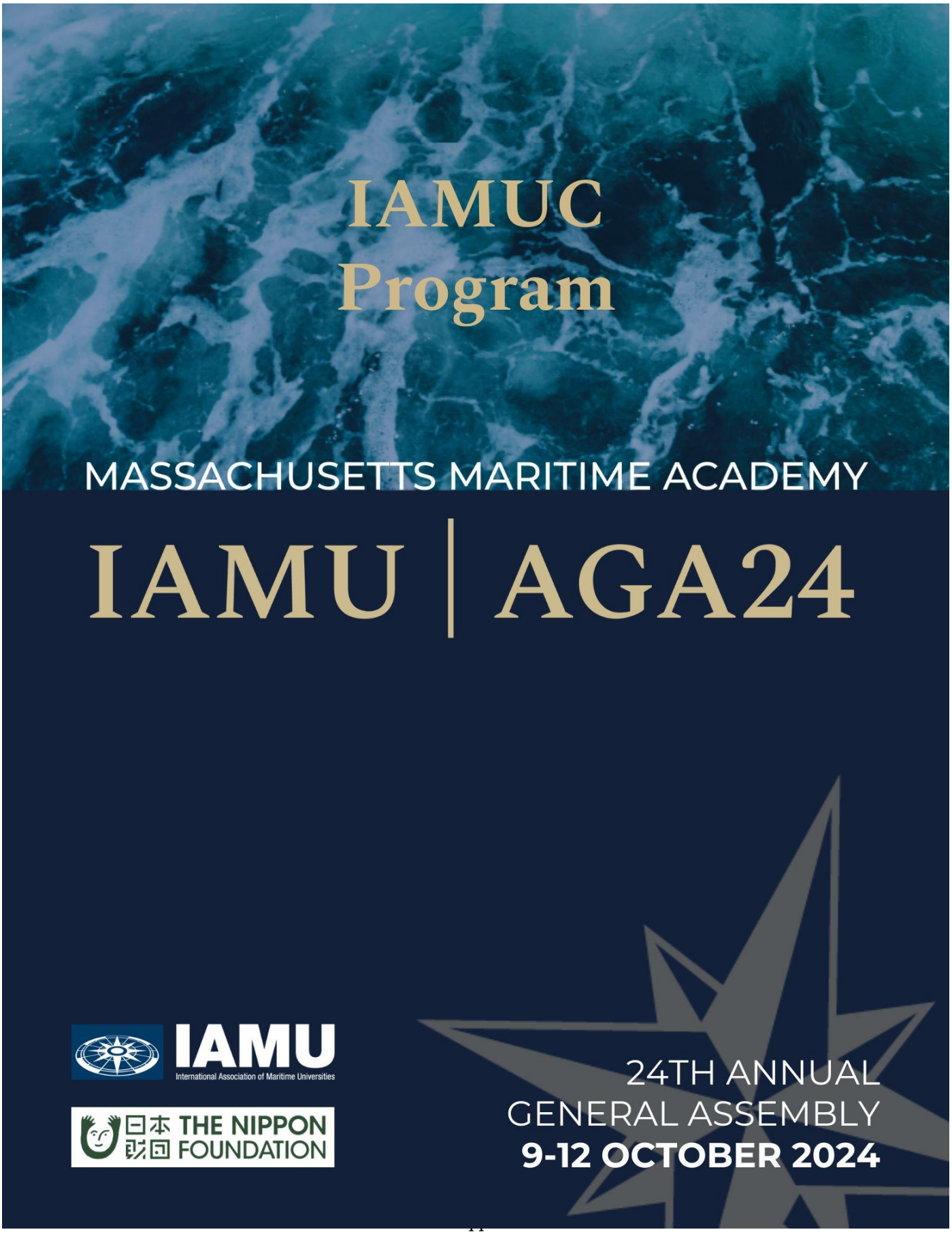
The 24th IAMU Conference takes place on the campus of Massachusetts Maritime Academy.

Massachusetts Maritime Academy (MMA), located in Buzzards Bay, Massachusetts, is a public, coeducational maritime college that prepares students for careers in the maritime industry, engineering, environmental protection, and emergency management. Established in 1891, MMA is one of six state maritime academies in the United States.

The academy combines a rigorous academic program with practical, hands-on training, offering degrees in fields such as marine engineering, marine transportation, international maritime business, emergency management, and energy systems engineering. One of the key features of the academy is its focus on leadership and discipline, modeled on a regimented lifestyle similar to military academies, though it is not affiliated with the military.

Cadets participate in a unique training experience aboard the academy's training ship, which offers them real-world maritime experience through voyages and operations at sea. A brand new Training Ship, The Patriot State will be arriving in October 2024.

The campus is situated along the Cape Cod Canal, providing a scenic backdrop and access to various maritime facilities. Graduates from MMA are highly sought after in industries like shipping, energy, and logistics, and many go on to pursue leadership roles in both the public and private sectors.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International Association of Maritime Universities (IAMU)

IAMU was founded by seven universities representing the five continents of the world (Representative Universities) in November 1999, with a shared recognition of the significance of maritime education and training in the rapid globalization of the international shipping arena. Since then, IAMU has significantly expanded its membership , and now boasts **73 universities**/academies/faculties of the world's maritime education and training institutions, and the Nippon Foundation as its members, total **75 altogether.**

IAMU Annual General Assembly (AGA)

The Annual General Assembly (AGA) is a forum to allow the exchange of information, policy approvals, and the development and fostering of good relations and collaboration among IAMU member universities.
The Plenary Session, Presidents' Forum, Project Presentations and IAMU conference (IAMUC) are the main components of AGA. The IAMU Student Program (IAMUS) may be jointly organized by the host university.

Plenary Session

The Plenary Session provides all staff of member universities with an opportunity to review activities of IAMU and to approve IAMU policies, programs and budget as recommended by the International Executive Board (IEB). The Chair of IAMU and the Executive Director, on behalf of IEB, report to the member universities on the decision of the IEB.

Presidents' Forum

The Presidents' Forum is a meeting in which the Presidents of IAMU member universities talk about issues especially on policy, direction, and activity of IAMU considering the academic relationship among member universities as well as the economic and technological developments in the international maritime community. The Local Executive Committee (LEC) of an AGA is responsible for organizing the Presidents' Forum during the AGA.

Project Presentations

Each project coordinator/representative of a funded project such as a working group, research, and development project shall make a project presentation in front of academic staff of member universities during the AGA, which is to improve the quality of the project.

IAMU Conference

IAMU Conference (IAMUC) provides academic staff of member universities with an opportunity to present the outcomes of their academic/scientific research to the IAMU community. The LEC together with the International Program Committee (IPC) jointly organizes the IAMUC, including the selection of session topics and papers.

IAMU Student Program

LEC of an AGA may organize the IAMU Student Program (IAMUS) during the AGA where students of member universities jointly participate in some events related to students' activities.

Welcome to AGA24

The Annual General Assembly (AGA) is the annual meeting of the International Association of Maritime Universities (IAMU). The International Association of Maritime Universities Conference (IAMUC), held annually as part of the AGA, brings together experts and official representatives of IAMU member universities from all over the world to discuss recent progress and future trends in Maritime education, training, research, and other matters within the scope of IAMU.

Massachusetts Maritime Academy is honored to host the 24th Annual General Assembly, IAMUC and IAMUS 2024.

Introduction

The 24th Annual General Assembly will be a remarkable event hosted by the Massachusetts Maritime Academy, an institution that has educated and trained mariners since its founding in 1891. The conference will highlight our theme of protecting mariners, promoting our industry, and providing for the future. The Academy is located at the mouth of the Cape Cod Canal on a more than 55-acre, oceanfront campus. This picturesque location is just minutes away from Cape Cod's quaint villages, sandy beaches, harbors, and lighthouses, with access to the islands of Martha's Vineyard and Nantucket. Located just 60 miles from Boston, Massachusetts Maritime Academy enjoys convenient access to all the cultural offerings of the city.

AGA24 | IAMUC Technical Tour

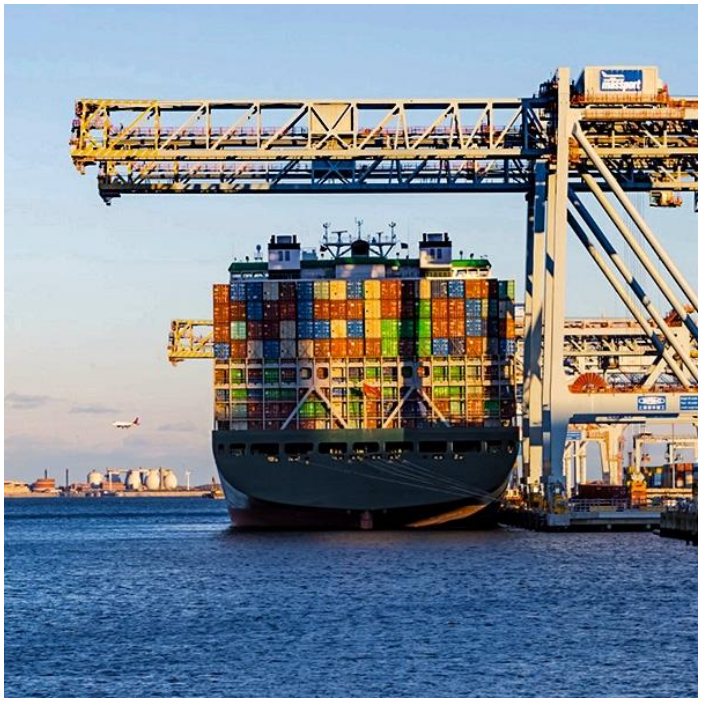
Massport Boston

Please join us while Massport leads a bus and walking tour of both the operations center and the port. We will learn about the expansion plans, the sophisticated software used to organize storage containers and how port operators prepare for specific needs like refrigeration hookups as freight waits to be transferred to trucks.

Conley Terminal is a congestion-free port where ships can quickly enter and exit. A wide variety of items are imported through Conley Terminal, including substantial quantities of olive oil, pasta, and wine.

As the technical tour ends in Boston, attendees have the option to depart the conference and stay in Boston or return to Buzzards Bay on the buses.

If you have already booked a hotel in Buzzards Bay through the 12th, you have the option to cancel the last night and rebook in Boston. You can bring any luggage with you on the buses. Please remember to dress casual for the tour and wear comfortable closed toe shoes.



AGA24 | IAMUC Conference Schedule

Tuesday, October 8	
Time	Event and Location
1300 - 1600	**Early Registration** *There will be registration desks in the lobbies of the Hampton Inn and TownePlace Suites hotels.*
1830	**Motor Coach Pickup at Hampton Inn and TownePlace Suites** Maritime Conference Center Shuttle Service from Quality Inn and Onset Bay Drop off Maritime Conference Center
1900 - 2100	**Welcome Reception and Registration** Fantail Student Center *(Located next to the Mess Deck on the Campus map)* Massachusetts Maritime Academy *Welcome Remarks: CMDR Brigid Pavilonis, Provost and Senior VP, Massachusetts Maritime Academy* *Music: Sine Verba, Sarah Jeremias and Steve Reynolds, Massachusetts Maritime Academy*
2100	**Motor Coach Back to Hampton Inn and TownePlace Suites** **Shuttle Service to Quality Inn and Onset Bay Inn**

Wednesday, October 9	
Time	Event and Location
0900	**Motor Coach Pickup at Hampton Inn and TownePlace Suites** Maritime Conference Center Shuttle Service from Quality Inn and Onset Bay Drop off Maritime Conference Center
0900	Same-Day Registration / Information Table Admirals Hall Lobby, Harrington Hall
0930 - 1030	AGA24 Opening Ceremony Admirals Hall
1030 - 1100	Group Photo American Bureau of Shipping Information Common

Wednesday, October 9 (continued)		
Time	Event and Location	
1100 - 1200	Presidents Forum Maritime Conference Center (Presidents or official proxies only)	Coffee & Campus Tour Start: Admirals' Hall Lobby (All conference attendees)
1200 - 1300	Lunch Mess Deck, Pande Dining Hall	
1300 - 1430	Plenary Session (IAMU Members Only) Admirals' Hall	
1430 - 1445	Coffee Break Admirals' Hall Lobby	
1445 - 1645	IAMU Funded Research Project Presentations Admirals' Hall	
1450 - 1500	Opening for Project presentation	Nafiz Arica (head of AAC)
1500-1510	Modeling of the Use of Artificial Intelligence Platforms in Maritime Education and Training: Benchmarking of the IAMU Member Universities	Funda Yercan
1510-1520	Technological Challenges Identification Based on MASS Degree of Autonomy Framework	Ruolan Zhang
1520-1530	Facilitating greener education and cleaner shipping through the development of NOvel bespoke microtextured metals to combat bioFOULing in niche areas on vessels	Simone Dürr
1530-1540	Women in Maritime: Aiming for a Gender-Equitable Future Workforce	Gholam Reza Emad
1540-1550	Maritime Decarbonization Education and Training Initiative (MDETI)	Strata Paola
1550-1600	Contributing to the Revision of the STCW Convention/Code	Meric Karahalil
1600-1610	ROV education and training for seafarers	Antonio Blazina
1620-1630	IAMU framework for collection of information on graduate employment	Huanxin Wang

Wednesday, October 9 (continued)		
Time	Event and Location	
1630 - 1640	Developing of NOISe MAPs for passenger port of SpliT	Luka Vukić
1640-1650	Closing of Day AGA	
1700	**Motor Coach Back to Hampton Inn and TownePlace Suites** **Shuttle Service to Quality Inn and Onset Bay Inn**	
1810	**Motor Coach Pickup at Hampton Inn and TownePlace Suites** **Shuttle Service from Quality Inn and Onset Bay** Drop off Maritime Conference Center	
1830	Cape Cod Autumn Harvest Dinner Parade Field Tent *Please dress for an outdoor tent event on the lawn.* *Welcome Remarks: RADM Francis X. McDonald, USMS, President Massachusetts Maritime Academy* *Music: John Ruzicka*	
2100	Bus Transportation from Massachusetts Maritime Academy to Hampton Inn and TownePlace Suites	

Thursday, October 10	
Time	Event and Location
0815	Bus Transportation from Hotel to Massachusetts Maritime Academy
0845 - 0900	IAMU Conference, Technical Sessions Opening Remarks - Brigid Pavilonis, CDRE and Senior VP Academic Affairs Paul Szwed & Boris Sviličić - Program Editors Maritime Conference Center

Thursday, October 10 (continued)			
Time	Event and Location		
0900 - 1000	Oral Presentations		
	Session A1 Maritime Conference Center	Session B1 Maritime Conference Center	Session C1 Baystate Conference Center
	Simulating the Future: AI, Data, and Virtual Reality in Maritime Training Moderator: Darko Glujić, University of Rijeka	*Navigating New Horizons: Course Development for Seafarer Training* Moderator: Anthony Rogone, SUNY Maritime	*Shaping the Future Crew: Competency, Language, and Professional Growth* Moderator: Reza Emad, Australian Maritime University
9000-0920	**Jens Brauchli Jensen** Navigating Tomorrow: Designing a Simulator Scenario for AI Training Data Collection (p. 126)	**Nicolas Nause** Opportunities and challenges of part-time studies in Maritime Education and Training (p. 61)	**Iryna Shvetsova, Alona Leshchenko** Enhancing Professional Development through Foreign Language Communicative Competence in Navigation and Ship Handling Specialists (p. 90)
0920 - 0940	**Lars Finnema** Enhancing Realism in Maritime Simulators through Operational Data and Machine Learning (p. 135)	**Ana Gundić, Piotr Kopacz, Zaloa Sánchez Varela, F. X. Martínez de Osés** Harmonization of non-STCW short-learning courses (p. 82)	**Ryo Hiwatashi, Momoko Kitada** A pathway to competency by optimizing sea time and lecture time: A comparative analysis and the case of MET in Japan (p. 95)
0940-1000	**Darko Glujić, Goran Vizentin, Goran Vukelić, Dean Bernečić, Dario Ogrizović** Advanced CFD Fire Model in Ship Engine Room with VR Integration (p. 46)	**Paul Szwed, Srđan Vujičić, Martina Hrnić** Evaluating Alignment of IMO Model Courses - Simulation (p. 96)	**Heikki Koivisto, Gholam Reza Emad** Training of the Future Marine Engineers (p. 73)
1000 - 1030	Poster Sessions & Coffee Break Maritime Conference Center Rooms 109, 110		

Thursday, October 10 (continued)			
Time	Event and Location		
1030 - 1130	Oral Presentations		
	Session A2 Maritime Conference Center	Session B2 Maritime Conference Center	Session C2 Baystate Conference Center
	Breaking Waves: Gender Equality and Empowerment in Maritime Training Moderator: Angelica Baylon Maritime Academy of Asia & the Pacific	*Enhancing Maritime Skills: Tools, Technology, and Extracurricular Impact* Moderator: Tanzer Satir, Istanbul Technical University	*Cybersecurity and Situational Awareness: The Cutting Edge of Maritime Training* Moderator: Ashok Pandey, Massachusetts Maritime Academy
1030 - 1050	**Claudia Barahona-Fuentes, Marcella Castells-Sanabra** Gender mainstreaming practices in METIs: Some case studies (p. 94)	**Malte Pertiet, Markus Janczyk, Valentin Koob** Analysis of Vector and Trail Modes on Marine Radar Screens (p. 84)	**Charlott Sellberg, Olle Lindmark, Astrid Camilla Wiig** Radio-mediated instuctions in dynamic positioning training (p. 44)
1050 - 1110	**Momoko Kitada, Ryo Hiwatashi** Achieving Gender Equality Through Simulator Training (p. 81)	**Johannes Kolind, Mads Klit Rønn** How to Choose the Right Lab Equipment? – A Decision Support Framework for Investment in Energy Conversion and Storage Technologies for Engineering Educations (p. 137)	**Cihat Asan, Alparslan Baskaya** Scale Development to Measure the Cybersecurity Perception of Maritime Industry Employees and a Sample Application on the Istanbul - Türkiye Region (p. 119)
1110 - 1130	**V. Sangeetha, R. Vettriselvan, R. Ramya** Fostering Sustainable Societal Progress: Unveiling the Crucial Role of Gender Equity in Empowering Women across MTI's (p. 57)	**Jeric Bacasdoon, Caroline Dacwag-Balila** Are extras just extra? Extra-curricular activities and the attainment of GMP BoK Learning Outcomes (p. 109)	**Khairul Izzati bin Kamarumtham, Koji Murai** An Ingenious Method to Reveal Seafarers' Situational Awareness Levels: A Bio-signal and Video Analysis (p. 55)
1145 - 1245	Lunch Pande Dining Hall		

Thursday, October 10 (continued)			
Time	Event and Location		
1300 - 1400	Oral Presentations		
	Session A3 Maritime Conference Center	Session B3 Maritime Conference Center	Session C3 Baystate Conference Center
	Autonomous Seas: Revolutionizing Maritime Operations and Education Moderator: Peter Sandell, Novia University of Applied Science	*E-Learning at Sea: Redefining Maritime Education for the Digital Age* Moderator: Nino Kurshubadze, Batumi State Maritime Academy	*Reframing the Profession: Education, History, and New Frontiers* Moderator: Mahmoud El Bawab, Arab Academy of Science Tech. & Maritime Transport
1300 - 1320	**Peng Lin, Guoliang Yuan, Xianping Fu** Autonomous launch and recovery of nearshore ROV based on USV (p. 124)	**Johan Bolmsten, Woo-Seung Shin, Daniel Moon** E-Learning Capacity-Building – The Case of IMO's Integrated Technical Cooperation Program (p. 102)	**Anne Pazaver, Momoko Kitada** Popular representations of the seafaring profession: A corpus-assisted discourse analysis (CAD) (p. 49)
1320 - 1340	**Peter Sandell** Autonomous Vessels and Fairways – The Nordic Law approaches (p. 116)	**Dino Zupanovic, Srdjan Vujicic, Marcella Castells-Sanabra, Krzysztof Wróbel** E-Learning in Maritime Higher Education (p. 88)	**Astrid Zekić, Zaloa Sanchez-Varela, Ivica Skoko, Renato Ivče** Analysis of Maritime Pilots' Education in the Republic of Croatia (p. 67)
1340 - 1400	**Peter Sandell** Autonomous Vessels and AutoMare EduNet – National Revolution of Maritime Education in Digivisio 2030 Platform (p. 71)	**Nicolas Nause, Christian Jauernig** Use of lightboard videos in Maritime Education and Training (p. 59)	**Paul A. Wlodkowski, Laurie E. Flood, Jerald S. Paul** The Nuclear Merchant Mariner (NMM): Designing a Framework for Education and Training (p. 132)
1400- 1430	Poster Sessions & Coffee Break Maritime Conference Center Rooms 109, 110		

Thursday, October 10 (continued)			
Time	Event and Location		
1430 - 1530	Oral Presentations		
	Session A4 Maritime Conference Center	Session B4 Maritime Conference Center	Session C4 Baystate Conference Center
	Future-Proofing Maritime Operations: Health, Safety, and Digital Skills Moderator: Paweł Kołakowski, Gdynia Maritime University	*Navigating Emissions, Risks, and Arctic Routes in Maritime Policy* Moderator: Cassia Bömer Galvão, Texas A&M University	*Digital Skills and Cybersecurity: Safeguarding the Future of Maritime* Moderator: Johan Eliasson Ljungklint, Chalmers University of Technology
1430 - 1450	**Samrat Ghosh, Marcus Bowles** Incorporating the Human Capability Standards (HCS) Framework into the STCW Code for future ship operators (p. 50)	**Germán De Melo Rodríguez, Reza Ziarati, Heikki Koivisto, Janusz Uriasz, Markku Mylly, Lakhvir Sing and Amir Lazempour** Pareto Analysis of ISM Code Deficiencies (p. 128)	**Inga Bartusevičienė, Iryna Savelieva, Momoko Kitada** Integrating public policies to increase digital skills among the MET faculty (p. 114)
1450 - 1510	**Sofia Kallou, Nikitas Nikitakos, Dimitrios Papachristos, Dimitrios Dalaklis, Momoko Kitada** Emotional Intelligence (EI) and Teamwork in Ship's Bridge: A Proposed Training Framework for Upskilling (p. 41)	**Filip Bojić, Anita Gudelj, Rino Bošnjak, Ante Čalić** Modeling and analysis of emissions released by MGO and LNG powered cruise ships in port areas (p. 34)	**Knud Benedict, Michael Baldauf, Mario Gehrke, Michael Gluch and Matthias Kirchhoff** Ship Handling Training using Manoeuvring Prediction (p. 111)
1510 - 1530	**Dhiraj Kumar, Bappa Acherjee and Arunanshu Shekhar Kuar** Microstructural and Corrosion Behaviour of Laser Welded NITINOL for Marine Engineering Application	**Saim Turgut Koçak, Funda Yercan** Comparative Analysis of Arctic and International Shipping Routes - A Comprehensive Update (p. 30)	

Thursday, October 10 (continued)	
Time	Event and Location
1530- 1600	Poster Sessions & Coffee Break Maritime Conference Center Rooms 109, 110
1630	Bus Transportation back to Hampton Inn and TownePlace Suites
1830	Bus Transportation from Hampton Inn/TownePlace Suites to Massachusetts Maritime Academy
1900	GALA Dinner Pande Dining Hall **Welcome Remarks** Dr. Takeshi Nakazawa, Professor, Executive Director, IAMU **Keynote Speaker** Ms. Tina Revsbech, Chief Executive Officer, Maersk Tankers *Music: Massachusetts Maritime Academy Jazz Band*
2200	Bus Transportation from Massachusetts Maritime Academy to hotels

Friday, October 11		
Time	Event and Location	
0800	Bus Transportation from hotels to Massachusetts Maritime Academy Luggage storage at Maritime Conference Center Coat Room (Volunteers)	
0830 - 0930	Oral Presentations	
	Session A5 Maritime Conference Center	Session B5 Maritime Conference Center
	Maritime 5.0: Shaping the Future Maritime Workforce Moderator: Senka Šekularac-Ivošević, University of Montenegro	*Wellness and Absenteeism: Charting a New Course for Maritime Education* Moderator: Portia Ndlovu, Massachusetts Maritime Academy

Friday, October 11		
Time	Event and Location	
0830 - 0850	**Gholam Reza Emad, Mehrangiz Shahbakhsh** Industry 5.0: The Critical Element in Shaping the Future of Maritime Workforce and MET Institutions (p. 110)	**Marcella Castells-Sanabra, Claudia Barahona-Fuentes, Clara Borén, Rosa M. Fernandez-Canti, Anna Mujal-Colilles, Roger Castells-Martínez, Elisabet Mas de les Valls** Absenteeism in Maritime Education: Insights, Challenges, and Innovative Solutions (p. 92)
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0930 - 1000	Poster Sessions & Coffee Break Maritime Conference Center Rooms 109, 110	
1000 - 1100	**GMP BoK Workshop** Moderator: Gamal Ghalwash, Arab Academy of Science Technology, and Maritime Transport	
1115 - 1200	**Closing Ceremony** Maritime Conference Center	
1215	Lunch (Grab-n-Go)) Maritime Conference Center Please grab a box lunch and head to the buses for the Tech Tour	
1230	Buses depart for Boston	
1400 - 1600	MASSPORT Tour of Conley Terminal Boston *Please dress in comfortable, closed-toes walking shoes.*	

1600	Buses will depart for Massachusetts Maritime Academy, Hampton Inn Boston & Buzzards Bay Hotels

Saturday, October 12	
Time	Event and Location
0900	Bus To Boston from Hampton Inn, Towneplace Suites and Massachusetts Maritime Academy to Logan International Hotel

Key Locations on Campus

1: Admirals' Hall	2: Maritime Conference Center	3: Parade Field	4: Fantail	5: Baystate Conference Room	
6: American Bureau of Shipping	7: Pande Dining Hall	8: *SSV Ernestina-Morrisey*	9. TS Patriot State	10: Parking	11: Shuttle Stop

Poster Presentations

All posters will be at the Maritime Conference Center

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Notes:

Name Badge: All attendees must be registered and wear their name badge at all times to gain admission to all IAMUC events.

Mobile Phone: As a courtesy to our presenters and attendees, please turn off your mobile phones during the sessions.

Economic / Trade Aspect

Comparative Analysis of Arctic and International Shipping Routes - A Comprehensive Update

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Keywords: Arctic Shipping, International Shipping, Global Warming, Multi-Objective Optimization

Researchers around the world continue to study different aspects of possible future shipping operations between Europe and Asia via Arctic routes and passages, due to the adverse effects of global warming on Arctic ice. In this respect, a study continues on the cost-effectiveness of transit transportation by different sizes of container ships via Arctic routes as compared to current international shipping routes. A relatively long-time frame is evident until some frequent shipping routes are to be established, but updates on the studies provide guidelines for intentions in addition to possible environmental concerns. The cost-effectiveness of shipping via six Arctic and two current shipping routes was analyzed and studied by the Authors previously (Kocak and Yercan, 2022). Subsequently, a comprehensive examination of entropy and environmental impact was undertaken by the Authors employing the same dataset (Yercan and Sogut, 2023). Those studies referenced eleven different-sized container ships, voyage distances, and durations based on ice thicknesses and weather conditions. Furthermore, considerations encompassed initial and operational costs, fuel consumption and fuel prices, freight rates, and entropy, constituting pivotal elements within the research framework.

The 2020 research (Kocak and Yercan, 2022) posited the prospective feasibility of the Central Arctic Ocean (CAO) and Northwest Passage (NWP) routes around the year 2050 vis-à-vis prevailing international maritime routes. For container shipping between Asian and European ports, the Suez Canal route is a costly and high-fuel-consuming choice for the transit voyage of all container ship sizes, but it is still the most effective route today. However, CAO and then NWP routes around the year 2050 may become more cost-effective if Ice Class construction will not be needed, no ice exists on the routes, harsh climatic conditions lessen, specially trained crew for Arctic navigation becomes unnecessary, and Search & Rescue (SAR) means are improved. Also, efficient propulsion systems and better ship technologies are needed to prevent a high environmental impact.

In this ongoing study, an update was deemed necessary as of early 2024 since the freight rate has shown an increase much higher than previously referenced values, despite the fuel costs remaining in the foreseen boundaries of the sensitivity analysis. In addition, the multi-objective optimization (MOO) method was decided to be used in this study to obtain some inferences on earlier results, compared to the previously applied Fuzzy Analytic Hierarchy Analysis (FAHP) process in cost-effectiveness analysis. The optimization objectives of the study were set to minimize the duration of Arctic shipping operations, minimize fuel consumption, and maximize net profits. Route preference by ship size formed the second point of interest. Current results show the feasibility of CAO and NWP routes in the year 2050 for mid-size to the largest capacity containerships however, to-be-final decisions will be reached in the first quarter of 2024. Concludingly, this study will bring implications for future investment decisions, particularly concerning the transition from fossil fuel-burning, relatively inefficient engines to more efficient and environmentally friendly ship technologies. Moreover, insights stemming from this study are anticipated to be of considerable value in developing policies for Arctic region shipping operations by enhancing strategies for future research.

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Unveiling the Potential of AI-Enhanced Resource Management for Sustainable Fisheries and Aquaculture in the Indian Ocean

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Keywords: Marine Resources, Resource Management, Artificial Intelligence, Sustainability

Abstract: Fisheries serve as a primary source of food and protein in specific global regions and the rapidly expanding aquaculture sector is anticipated to surpass traditional fishery production within the next decade. By 2030 global fish production will reach 200 million tons with half of this output originating from aquaculture. Despite the dominance of freshwater in aquaculture, oceans are expected to play a significant role in meeting the world's food needs. This shift towards aquaculture not only addresses nutritional requirements but also generates employment and prosperity. The Indian Ocean acts as a vital lifeline for numerous coastal communities and stands as a central hub for global fishing by contributing 14% to the global captures harvest. Recognizing the influential role of the resource environment and advancements in scientific and technological management, this research explores the transformative potential of the Blue Economy in marine fisheries and aquaculture in the region of Indian Ocean. This research delves into the integration of Artificial Intelligence (AI) for species identification which aims to enhance precision and efficiency in ecosystem monitoring. This proposed AI driven species identification plays a crucial role in unravelling the intricacies of marine biodiversity by enabling the researchers and resource managers to swiftly and comprehensively assess the abundance, distribution and health of various marine species. The timely acquisition of this information will be utilized for informed decision-making in resource management. By facilitating the identification of endangered or overexploited species, AI contributes to the prevention of overfishing and also fostering the conservation of marine ecosystems. This approach provides an intricate balance among resource management, economic enhancement and sustainability by underlining the pivotal role of AI-driven methodologies in comprehending and overseeing marine biodiversity for effective resource management practices.

Scenarios and the capacity needed in growing and promoting a sustainable ocean economy for South Africa towards 2060

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Keywords: *Ocean economy, scenarios, causal layered analysis (CLA), futures triangle and South Africa*

With several maritime nations highly dependent on the ocean and its rich resources, increasing threats are forcing states and stakeholders to improve on sustainable maritime planning. By adopting the concept of a sustainable ocean economy and developing more coherent, integrated, fair and evidencebased approaches to managing the economic development of the ocean, leaders stand to alleviate one of their defining obstacles to sustainable development, namely, a narrow resource base. According to the OECD (2020a), 37% of South Africans do not have access to reliable water supply and 20% do not have access to sanitation, resulting in water pollution and adverse health impacts. A sustainable ocean economy approach offers the prospect of sustained, environmentally-sound, socially inclusive economic growth, as well as fostering innovation. Moreover, a path towards a sustainable ocean economy also incorporates and builds strategies that are important to not only address SDG14, but to contribute to meeting targets on at least nine other SDGs.

This paper explores scenario planning and how can it be used to improve the quality of the strategic conversations that organizations need to have as a position in preparing for the future of South Africa's Ocean economy. A futures triangle and a causal layered analysis (CLA) was used as part of a larger foresight process to explore issues around South Africa's Ocean economy with a key focus on maritime trade and economic growth attributed to the ocean economy. A literature review was conducted to gain a better understanding of the ocean economy, and primary data was collected through a semi-structured interviews process with experts and decision-makers in South Africa's Ocean economy. An explorative scenario matrix was developed for South Africa's Ocean economy and four scenarios, and their implications were analysed. The semi-structured interviews collected information on the proposed scenarios and the capacity needed in growing and promoting a sustainable ocean economy for South Africa towards 2060.

The preferred scenario was a resilient ocean economy for South Africa towards 2060. The study took a step forward with a view to provide reference to stakeholders and governments in progressing towards a possible scenario and developed an integrated vision for a sustainable oceans' economy. No specific scenarios have been developed for South Africa's Ocean economy except for the OECD's (2016) baseline scenario, which assumes a continuation of past trends, no major policy changes, no abrupt technological or environmental developments, and no major shocks or surprises. The proposed scenarios for South Africa, presented in the paper, took into consideration the complex ocean economy, the multiple crisis that affect trade and many economies globally and the integrated approach needed to address social, technological, economic, environmental, political, legal and ethical dimensions for South Africa's Ocean economy towards 2060.

Environmental Aspect

Modeling and analysis of emissions released by MGO and LNG powered cruise ships in port areas

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Keywords: ship emissions; seaport air pollution; sustainable shipping; LNG; alternative fuels

The effects of global climate change and local air pollution in seaports have been recognized as a long-term problem within the shipping industry (IMO 2020). With the aim of reducing overall emissions from ships, stricter regulations on air pollution from maritime transport have been established (IMO 2024; ESPO 2024). These requirements have limited exhaust emissions from ships internationally and led to the introduction of efficient marine engines and cleaner fuels (ICCT 2020.). Due to its potential to reduce overall combustion emissions and because it is both available and affordable, liquefied natural gas (LNG) has emerged as the dominant alternative marine fuel (IMO. 2020). Although the aforementioned changes towards more sustainable shipping have improved the emissions intensity of ships, a 9.6% increase in total greenhouse gas (GHG) emissions has been documented over a 6-year period, with a dramatic 87% increase in methane (CH4) (IMO. 2020). However, the impact of air pollutants released from the use of conventional fuels can seriously affect public health in urban areas. Deteriorating air quality in port communities has been linked to a variety of health effects such as asthma, heart attacks and hospital admissions (Sofiev et al. 2018). Although coastal shipping accounts for only a small proportion of global emissions, the dense marine traffic and proximity to populated areas emphasize the need for air pollution control in ports (Nunes et al. 2017; Bojić et al. 2022). Therefore, the main objective of this research is to predict emission levels and investigate the potential of LNG as an alternative marine fuel for mitigation of air pollution in port areas compared to actual emissions. To obtain estimates of ship emissions, detailed technical and near-real-time shipping data from the Automatic Identification System (AIS) were used in the model for estimating ship-related emissions (Bojić et al. 2023). Throughout the process, estimates of exhaust gas pollution from MGO such as carbon dioxide (CO2), CH4, sulphur and nitrogen oxides (SOx, NOx), particulate pollution (PM), non-methane volatile organic compounds (NMVOC) and carbon oxide (CO) were determined on a ship-by-ship basis. Subsequently, by combining available datasets and estimated results with relevant technical details of dualfuel engines, a prediction of emissions where same ships would use LNG was modelled and analysed. As one of the leading seaports in the Mediterranean in terms of passenger traffic with a growing number of cruise visits and its spatial connection with the populated city centre, the Port of Split and its cruise activities were used as a case study for this research.

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Alternative Energy Sources for Cargo Ships: Turkish Shipping Sector

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Keywords: Alternative energy; cargo ship; biofuel; alternative fuel.

Abstract: Several alternative marine fuels are an important strategy for maritime decarbonization. These alternative marine fuels include liquefied natural gas (LNG), liquefied biogas (LBG), hydrogen, ammonia, methanol, ethanol, hydrotreated vegetable oil (HVO), nuclear power and electricity. Wind and solar power are other energy sources for ships, but these are not alternative fuels; they are supporting energy sources, such as hybrid ships. In the maritime sector, wind and solar power are currently in the research phase. There are fewer wind or solar hybrid ships at sea. Shipping companies are focusing more on alternative fuels such as LNG, methanol, and ethanol. The Turkish merchant fleet consists of 475 vessels, of which 250 (4.5 million DWT) were imported and 225 (1.3 million DWT) were built in Türkiye. The 475 ships are broken down by type: 23.8% dry cargo ships, 12.2% chemical tankers, 10.3% service ships, 9.9% container ships, 7.0% bulk carriers and 36.8% other types. The number of alternative fuel ships in the Turkish fleet is very small. This study is focused on ships switching to alternative fuel at the Turkish Fleet compared to the World Fleet.

Empirical in-port tugboats emissions assessment based on operational modes

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Keywords: ship emissions; tug; operational mode; port. *Theme*: Environmental aspect.

Pollution emitted from ports comes from merchant ships constantly docking and undocking but also from other auxiliary port vessels working continuously throughout the year, like pilotage vessels, bunkering barges, vessel-generated waste collection services, mooring and unmooring services and port tugs. Ship emissions are deeply bound with ship engines operational modes. The estimation of fuel consumption and the consequent emissions, is commonly based on the cubic speed–power relation as a bottom-up approach (Kristensen 2017). The need to emission-control policies and regulations at ports is widely acknowledged as an active policy issued by maritime port authorities. It is also considered an answer of international and European regulations and depends on an accurate estimation of emission inventory in close-to-land and in-port (Yu et al. 2021). Current emissions estimation methods fail to reach accuracy when vessels are not sailing under design conditions, that being the case for port tugboats in most of their performance range. Port tugboats have powerful engines but they are not prepared for speeding and in most ports, between 40% and 70% of all light-sailing is done at speeds where the fuel consumption is higher. The traditional propeller-law-based method is not applicable to estimate the emissions during pushing and pulling operations, even during light-sailing phases in tug speeds due to the characteristic engines these vessels are designed with (Chen et al. 2021). The empirical rules are based on the experiences of tug captains and operational guidelines, thereby providing a more accurate estimation of main engine load than the propeller-based method. However, these empirical rules face the emissions assessment considering real data of main engine load during operations. The limited availability of fuel consumption data and the changeability of engine orders under maneuvering conditions hamper the emissions assessment.

This contribution aims to stablish the adequacy of empirical rules to override the discrepancies on the outcomes of port tugboats emissions when calculated though the propeller law based method in the different operational phases and compare them with data gathered during a field campaigns. The scenario selected for analysis is the Barcelona Port, where an in-port tug has been monitored over 40 maneuvers during the month of April 2023. The field campaigns have enabled the characterization of port tug manoeuvers by collecting realtime engine orders and their duration.

Results identify in which operational phases the existing formulae yields higher errors and if they can be easily corrected within the formulae adjustment or new expressions are needed. The results point out the adequacy of applying low load adjustment factors (Chen et al. 2021) when the vessel is sailing slow ahead condition (showing a discrepancy below 5% when compared to real values), and they also state that most penalizing operational mode for the case study vessel is during half ahead engine order.

The findings suggest that port operators can reduce emissions by requiring tugs to perform pushing and pulling operations with an optimal engine load depending on the maneuvering requirements. This approach will help to reduce the impact of in-port ship emissions on human health, the environment, and the climate of the coastal community.

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New challenges for Black sea region Ecology

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Keywords: Ecology; Black Sea Region, Russian invasion

On the 24th of February 2022 by the Russian invasion the world has been change. The ongoing armed conflict between the Russian Federation and Ukraine created many challenges for Black Sea region. Russia's unprovoked aggression on Ukraine as well as the war between Israel and Palestine, are among the primary concerns. Furthermore, the area has recently faced the aftermath of natural disasters, including the earthquakes in Turkey and Syria, widespread flooding, and extensive fires in Greece. The repercussions of these conflicts and disasters have resulted in numerous casualties, devastated cities, and damaged ecosystems.

However, amidst these well-documented consequences, the environmental impact of these conflicts, particularly beyond the war zones, has received considerably less attention. This article pays attention of warinduced pollution in Ukraine, highlighting how it extends across a much broader region through air and water currents.

Problems:

- War-induced pollution;
- Mechanism connecting cause and effect; and
- Health impact beyond the war zone.

In times of war, various activities such as munition detonation, rocket propellant combustion, and burning of fuel in vehicles or of buildings release a diverse range of chemical substances into the environment.

There is a significant gap between the current situation, where the impact of the war in Ukraine on the health of citizens in the Black Sea Region is generally unknown, and future of the region is a big question. The authors explain in the article how that gap can be bridged.

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MET / Social Aspect

Acquisition of Knowledge of the ISM Code in MET

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Keywords: ISM Code, maritime training and education, safety at sea

Given the importance of the maritime industry to international trade and the globalization process, it is necessary to ensure safe and accident-free shipping. Despite today's technological advances and the various recommendations and guidelines issued by the International Maritime Organization (IMO) to improve safety at sea, numerous accidents continue to occur (EMSA 2023, Antao et al. 2023). Many studies have shown that human error is the main cause of the majority of maritime accidents (Hasanspahić et al. 2021). To reduce accidents caused by human error and consequently create an understandable safety culture, the International Safety Management (ISM) Code was introduced (IMO 2018, IMO 2023, Lee 2016). Proper implementation of the ISM Code standards, unavoidably requires the acquisition of the ISM Code knowledge from the very beginning, in fact during formal education (Frančić et al. 2023).

The aim of the paper is to investigate and analyze the students' understanding and knowledge of the ISM Code. The research will be carried out through a survey that will be disseminated among active students in the final year of undergraduate and graduate MET study programs at the maritime universities in the Republic of Croatia.

Following the survey results, based on statistical analysis and comparison with the ISM requirements, potential improvement will be identified, and guidelines drawn up to emphasize relevance of the ISM Code in maritime education and training

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Emotional Intelligence (EI) and Teamwork in Ship's Bridge: A Proposed Training Framework for Upskilling

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Abstract: The notion that computers equipped with software and artificial intelligence (AI) applications could effectively replace human intelligence is under the existing paradigm of operations. This is the main facilitator of task-automation on board a ship to fulfill various jobs and often supported by numerous scientists/academics who contribute to gaining today momentum in the public opinion. The maritime industry has already been under the influence of the so-called 'Industry 4.0' phenomenon; however, the related discourse tends to focus on technological contexts and overlook the socio-economic ones. This gap is observable in the strong emphasis on soft skills (or, digital skills), for future maritime professionals. This paper argues how socio-economic contexts of Industry 4.0 can be understood in fostering soft skills for future seafarers. Particularly, our focus is emotional intelligence (EI) in relation to "future skills" on demand in the maritime industry. This paper reviews relevant theories and conceptualizes how the integration of EI into maritime education and training can support the transition towards maritime digitalization. Presenting a conceptual framework that successfully integrates EI into a teamwork environment suitable for the ship's bridge and detailing a framework of skills training (based on Transformative Learning) is the main aim.

Keywords: Industry 4.0; emotional intelligence; teamwork; training framework; transformative learning.

Tolerance in seafarers' life and how to train it

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Keywords: seafarers' well-being; crewing companies' policy; psychological tolerance; physiological tolerance

While working at sea, a seafarer faces many psychological and physiological problems. To solve these problems, it is necessary to understand the concept of tolerance. Tolerance is considered in different spheres, in engineering an essential concept in manufacturing and design processes to ensure that components fit and function properly when assembled, in pharmacology, as a response of an individual to a drug, the closest for our research was the tolerance in sport. We researched different aspects of tolerance connected with the seafarers' professional activities, such as social tolerance, which is related to the psychological aspects of a person, the physiological tolerance, which is related to the physical endurance of a person. To support seafarers in terms of their well-being both psychological and physiological tolerance education is a very urgent task nowadays. Psychological tolerance refers to an individual's capacity to withstand or adapt to various psychological stressors. There are several key aspects of psychological tolerance that can impact a person's well-being and overall mental health, such as: emotional, cognitive, behavioral, uncertainty, resilience, etc. It is important to note that psychological tolerance can vary from person to person, but can be influenced by environmental factors – working at sea. Physiological tolerance refers to the ability of an organism to endure and function within certain physical or physiological conditions. It is the limit within which an organism can adapt and survive in various environmental conditions, such as temperature, humidity, or salinity. Different organisms have different levels of tolerance for these conditions, and their ability to tolerate or adjust to changes in their surroundings is crucial for their survival and well-being. Seafarers' physiological tolerance is understood as the ability to bear certain loads for a certain period without receiving severe and irreversible injuries. It is important for seafarers to develop psychological and physical resilience and tolerance, as this contributes to successful work in conditions that are often a challenge for their physical and mental health.

Methods we used are linguistically oriented. We studied 1) IMO Conventions with the purpose to find information about tolerance requirements for seafarers; 2) information on the sites of different crewing companies concerning tolerance; 3) author's questionnaire to the students of Navigation department to find out at what subjects they get information about physiological tolerance; at what subjects they get information about physiological tolerance; how they improve their physical abilities; their attitude to the cultural differences, etc. The International Maritime Organization promotes tolerance for seafarers through various conventions and initiatives. These documents protect seafarers' rights, ensure their welfare, and improve the working conditions on board vessels. Moreover, implementing policies that combat discrimination or prejudice based on race, gender, nationality, or any other factor is essential for fostering tolerance towards seafarers. Such policies contribute to creating a harmonious and inclusive environment within the maritime industry. The study of the crewing companies' sites referred us to the notion "zero tolerance policy", mostly towards pollution, harassment and bulling, exploitation of seafarers.

In the article, we give practical recommendations and techniques how to develop tolerance at the lectures of social and humanitarian sciences, in extracurricular activities, and in the process of self-study. In general, the results of the study will help lecturers understand what aspects of tolerance education may need some correction, who can do it, at what lectures and in what way.

Factors affecting the time-extended evacuation on cruise ships

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Abstract: The safety of human life is the top priority on cruise ships. Carrying out an appropriate evacuation procedure in an emergency will prevent loss of life (SOLAS 2018). The total time to evacuate a passenger ship includes the time it takes for passengers and crew to assemble at the assembly point after the first alarm and the time it takes to abandon ship. Rushing, climbing to a greater height due to the inclination of the ship, uncontrolled movements, not responding to an alarm, turning back or going to dangerous places to collect valuables are elements that the crew should deal with when a panic occurs, as these are natural phenomena that occur with individuals or groups (Sarshar et al., 2013). Passengers follow the actions and behaviour of crew members. By observing the crew and their attitude towards safety measures on board, they get an idea of the general safety on board, which can be an important factor in avoiding panicked behaviour and thus reducing the average evacuation time (Tisseraa, 2013). There are a variety of factors that influence evacuation efficiency. The authors conducted a survey on a sample of 79 seafarers to investigate these factors. For the purposes of this article, the factors affecting the time-extended evacuation are analysed. The statements in the questionnaire that were used to try to find answers to the significance of this factor relate to the location of the lifejacket, the passengers' familiarity with crisis management, the influence of language barriers, the physical condition of the passengers and the physical condition of the crew, i.e. whether the crew members engage in leisure activities or avoid them due to long working hours (ILO MLC, 2006).

Keywords: cruise ship, evacuation, crisis management, working hours

Radio-mediated instructions in dynamic positioning training

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Abstract: The aim of this study is to identify different types of radio-mediated instructions during dynamic positioning (DP) operations in a high-fidelity bridge operations simulator, exploring what types of instructions routinely is being managed remotely during simulation and as part of the participants' practices of assuming different professional roles during simulations. Within their role-play, we have identified two types of radio-mediated instructional practices that routinely takes place. The first is related to the need of correcting students', highlighting the high standards of safety that should apply in the offshore industry. The second relates to the instructors' need to continuously assess the students' understanding of the situation at hand and are formulated as requests for information. The findings deepen our understanding of the complex interplay between technology, instructions, and professional learning in simulated environments by providing detailed accounts of the instructional practices that makes simulators into simulations, and simulations into an entry point to the offshore industry for students.

Keywords: instructions; dynamic positioning (DP); simulation-based training, Maritime Education and Training (MET)

Mitigation of Infectious Diseases Spread on Large Passenger Ships: Development of a Maritime Course Curriculum

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Keywords: cruise industry; large passenger ships; infectious diseases; maritime education

Recent Covid-19 pandemic has significantly affected global cruising industry, plummeting the number of passengers and revenues of cruising companies (Lin 2022). While the industry is struggling to return to preCovid-19 numbers, it has become clear that an improved approach for prevention, mitigation, and management (PMM) of infectious diseases on large passenger ships is needed. An important part of the approach is education and training of seafarers handling passengers on such ships, especially future seafarers, i.e. students at maritime universities. This paper is a continuation of that effort, after the proposed educational standard for mitigation of infectious diseases spread on large passenger ships (Vukelic 2023).

Here, a development of an accompanying curriculum is presented referring to the specific content that students should receive. The proposed curriculum is founded upon extensive literature review with more than 300 references reviewed, and on the evidence-based research performed as a part of Horizon Europe project "Healthy Sailing" (Healthy Sailing 2024). Within the project, underlying evidence of mechanisms facilitating infection spread was detected; interactions of ships with land-based operations were reviewed; behavioral, social, and cultural aspects among passengers and crew affecting infectious disease spread were identified; and requirements for compatibility of project outputs with existing ship operations were assessed.

Within the curriculum, a general framework is given with the aims and objectives of the course, plus staff and facilities requirements. Further, a course outline with a suggested timetable is given. In this part, topics needed to get a grasp with PMM measures are listed with the detailed learning objectives for every topic. Finally, suggestions for additional reading material are provided. Based on this curriculum, teachers at maritime universities can build their own course syllabus, tailored to the specific needs of all the stakeholders in the education process. It is expected that this type of course would better prepare seafarers for possible future outbreaks of infectious diseases spread on large passenger ships.

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Advanced CFD Fire Model in Ship Engine Room with VR Integration

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Keywords: ship engine fire model; CFD; VR engine room fire

The management of fire hazards on marine structures and vessels holds immense importance as it greatly influences the design of the ship structure, influences engineering decision-making processes and training protocols (Sim et al. 2019). The occurrence of an onboard fire is a multiparameter event that depends on various factors. Due to safety concerns, conducting live fire hazard training experiments is not a feasible option. Fortunately, the advent of virtual reality (VR) technology has provided a viable alternative for training individuals in hazardous situations (Smutny 2023).

The data and procedures presented here are the preliminary results of research aimed to improve fire hazard marine training. An innovative fire spread model for a ship's engine room has been developed. Employing computational fluid dynamics (CFD) modeling, the behavior of fire and smoke is represented accurately, thus enhancing the overall realism and effectiveness of the VR training simulations (Shen et al. 2020). The developed VR environment mimics the dynamic nature of onboard fires, reflecting the complex and evolving nature of such events. This level of immersion enables trainees to get a firsthand understanding of the challenges associated with firefighting, evacuation procedures, and emergency response protocols.

A scenario of a fire originated at the ship engine was developed. The results of the fire CFD analysis for this specific scenario are represented in the VR environment. Developed interface ensures the complex data from the CFD model is accurately transferred into the virtual reality environment, making the simulation more practical for real-time interaction and analysis. An initial user survey was conducted to determine the level of realism and validity of the VR model and the results are presented here.

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The Use of Artificial Intelligence Applications in Maritime Education and Training

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Keywords: Artificial Intelligence (AI); Maritime Education and Training (MET); Education Technologies; Adopting New Technologies

The use of Artificial Intelligence (AI) applications, which are continuing their development, is gradually increasing in areas such as economics, finance, medicine, and education. While the use of artificial intelligence by both teaching staff and students is considered beneficial by some, some have the opposite view. While it is accepted that the use of artificial intelligence is a very efficient tool for scientific research, those who hold the opposite view say that it prevents students from developing their critical thinking abilities. It is also a fact that the opportunities offered by AI will increase even more soon, and its harmful aspects will be eliminated while the opportunities it provides increase. The maritime profession has to follow the constantly developing technology and, accordingly, Maritime Education and Training also has to follow this pattern. The MET has to benefit from AI both in terms of improving education and training and contributing to scientific research.

This research aims to investigate how AI applications can be used for the development of MET by considering AI applications in other professional groups and to provide suggestions on what should be done in this regard. The study will start by examining AI applications in different business areas and will continue by evaluating how they can be applied to the MET under the current and future needs of the MET. The needs of both teachers and students will be considered in the study.

Technology-Assisted Instruction: Its Impacts on the Academic Performance and Satisfaction of Maritime Students

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Keywords: technology-assisted instruction, impacts, academic performance, satisfaction, maritime students

This inquiry aimed to determine the impacts of technology-assisted instruction on the academic performance and satisfaction among selected first year BSMT (Bachelor of Science in Marine Transportation) students during the first semester of Academic Year (AY) 2018-2019. Results showed that the grand average GWA in prelim was 87.25%, 90.17% for midterm, and 88.46% in the tentative final. According to Gulek and Demirtas (2005), substantial evidence showed that incorporating technology, in the classroom as an instructional tool enhances student learning and educational outcomes. Bonferroni test for multiple comparisons revealed that Polaris 1B students had the highest average GWA while Blackwall and Carrick Bend had the lowest average GWA. Adodo and Agbayewa (2011) study showed that when students were grouped homogeneously, they showed better development not just in their learning outcomes but as well as positive changes in attitude and attentiveness in the classroom. Moreover, the key determinants affecting the satisfaction of the students in the use of technology are as follow: accessibility, facilitate integration of learning, eco-friendly learning style, time saver, and easy compilation of documents. Caruso and Kvavik (2005) determined the convenient usage of technology in academic and social activities among students.

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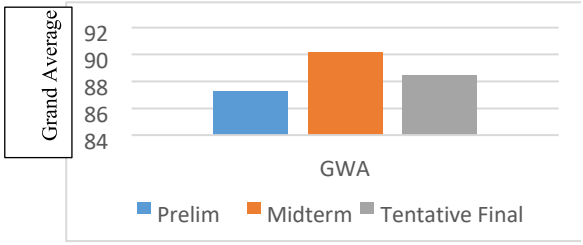

Fig.1: Grand Averages of General Weighted Average for Student Prelim, Midterm, and Tentative Final

Section	GWA per Section (%)
Polaris 1B	92.19[a]
Bowline	88.71[b,d,f]
Lineman's Know	88.62[c,d,f]
Blackwall	87.87[d,g]
Carrick Bend	85.73[e,g]

Table 1. Bonferroni Test Results for Multiple Comparisons of the Grand Average GWA in the Subject Understanding the Self among Selected BSMT Students When Classified According to Section

Popular representations of the seafaring profession: A corpus-assisted discourse analysis (CAD)

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Keywords: Seafarers, seafarer shortage, public image, sustainability, language use, corpus-assisted discourse analysis (CAD)

With the merchant fleet's ongoing expansion, there is a growing mismatch between labor demand and supply, leading to a notable shortfall in the seafaring workforce and related concerns about its sustainability. In tackling this challenge, the public perception of the seafaring profession emerges as a critical factor. Crucially, fostering a positive image of seafaring careers, particularly among the younger generation, is essential for attracting and sustaining a robust labor force (Jensen et al. 2015). Understanding the representation of seafarers in popular public discourse, including media coverage and social media discussions, becomes imperative in this context.

This paper presents a corpus-assisted discourse analysis (CDA) of the popular discourse surrounding seafarers and the seafaring profession. It aims to investigate how language use may influence public perceptions and societal attitudes and, by extension, the attractiveness of a seafaring career. Utilizing general linguistic corpora such as New on the Web (NOW) and the Corpus of Contemporary American English (COCA), containing over 20 billion words of data, the analysis identifies prevalent linguistic and thematic patterns in the seafaring discourse, including positive and negative attributes associated with seafarers and how these may have changed over time.

Furthermore, the study delves into the implications of these linguistic findings for the seafaring workforce, exploring whether certain narrative constructs and lexical choices in seafaring discourse could contribute to a negative image of the profession, deterring potential entrants and exacerbating the workforce shortage. The paper discusses how a nuanced understanding of this discourse can inform strategies to more effectively promote seafaring careers, including the role that maritime universities and the IAMU community can play in cultivating a positive public image of seafarers.

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Incorporating the Human Capability Standards (HCS) Framework into the STCW Code for future ship operators

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Keywords: Human Capability Standards, STCW Code, maritime education and training, durable skills, future ready, MASS

Current and past research has focused on identifying soft skills future ship operators are expected to possess or acquire for efficient maritime operations. This is especially relevant with the advent of fast changing technologies and Maritime Autonomous Surface Ships (or MASS). In the absence of an existing framework, the authors of this paper propose drawing insights from an award winning, globally recognized, and validated Human Capability Standards (HCS) Reference Framework to identify the required soft skills and associated abilities. The HCS Framework is based on more than 30 years of research and dedicated to identifying the human capabilities that are most predictive in creating a future ready workforce, career, profession or graduate. The HCS Framework is highly reputed and has been adopted by over 50 companies listed in the Australian Stock Exchange (ASX) and global Forbes 500 companies including telecommunications, banking, fast food, etc. Since the standards of competence for a traditional seafaring licence are dictated by the Standards of Training, Certification, and Watchkeeping (STCW) Code, it was imperative to investigate if the Code, in its current form, already incorporates the skills from the HCS Framework or will focus on short shelf-life technical skills that do not enhance non-technical, durable skills. The theoretical and analytical research presented in this paper is based on the analogy drawn between the elements of the STCW Code and the HCS framework. The findings of this research paper set out to answer the future dilemma between the need to revise an existing, global standards (STCW Code), the approval of which may find a quick consensus among existing members of the International Maritime Organization (IMO) versus reinventing and building new standards which may become redundant due to possibly delayed regulatory bureaucracy. The recommendations, based on the findings of the theoretical analysis, provide a pathway for the seafarers to be relevant and employable in the future workforce along with enhanced career fulfillment. This is notwithstanding the emphasis on the evolution of the STCW Code to changing requirements of skills and competencies ensuring pertinency and adaptability.

Implementing the Human Capability Standards (HCS) Framework for future seafarers: Challenges and Benefits

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Keywords: Human Capability Standards, capability framework, durable skills, future ready, technology, maritime workforce

With the rapid advancement and growth in technologies used for ship operations, the once stable seafarer role is facing ever accelerating transformation. The boundaries between functions performed by the seafarers are increasingly blurring as automation reshapes how work is designed and the value of non-technical, human skills and mindsets that cannot be automated are rediscovered. The value of non-technical, human skills and mindsets will also be essential as employers increasingly need new recruits and their seafaring workforce to adapt, learn and be willing to rapidly shift to fill not only new roles but also new ways of undertaking work. Based on a literature review, the authors of this paper found an absence of a suitable framework which address the skills gaps and align the competencies of the current seafarers to those required in the ship operators' future workforce. This paper also highlights the need of the seafaring industry to distinguish the current competencies required by the seafarer (and those outlined by the Standards of Training, Certification, and Watchkeeping or STCW Code) from capabilities which specify not just the skills and knowledge but also the personal attributes, such as mindset and behaviours, that are required to an applied standard expected in professional practice at a given level of career progression. To define the missing human capabilities, this paper applies the award winning, globally recognized, and validated Human Capability Standards (HCS) Reference Framework which is backed by over 30 years of research and has already been accepted by Forbes 500 companies and organizations listed on the Australian Stock Exchange (ASX). The focus of this paper is to contextualize the framework to the needs of the seafaring industry and identify the challenges facing implementation in maritime education and training. The challenges identified are then addressed with suggested strategies that will build a regulated and regimented structure for the training of future ship operators and meet the expectations of the industry looking to employ graduates that are ready for not only the performance demands of the current workforce but the adaptive demands confronting the fast-emerging future workforce.

Enhancing the future employability of seafarer graduates through recognition of human capabilities

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Keywords: Human Capabilities, Graduate Employability, Latent Dirichlet Allocation, Future Work, Seafarer

Digitalisation and cyber physical systems are producing highly intuitive systems in the maritime industry and transforming the nature of work and how seafarers will interact with advanced technology on Maritime Autonomous Surface Ships (MASS). With predictions of both seafarers and non-seafarers to be involved in the critical operations of autonomous vessels, researchers are actively investigating the new skills and competencies that may be required by future MASS operators. While many frameworks have emerged purporting to describe soft skills, employability skills, or behaviour-based capabilities, there exists sparse research comparing these frameworks or isolating the most important skills within a future maritime workforce context. Currently, the seafaring industry solely relies on and references the Standards of Training, Certification, and Watchkeeping (STCW) Code (revised last in 2011) to identify minimum standards of competencies required for seafarers to operate ships. Given the importance of using a skills framework to analyse and predict future skills demand in the workforce, regulators, educators, employers and seafarer graduates need to better appreciate the value certain skills will hold over others in terms of future employability. Using a data-driven approach (such as Latent Dirichlet Allocation) based on text analysis, this paper will present the results of the analysis of the aggregate information contained in existing soft skills frameworks, including the STCW Code, to discover the future capabilities. These future capabilities will provide a framework and scientific reasoning to create a taxonomy of capability stacks that will direct the future of seafarer education and training.

Educating Global Maritime Professional: An Action Research to Implement Courses Regarding Effective Communication

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Keywords: Global Maritime Professional; Body of Knowledge; Interpersonal Communication, Action research, E-learning

Abstract: The purpose of this study is to strengthen the interpersonal skills of future global maritime professionals through a collaborative e-learning initiative focused on Effective Communication, which is related to one of the focus areas of the Body of Knowledge (BoK) of the Global Maritime Professional (GMP) Initiative (IAMU, 2019). Specifically, this research explores the potential of collaboration among IAMU member universities in delivering the learning outcomes stated in BoK, as a teaching and learning strategy. Employing an action research methodology, instructors and students from different Maritime Education and Training (MET) member universities participated in determining the content and educational approaches needed to improve students' interpersonal communication skills. Subsequently, a collaborative e-learning course incorporating the content and various Teaching and Learning Activities (TLA) emerged and underwent testing and evaluation with students representing three different MET institutions. The findings underscore pressing educational needs within MET, particularly in verbal and written communication skills. The study highlights the value of implementing communication courses with students from different nationalities, revealing that despite time zone disparities, culture and language barriers, students not only enhance their communication skills but also cultivate essential social skills crucial for a Global Maritime Professional. IAMU member universities have faced numerous challenges in implementing the GMP and BoK. This study proposes alternative ways for GMP implementation, emphasizing the potential of member universities coming together to deliver BoK's focus areas and their learning outcomes effectively.

Utilising the Bayesian network model in near-miss reporting at sea

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Keywords: maritime safety; near-miss; organisational learning; reporting barriers

Shipping is one of the most dangerous industries where accidents can cause catastrophic consequences for human lives, the environment and the global economy. Furthermore, studies have shown that the human factor is the most common cause of marine accidents. To reduce the occurrence of such unwanted events to a minimum, one of the possible solutions is to analyse accidents, discover their root causes and implement corrective measures that will remove or minimise these causes (corrective approach). Another solution is to analyse and learn from near-miss events (proactive approach). However, to learn from near-misses, it is necessary to report them. To tackle this issue, the International Maritime Organization (IMO) introduced the mandatory International Safety Management (ISM) Code, whose Section 9.1 mandates reporting hazardous situations to the Company. However, according to some research, not all observed near-misses are reported in the maritime industry, although reporting is mandatory. Thus, a lot of important data that could be used to improve safety is irretrievably lost. To enhance the reporting of near-misses on ships, it is necessary to identify the factors that prevent it and act on them.

In this paper, expert judgment was used in combination with the available literature review to determine the factors that prevent reporting. In addition, experts evaluated the causal relationships between the factors, and the Bayesian network was used to develop a near-miss reporting model. The factors that most significantly influence near-miss reporting have been identified based on the proposed model. Accordingly, measures have been proposed to improve reporting at sea. That way, more adequate risk assessments and appropriate mitigating measures could be introduced.

An Ingenious Method to Reveal Seafarers' Situational Awareness Levels: A Bio-signal and Video Analysis

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Keywords: maritime education and training; non-technical skill; *kansei*; heart rate variability; ocular behavior

One of the crucial non-technical skills for seafarers is to maintain situational awareness. This skill will be particularly important in the upcoming decades due to the advent of autonomous ships. Consequently, several studies have been conducted to measure seafarers' situational awareness levels. A majority, if not all, of these studies, involve seafarers performing navigational tasks using ship simulators. This study aims to develop a simple yet effective method to reveal seafarers' situational awareness levels. In essence, this study aims to answer the following research question.

"Can bio-signals and ship operational videos measure seafarers' situational awareness levels?"

To measure seafarers' situational awareness levels when viewing videos of entering and leaving port operations, their bio-signals: heart rate variability (hereafter HRV), and ocular behavior (hereafter OB) are used. Respondents are divided into three groups according to their levels of experience. The videos of the entering and leaving port operations are divided into three sections as shown below.

Entering Port Operation	*Leaving Port Operation*
Stage 1: Approaching Port Entrance	Stage 1: De-berthing
Stage 2: Approaching Berth	Stage 2: 180-degree Turn
Stage 3: Berthing	Stage 3: Leaving Port

Figure 1 shows the HRV of the respondents when viewing the video of the entering port operation. Alternatively, Figure 2 shows the HRV of the respondents when viewing the video of the leaving port operation. The figures evidently show that the intermediate and expert seafarers have similar patterns, while the beginner differs greatly. This means that intermediate and expert seafarers possess a similar degree of understanding of the complexity of the operations. This finding is consistent with a previous study that used a ship simulator (Sugimoto et al. 2019). Next, Figure 3 shows the OB of the respondents when viewing the video of the entering port operation. Alternatively, Figure 4 shows the OB of the respondents when viewing the video of the leaving port operation. As the figures demonstrate, compared to the beginner, the intermediate and the expert seafarers spend more time looking at the actual view. This finding aligns with a previous study that used a high-speed boat (Forsman et al. 2012).

In conclusion, the findings of this study may suggest that seafarers' situational awareness levels can be measured using bio-signals and ship operational videos. The alignment of findings with previous studies further supports this notion. As a future assignment, the application of image processing may be needed to comprehensively measure the differences between beginner, intermediate, and experienced seafarers in terms of their OB. As importantly, more respondents are needed to further solidify the findings of this study.

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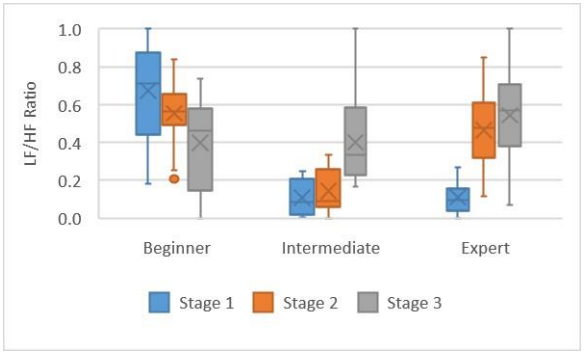

Figure 1. Change in LF/HF Ratio (Entering Port Operation)

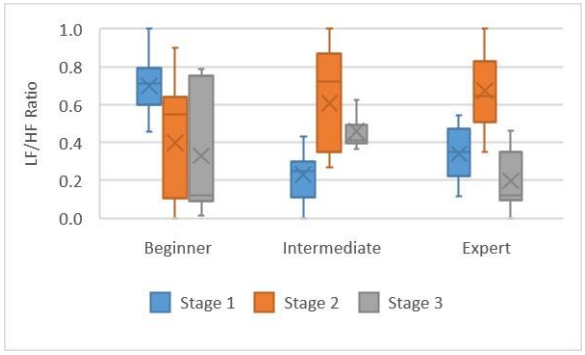

Figure 2. Change in LF/HF Ratio (Leaving Port Operation)

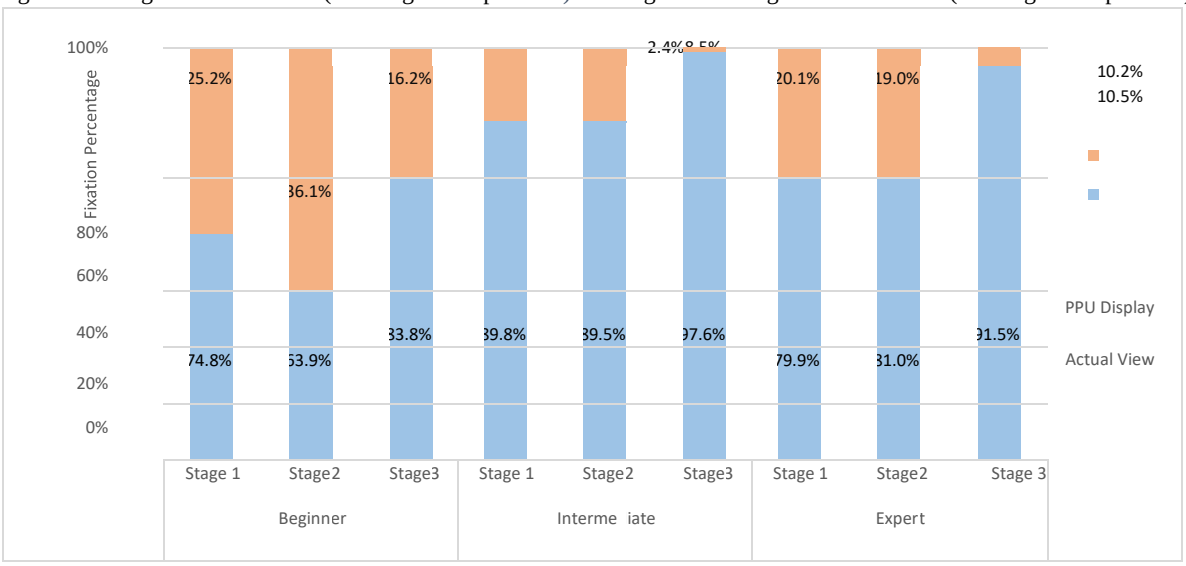

Figure 3. Ocular Behavior (Entering Port Operation)

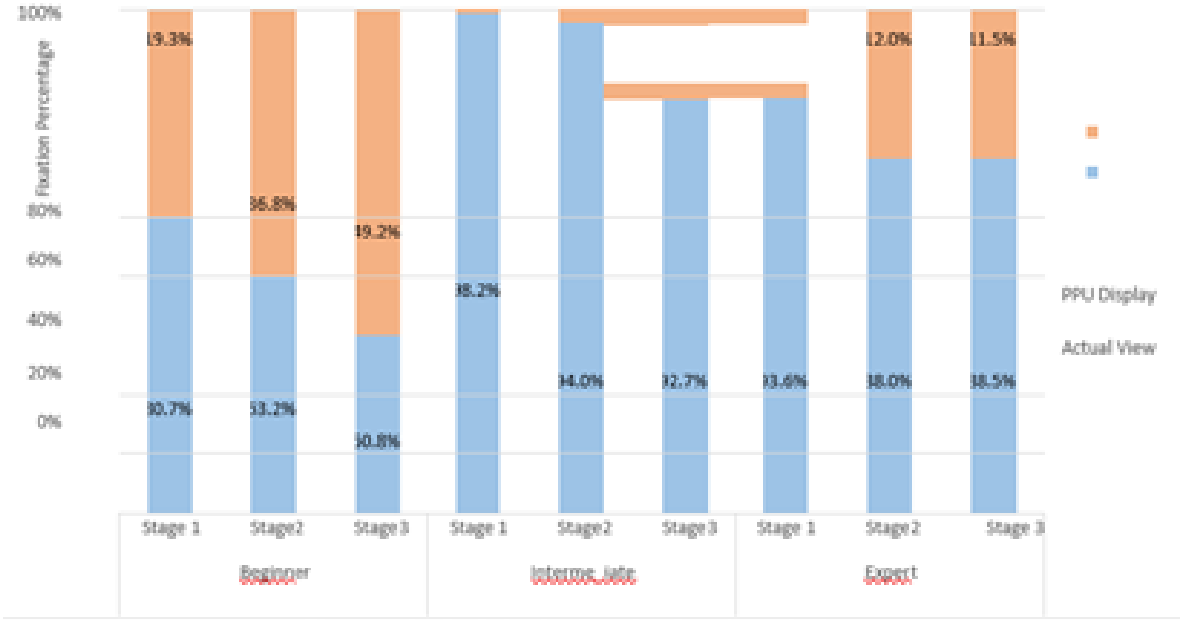

Figure 4. Ocular Behavior (Leaving Port Operation)

Fostering Sustainable Societal Progress: Unveiling the Crucial Role of Gender Equity in Empowering Women across MTI's

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Keywords Maritime Education, Gender Equity, Seafarer, Sustainability, Women Empowerment

Ensuring true sustainability requires addressing gender equity within society, particularly through the empowerment of women. This empowerment is crucial for the sustainable development of communities, as mentioned by the 2030 Sustainable Development Agenda. Women's economic empowerment involves their equal participation in markets, access to decent work, autonomy, control over resources, and increased decision-making power. In the maritime sector, historically male-dominated, the International Maritime Organization (IMO) has pursued gender balance through its "Training-Visibility-Recognition" strategy. While progress has been made, gender inequity persists. A survey of 150 maritime professionals in India reveals challenges, including low female cadet enrollment due to lack of support and safety concerns. With only 1.2% of seafarers globally being women, promoting gender equity is critical. The study address the further research and collaborative efforts between maritime institutions and the industry to support women in pre-sea courses, thus promoting their education and maritime sector gender equality for a sustainable future. Addressing these challenges is paramount for achieving true sustainability, where gender equity plays a central role in shaping a more inclusive and resilient society.

How much time is needed for a control take-over? A study among onboard management

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Keywords: MASS, human factors, control take-over, remote control, degrees of autonomy, situation awareness

With prospective implementation of Maritime Autonomous Surface Ships (MASS), the aspect of properly controlling them is in a spotlight. Various modes are postulated including full autonomy and remote control. It remains unclear however what conditions must be met to safely switch between these, including time needed for such operation. In order to investigate this issue, we asked a number of Masters Mariners and senior Engineers about their experience with situations in which they needed to take over the control in both emergency and during normal operations. The results of this study may prove valuable in determining the time required for obtaining a situation awareness during control takeover of MASS and switching between their respective Degrees of Autonomy.

Use of lightboard videos in Maritime Education and Training

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Keywords: lightboard videos; maritime education and training; distance education; student motivation

This paper presents an update on the instructional design of the post-graduate, distance-education degree course of International Maritime Management, M.Sc. (IMM). The discussion includes a concept for the use of lightboard videos as teaching and learning methodologies (Fallas-Ramírez et al. 2022; Jose et al. 2021) and its implementation within the Maritime Business and Logistics (MBL) learning module. Therewith, the paper refers to the topic of the conference of "Protecting Our Mariners – Promoting Our Industry – Providing for the Future.", in particular the "Social/Maritime Education & Training" aspect.

The past semesters have shown that the overall didactic concept of IMM works and that it is even crisisproof as Covid-19 pandemic has had only limited impact (Nause and Greenwood 2022). The reason for this is that the course has been designed in distance education format (Willis 1993) right from the onset and, even more important, along the needs of nautical officers (IAMU 2019; Means et al. 2014). A higher level of acceptance of digital services – mainly as an outcome of Covid-19 pandemic – as well as further advances in technology lead to new teaching opportunities. This refers to education in general, but especially to Maritime Education and Training (MET) with its target groups that are difficult to reach on board ships. Therewith a reduced amount of face-to-face teaching and learning and simultaneously an increased level of flexibility from a student's viewpoint goes along (Simonsen et al. 2019). At the same time, the need of adopting appropriate methods and digital tools arises. This results in higher demands for learners in terms of self-management, time management, adaptability and development of competences, motivation and so on (IU 2023).

Experience from teaching and student feedback in the context of the above-mentioned case show that students also face different 'practical' hurdles while studying, for example, work with extensive datasets and databases, calculate freight and utilization rates, as well as interpret economic principles, numbers and statistics in a maritime context. Here, short and succinct videos of up to five minutes length should be introduced (see picture 1 below). These videos facilitate teaching and learning, serve to enhance the understanding of practically relevant issues in the maritime industry as these are very hands on, reflect experience, consider social cues, initiate discussions, problem-solving skills, self-efficacy, strengthen online community engagement as well as enhance users' understanding and interaction (Perkins and Woods 2023; Gleason 2018; Koumi 2009). Once recorded, students can use these videos asynchronously and as often as needed. On this basis, learners can work on their own questions, projects and examination and discuss with their peers and lecturers.

The article starts with the relation between motivation, the learning environment and learner and discusses the influences on motivation according to the self-determination theory (Deci and Ryan 2000a, b; Ryan and Deci 2002): autonomy, competence, relationships. Taking this into consideration, the discussion proceeds with the use of videos and their implementation in the existing instructional design of the degree course.

This paper also synthesizes new ideas as the implementation of videos goes far beyond teaching and learning within the above-mentioned case. It can, for example, also be used as a mode of examination by asking students to record videos. This seems promising as it puts active modes of teaching, learning and assessment in the foreground. It can contribute to 'active assessment' by putting students in situations during examination which are far closer to reality as written exams do, for example.

Finally, the videos and experiences gained here serve as an example of good practice which should be transferred to other modules, degree courses and universities. Therewith, the concept serves as a blueprint for further projects in MET, namely at other IAMU member universities.

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For illustration purposes a picture of a lightboard video from the MBL learning module is shown in the following figure:

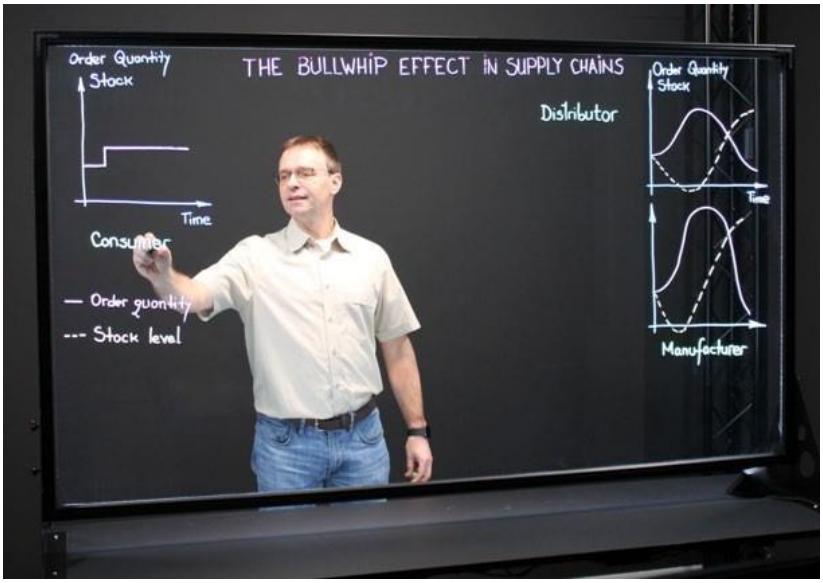

Figure 1. An example of a lightboard video, source: own picture.

Opportunities and challenges of part-time studies in Maritime Education and Training

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Keywords: Boundary Theory; Lifelong Learning; distance learning; micro-credentials; maritime education and training

Following the acquisition of their Certificate of Competency which goes regularly along with a bachelor's degree (depending on country-specific characteristics), young women and men can start working on board seagoing vessels or continue their education with further studies (on post-graduate level) in order to prepare for highly qualified jobs in the maritime domain. Due to the characteristics of the workplace at sea (long and irregular phases of work and holidays, different and changing time zones, limited access to the Internet), the combination of starting work on board – with the aim of acquiring a Certificate of Competency unlimited – and continuing formal learning at a university (in a master's degree course) seems particularly attractive for this group of people. The distance education degree course of International Maritime Management (M.Sc.), offered at Jade University of Applied Sciences in Germany, should be mentioned here as one example.

Even if this approach requires a very high level of motivation, coordination and perseverance from a student's viewpoint which is a (the) hurdle (IU 2023: 25), the combination of these two qualifications bears a great chance: the transformation and change that is taking place at the moment in the maritime economy (Stopford 2022) requires further education and up-to-date knowledge. In this context, the concept of lifelong learning (European Commission 2006; Slowey & Schuetze 2012) and the individual ability to be able to acquire new skillsets needed are becoming increasingly important. A sequential format from primary school through under-graduate degrees and professional entry to retirement no longer seems to be appropriate. Instead, we need concepts that follow and build on university education and enable employees to continue their training as needed throughout their careers (Richards 2020).

This article discusses the area of tension described and builds therefore on the two concepts of lifelong learning and the boundary theory (Ashforth et al. 2000; Nippert-Eng 1996). Besides the reasons given above, the discussion seems particularly appropriate in the context of lifelong learning because from a participant's viewpoint multiple commitments from different roles at the workplace, private life and studies result in conflicts which is seen as the greatest challenge in distance education (O'Shea et al. 2024). Therefore, those who have already learned how to learn can particularly benefit from the above-mentioned approach. The model primarily serves the purpose of further training, builds on existing competencies and develops these further. Therefore, besides entire study programs, smaller continuing education formats are increasingly required in order to be able to keep up with beforementioned demands on the one hand and tackle the changes that are taking place in the maritime domain on the other hand. In Europe, this discussion is referred to as so-called micro-credentials (European Commission 2020). This topic is even more important as different areas of life (workplace, private life, studies) are increasingly interconnected. In this context the boundary theory posits that individuals differ in the way they separate or integrate activities from different life domains. They usually tend to prefer strategies that refer to one approach or the other and their behavior in the different roles in everyday life is appropriate (Kreiner et al. 2009; Kossek and Lautsch 2008). However, the debate is particularly relevant for seafarers, as crew's everyday life is very much determined by the on-board routine. It can be assumed that this requirement will have a major impact on well-being at sea.

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Ship Security Awareness Training: The Experiences of MAAP Cadets During Shipboard Training

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Keywords: ship security; security awareness; shipboard training

Theme Category: Social/Maritime Education and Training aspect

To ensure the safety of seagoing vessels and their personnel, the maritime industry may implement comprehensive training programs in response to the escalating number of security concerns that the sector faces. The objective of this research is to measure the ship security awareness experienced by the cadets of the Maritime Academy of Asia and the Pacific (MAAP) during their onboard training.

A quantitative research design was employed to gather information through surveys and to obtain an understanding of the respondents' perspectives regarding ship security awareness. Likewise, it is also aimed to identify both areas of strength and those that could benefit from improvement. A self-made questionnaire was used in the study. The questionnaire was divided into five parts namely: the profile of the respondents, ship security training during shipboard assignment, security incidents and reporting, communication and emergency procedures, and effectivity of ship security awareness training.

The results showed that the profile of the respondents had no significant effect on the ship security awareness training during their shipboard training. However, in terms of communication and emergency procedures as well as in security incidents and reporting, there is a low correlation effect.

The research provides valuable insights into the impact of the SSAT on the readiness of MAAP students to confront complex security scenarios that might transpire throughout their onboard assignments. The aforementioned discoveries may be utilized to contribute to the enhancement of existing training modules, ultimately leading to a heightened impact on security awareness initiatives within maritime education settings. Ultimately, this research aims to improve the safety and security protocols implemented by aspiring maritime professionals, thereby making a valuable contribution to the advancement of a more resilient and secure maritime industry.

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Use of HAZOP for Existing Training Ship Safety Operation

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Keywords: HAZOP Method; Engine room operation; Safety Operation; Risk Management

In ship engine plants, there may be potential risk materials such as fuel oil, liquified gas, lubricating oil, steam etc. When the engine plants are in operation, all factors will change due to high energy materials being high pressure and high temperature. If these high potential energy material leak, burst or spill out of the engine room, engineers or seafarers and also the plants themselves can sustain damage. It is important to discover the multiple preventive measures effectively beforehand and to take actions to use them before an error or malfunction become major catastrophe. Planning and designing countermeasures from a strategic standpoint are critical actions. Consequently, the implementation of reasonable verification and safety measures in engine room must factor in risk assessment and risk management.

Risk management for vessels and maritime field are discussed in 2000 ISSC (International Ship and Structures Congress), developed and established the specialist committees for risk assessment. The IMO and Classification society NK have introduced FSA (Formal Safety Assessment) and made guidelines for use in the IMO rule-making process, especially for bulk carriers and passenger ships, which have risks of losses of life and property. HAZOP (Hazard and Operability analysis) method is originally invented as one of the qualitative hazard evaluation techniques by chemical industry. It widely used as risk management method for offshore fuel and LNG plant construction. Recently, HAZOP are used for design of engines in purpose of ships using gas or other low-flashpoint fuels (IGF Code) vessels because there will be more risks using gasses compare to fuel oil. Purpose of using HAZOP for existing training ship (KAIJIN MARU) have two aims. First aim is to propose safety operation and second aim is for education and training for student. To propose safety operation, firstly conduct research of SMS (Safety Management System), piping chart, operation manuals and another document which are necessary to conduct HAZOP. Secondly separate engine plant to several categories such as Main Engine fuel oil line, lubrication oil line, Diesel generator fuel oil line etc. Then carry out HAZOP brainstorming for each category with well-trained engineer and student. Consider if existing safeguards are enough for potential risks. For purpose of education and training, student conducting HAZOP will join the research of SMS, piping chart, operation manuals and another document to consider potential risks. Thus, even if potential risks are not found by conducting a HAZOP, brainstorming may improve knowledge of the plant understanding and the team member's operation skills.

From the result of HAZOP study, we can suggest that if there are new recommendations should be included in SMS and operation manual. Also, conduct countermeasures for actual engine room system if necessary. Based on the methodology of HAZOP, the scope of HAZOP is to identify potential process hazards or operability concerns, not to find all solutions to reduce or remove them. Which means applying for existing ship can not be change full construction of engine room. Ideas of minimizing risks are important and this idea may adopt to any other operating vessels. From the result of education and training viewpoint, difference of knowledge and understanding of plant operation before conducting HAZOP study and after brainstorming could be discussed.

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Developing a Short-Term Study Tour Program: Maximizing Benefits for Host University Students

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Keywords: Maritime Education and Training, Study Abroad, Short-Term Study Tour, Maritime English, Intercultural Interaction

For university students preparing for careers in international fields such those under the vast umbrella of the maritime industry, participating in study abroad programs can provide valuable intercultural experience, improve language and communication skills, and offer immersive learning environments not usually accessible in normal classroom learning (Paras et al 2019; Sjoberg and Shabalina 2010; Smith and Mitry 2008). Short-term study abroad tours are an increasingly popular and often more accessible but still beneficial form of study abroad that typically involve a group of students led by a faculty member on a visit to another country for around two to three weeks (Ogden 2015; Scharoun 2016). This paper presents the goals, methods, and issues involved in the development of a short-term study tour program at Kobe University's Graduate School of Maritime Sciences for a group of students visiting Japan from the United States. It also emphasizes the efforts to maximize benefits for the host university students and to plan for the promotion of the value of such programs among the community of maritime universities.

The program outlined in this paper takes place in May 2024, but the planning and development for the program started almost a year earlier in Summer of 2023. The goals for the American students participating in the program centered on expanding knowledge in maritime sciences topics, deepening understanding of the international aspects of their field, building confidence in working in international settings, developing intercultural skills, and learning more about the host country's culture, history, and language through immersive experience. To those ends, the program features various hands-on activities, academic lectures, instruction on Japanese language and culture, visits to maritime-related sites and cultural centers, and independent study. A key activity will be a special research project that students will conduct before and during their visit based on a maritime or Japanese cultural related topic. Importantly, there will be multiple opportunities for varied interaction with the Japanese students in the maritime sciences program.

While the program centers on fulfilling the goals for the visiting students, special care has been taken to maximize benefits for the host university's students by providing opportunities to voluntarily support outside activities such as day trips and sightseeing and to collaborate academically through classroom-based tasks. Including visiting students into an active course curriculum allows more students to be involved and better control over task features but also requires careful planning to ensure meaningful benefits for both groups and to avoid impeding the pre-set course objectives and schedule. This paper will detail how the activities were planned to maximize interactions with students in ongoing courses including the pre and post arrival tasks.

The final portion of this paper outlines efforts to promote the benefits of this program by documenting the development process, collecting data regarding learning, attitudes, and experiences, and promoting the results of the program both locally and among the larger community of maritime universities. Ultimately, the aim is to ensure that the energy put into the program leads to opportunities for Japanese students to travel abroad on similar tours, future study tour visits to our university, and continued evidence-based refinement of the programs that make up this tour, while also providing a template for other institutions who may be looking to develop similar programs.

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Analysis of Maritime Pilots' Education in the Republic of Croatia

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Keywords: education, maritime piloting, maritime pilot, education quality, acquired competencies

The increase in maritime traffic density, the presence of large vessels, mega-cruisers, a growing number of specialized terminals, and the rising transport of hazardous materials by ships are just a few characteristics of today's maritime industry. Over the past decade, coastal countries worldwide have faced a growing spectrum of maritime risks in their national maritime areas. If not controlled, these risks could evolve into real threats to local populations, economies, and the overall development of the state.

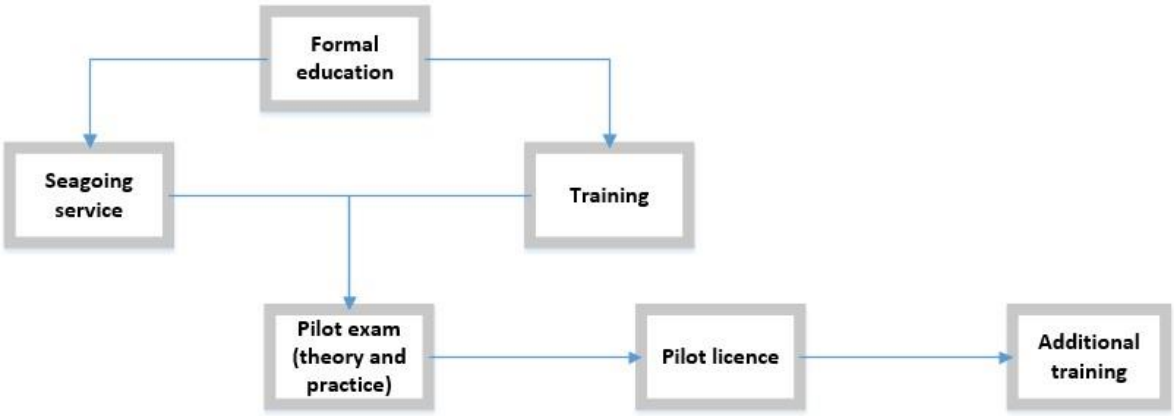
Piloting is of utmost importance for safe navigation in ports, straits, and other areas of internal waters and territorial seas. Compulsory piloting is prescribed for ships of certain types and sizes. The primary goal of piloting is navigation safety, and consequently, environmental protection. Piloting is typically carried out by maritime pilots, seafarers with a good understanding of local navigation conditions.

In the Republic of Croatia, piloting is regulated by the Maritime Code and the Regulation on Maritime Piloting. To safely perform piloting duties, maritime pilots in Croatia must undergo specific education, internships, and training following the guidelines outlined in IMO Resolution A 485(XII). The Regulation on Maritime Piloting specifies certain conditions that must be met to take the pilotage exam. These content areas include safety, maneuvering and navigation, and proficiency in the English language.

Due to the increasing demands of the maritime industry, additional education for maritime pilots is provided. Additional education takes place on simulators, covering various maneuvering scenarios in different weather conditions. Education is conducted at universities or specialized training centers. Although additional education is not legally mandatory in the Republic of Croatia, it is undoubtedly beneficial due to the needs of the maritime industry.

This paper systematically and comprehensively establishes the education, internships, and training of maritime pilots in the Republic of Croatia. Given that maritime pilots play a crucial role in ensuring maritime safety and environmental protection, the purpose of the paper is to analyze their additional education. For research purposes, a questionnaire on the implementation of additional education for maritime pilots was developed. The aim of the questionnaire was to obtain information about the quality of education and acquired competencies. The results of the conducted research indicate that maritime pilots believe the implementation of additional education is necessary, especially concerning specific types of vessels.

The goal of the paper is to explore the implementation of additional education for maritime pilots, with a specific focus on identifying potential opportunities for improvement. The authors emphasize the need for continuous education of maritime pilots to ensure maritime safety and environmental protection.



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Acquisition of business communication skills among students of maritime studies

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Keywords*: business communication, maritime industry, English, students, attitudes*

Business environment in the modern maritime industry involves many participants from all over the world. The globalisation process and internationalisation of the contemporary world have brought into focus the importance of communication among all parties involved. English being the official language of the trade, this research has focused on the communication skills in English of the students of maritime studies, taking into account the specific terminology and discourse in this specific business area. The paper aims to provide an insight into communication skills of students of maritime studies and their attitudes on acquisition of these skills. The research was carried out among undergraduate and graduate students of the University of Dubrovnik, Maritime Department. For the purpose of this research, a questionnaire was compiled by the author to ascertain the students' attitudes on the communication skills and also their application of the basic skills in business communication. The data gathered was analysed by using the statistical package SPSS 26. The research results obtained can be used as guidelines when developing new programmes and/or syllabuses for students of maritime studies but also of other business studies.

Current trends in the maritime education-transition and transformation from traditions to modern times

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Keywords: maritime education; tendencies in the maritime education, transformation processes in the maritime domain;

The seafaring profession will be a future job in a dynamically changing world of automation, digital transformation, sensor technology, data communication and remote controlling. Despite and in addition to these trends the human element in shipping still stays central and pivotal part of the security and safety of navigation and ship operations. There is a huge progress in technical solutions, especially in the autonomous shipping and operations maritime domain, but parallel with the technical and digital achievements some challenges arise. They are connected with financial sustainability and some ambiguity who, how and to which extent they will be managed. The maritime education is not only aware of these trends but devoted to prepare and train the future seamen to occupy positions that require broader scope of qualifications including various aspects of leadership, psychological, even cultural competences enabling them to work in a very dynamic, fast changing onshore and onboard positions requiring strong adaptiveness and flexibility.

The paper examines the maritime education and training (MET) at Bachelor's degree with added value at the level of vocational training, courses for qualification and upskilling, continuous learning courses etc. In the first part some concepts for MET are overviewed: learning through mentoring, micro-education, training using case studies and shared learning (academics and practitioners together), self-education and dual education. The goal is to present and **propose the modern maritime education as an adaptive model**. The overview is considered to upgrade and contribute to the common understanding of the classical traditional educational system existing in the current environment. Some general factors that form the current maritime environment are presented in order to outline the trends towards dynamic, changing, more sophisticated, even unpredictable (COVID-19) circumstances that affect the maritime business and its needs. The Bachelor education is transforming as a combination of acquiring traditional fundamental knowledge about the profession with more specialized specific skills that allows the future seamen to work in multi-connected environment. Very important part of them are self-education and soft skills that are implemented in the current academic curricula.

The second part of the paper presents some empirical data from two different directions: the students' dynamics in choosing their educational specialty and the corresponding needs of the employers and partners. The goal is to outline the "cross-needs" in order to combine qualifications and skills from traditionally different professional specialties, for example "Navigation", "Ship engineering", "Communication and Information Technologies", "Cybersecurity", even 'National Security". Additional feedback from the users, the maritime organizations is collected and analyzed. **A principle and conceptual model of curricula is proposed based on the principles of adaptive educational methods.** The proposed model can be complemented and modified according the specific requirements of various specialties and can be used as a basic idea-model for further developing catalogue of so called "boutique specialties".

Autonomous Vessels and AutoMare EduNet – National Revolution of Maritime Education in Digivisio 2030 Platform

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Keywords: Autonomous shipping; MET; E-learning; Digivisio 2030, STCW-convention

The autonomy of seafaring will take a huge step when IMO Maritime Safety Committee will finalize the MASS Code to be implemented as part of SOLAS. The Code will be implemented first on a voluntary basis in 2026 and it will be mandatory part of SOLAS since 1.1.2028. IMO Legal Committee has also started to renew the Maritime Conventions to meet the demands of vessels with different stages of autonomy. Technology has been developing fast in this area, especially in Nordic countries where the Maritime Cluster has been active in this field.

The Maritime cluster in Finland has built up a network for education of autonomous seafaring in order to combine the efforts of different Universities and Universities of Applied Sciences in this field. As combined effort of the Universities in this AutoMare EduNet -project (financed by Ministry of education in Finland), the universities made a survey on the needs for education and then planned the combined efforts to guarantee that the industry´s needs for well-educated workforce related to autonomous vessels are met since January 2025 and onwards. The education which will be covered by the consortium of universities is economical, legal, technical, and maritime education relating to shipping. The theoretical knowledge from scientific Universities is to be combined with Universities of Applied Sciences more practical knowledge needed at sea and in land-based organizations in shipping companies' management. As a separate part in this now permanent consortium the MET institutions will also clarify how the STCW education needs to be supplemented by the knowledge relating to autonomous seafaring when the IMO is progressing also on STCW standards. The Satakunta University of Applied Sciences as the only IAMU member from the project will also promote the results for the IAMU and invite foreign IAMU members to further develop common syllabuses orientating to vessels with different stages of autonomy according to the stages defined by IMO.

The project lasted two and a half years and during the project a platform for dividing the studies was found. As a government project Digivisio 2030 was initiated during the project, in which all the Finnish Universities have joined. This platform makes it possible for all university students to choose studies from all other universities since January 2025 and join the studies virtually, from wherever they are studying. The AutoMare EduNet consortium offers studies which have been determined by the needs of the maritime industry in relation to MASS vessels different levels of autonomy (IMO 1-4 levels). The Consortium makes it possible for MET Universities to allow the teachers to specialize deeper in their own research fields as the MET institutions can benefit from each expert's knowledge nationally. The MET institutions can also offer their students a large variety of expertise and professors can teach maritime students in hole nation at the same time in their courses. Students can also pick up the courses they are interested in, wherever they are studying and all possibilities are offered by Digivisio 2030 platform when they register their topics of interests in the digital system. This will certainly be a revolution of MET education that changes the future even more than autonomous shipping itself.

Preparing our engineers for engine room of the future

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Keywords: energy transition, electrochemical propulsion, training, green shipping

Last year, the IMO published the ambition of their member states to bring down green house gas emissions to close to zero. Additionally, member states made a commitment to increase the use of alternative fuel and propulsion types that emit zero or near zero green house gasses. It is therefore very likely that the students we educate in our schools today will sail on ships with different types of propulsion and fuels than currently conventional. Most of the current curriculum, as well as the STCW guidelines still, rightfully, focuses on conventional propulsion such as diesel engines and gas turbines.

We are currently still at the beginning of the green revolution. Research is conducted into many different areas, low flashpoint fuels, batteries, fuel cells and much more. It is impossible and undesirable to make students experts in all these types of propulsion and fuel. Primarily because there is too much to learn and not enough room in the program, but also because not all of the systems that are currently being researched are going to become the conventional propulsion of the future. So what should we teach our students?

In this article, we look at how we can best prepare our students for the unknown future, allowing them to excel regardless of how a ship's propulsion system will look in the future. This means identifying what new knowledge must be added to the curriculum and what knowledge related to modern propulsion translates well to knowledge of conventional propulsion that is already taught now. This article end with an overview of important subjects related to electro-chemical propulsion that should be added to the conventional curriculum to better prepare our students.

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Training of the Future Marine Engineers

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Keywords: Marine engineer, MASS, Autonomous shipping, Digitalization, SRtP

The International Maritime Organization (IMO) recognized advancement to full autonomy in four stages under MASS (Maritime Autonomous Surface Ships). The current perception of the shipping industry is that the technology for fully autonomous vessels, that is degree four of the MASS, potentially exists today. Over the next few years, the rapid rise of digitalization and sophisticated intelligent tools that allow remote monitoring and operations will disrupt the industry in an unprecedented way. To have a better understanding of what might the future look like and be able to prepare marine engineers for that, we designed a research project titled ROME (Investigating the Future of Maritime Workplace and the Role of Marine Engineers in Autonomous Ships). We collected data from different stakeholders including advanced marine engineering manufacturers, shipbuilders, shipowners, and marine engineers. We also visited the newly built or under construction ships having recently developed class notations such as Safe Return to Port (SRtP) and interviewed the designers and project managers. These included M/S AURORA BOTNIA delivered 2021, M/S MySTAR delivered 2022 from Rauma Marine Construction's shipyard, Finland, and M/S SPIRIT OF TASMANIA IV to be delivered in summer 2024. Data were also collected from the shipboard engine remote operations centers such Wärtsilä and Kongsberg.

Todays' advanced technology and digitalization allow connecting different elements of a ship such as main and auxiliary engines to the onshore remote operation centers. However, Our initial analysis shows that, as the autonomous technology is at its infancy and standards are not fully developed there are mismatch between products of different manufacturers. This creates a challenge when different manufacturers are installing their systems onboard a ship for the first time without comprehensive knowledge of compatibility of different elements of different systems installed. As the result systems such as software are constantly getting updated with the potential to endanger the safety of the ship due to possible errors or incompatibility with other systems. Currently, shipping industry is experiencing a transition from conventional to advanced smart shipping. The marine engineers onboard ships need to be educated to be aware of the changes and possible challenges to ensure safe sailing. These challenges may go further than the boundary of the ship and include the regulatory framework, responsibilities and liabilities, and the assurance of safety and environmental protection. The current STCW and the MET systems lack the capacity to train the next generation of marine engineers. There is a gap between the skills and competency included and the requirements for monitoring, controlling, troubleshooting, and maintaining the future ship's engine. The final outcome of the ROME project will help MET institutes take the initiative and make plans for required competency developments.

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Reviewing Gender Related Experiences in Maritime Education in some of the Black Sea Neighbourhood Countries (Georgia, Turkey, Bulgaria and Ukraine)

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Abstract: The article discusses the maritime industry, which traditionally has been characterized by imbalances in gender-related experiences, resulting in women's underrepresentation in the abovementioned field. The study aims to review gender-related experiences in the field of maritime education in some of the Black Sea Neighbourhood Countries (Georgia, Turkey, Bulgaria and Ukraine). By reviewing gender-related experiences in the above-related neighbouring countries, the study provides existing views on the status quo of gender equality and inclusivity in the areas of maritime education.

The method of study was based on secondary data obtained from the partner maritime universities in the above-listed countries. The literature around the topic was reviewed, and primary data was collected via an online survey with qualitative and quantitative information from partner institutions; in particular purposive sampling method was applied by selecting representatives from partner universities in the Black Sea region to share their experiences in the Gender-related issues in maritime education. The primary data was analyzed to draw assumptions on the existing trends and changes in genderrelated experiences through the women empowerment regional campaign. The study was based on reviewing various dimensions, in particular female and male alumni enrolment rates, career opportunities, and gender-related experiences in the maritime field.

In the article, we identified the key factors resulting in gender imbalances, as well as social factors, cultural perceptions, and institutional practices. We have explored the effect of the “women empowerment” regional campaign at the partner universities.

In the conclusion of the article, the importance of raising awareness about gender-related experiences within the scope of educational institutions and offering new insights to industry stakeholders and policymakers was underscored. Thus, the study fostered diversity and equity in maritime education in some of the Black Sea neighborhood countries.

***Keywords*:** Gender-related experiences; Inclusivity; Maritime education.

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Students' Mental Wellness: Basis For Designing a Wellness Intervention Program for Maritime Students

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Keywords: mental health; mental wellness; wellness; well-being, intervention program

Mental health issues remain a matter of global concern. According to the World Health Organization (2022), 280 million people worldwide are affected by depression as a serious form of mental illness, and seafarers are reported as suffering more from depression compared to other working groups (ISWAN, 2020; Jonglertmontree et al., 2022). This state of mind can be catastrophic and fatal if not given proper attention (Abila & Acejo, 2021; Iversen, 2012; Lucas et al., 2021).

Maritime Institutions play a crucial role in ensuring that future seafarers are mentally prepared to face the realities of seafaring. In the context of the academe, it is deemed essential to develop policies and programs for the promotion of mental health (Abila & Acejo, 2021) and integrate stress management and diversity training in the higher education of future seafarers on board to ensure mental readiness (Jensen & Oldenburg, 2020). Ideally, maritime students and seafarers must be educated in the basics of mental health to train them mentally and holistically (Abila & Acejo, 2021). Instead of waiting for a mental ailment to strike when they are already onboard, developing proactive mental wellness programs and activities tailored for maritime students could improve their preparedness to deal with challenging situations.

This study aimed to (1) measure the level of mental wellness among maritime students; (2) determine whether significant differences exist in their mental wellness when grouped according to age, academic year level, and program; (3) determine the variables that significantly influence their mental wellness; (4) and design an intervention program to develop their mental wellness.

The study employed a descriptive-correlational research design to address its objectives. Data were collected through a survey with 320 maritime students. The instrument used to measure their level of mental wellness was adapted from Warwick-Edinburgh's (2008) Mental Well-being Scale. The scores measuring the level of mental wellness obtained were categorized according to three levels of interpretation. Consequently, a t-test, Analysis of Variance, and Regression Analysis were conducted to test the variables.

Generally, the findings showed that the level of mental wellness among the sample size was moderate as a whole and when grouped according to age, academic year level, and program. Furthermore, there was no significant difference nor any significant influence of the said variables on the mental wellness of maritime students.

The study concluded that though the students' level of mental wellness was moderate – meaning they are doing well – the score could still gain much in terms of resilience and quality of life by taking evidence-based activities to improve their mental well-being. Moreover, the study supports the notion that mental wellness is not a static state of being but is more about prevention.

Interestingly, Keyes' (2002) Dual Continuum Model shows that mental illness does not necessarily imply an absence of mental wellness and vice versa. Mental wellness can co-exist with mental illness. Improving one's

mental wellness is recognized to be a protective factor for mental health and aids in reducing the severity of mental illness symptoms (Abila & Acejo, 2021).

Based on the findings gathered, the researchers of this study have proposed a Mental Wellness Program and other institutional initiatives to promote mental wellness among maritime students.

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The use of interactive blended learning model of Physics courses for future maritime professionals on LMS MOODLE

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Abstract: The article deals with the use of blended learning model in maritime education and training. Social changes due to the imposition of martial law in Ukraine, and the recent COVID-19 pandemic force teachers and researchers to search for new approaches to the learning process organisation (Law of Ukraine 2023). This also applies to the professional training of future seafarers. Transition from traditional education to blended learning prompts researchers to revise teaching methods, which should be aimed not only at acquiring a certain amount of knowledge, but primarily at future maritime professionals' personal enhancing. Today, interactive learning is recognised as a method that provides the most complete person-centred approach to students (HED Strategy in Ukraine 2020). However, the authors have not found any scientific and methodical papers on the organisation of future seafarers' mutual learning as a leading interactive method based on the LMS MOODLE. In view of this, application of an interactive blended learning model for future seafarers on the MOODLE of Kherson State Maritime Academy (KSMA) system is relevant (Voloshynov 2019, Sherman et al. 2022, Horn et al. 2014). The article is aimed at studying the possibilities of organising mutual learning of Physics courses for future seafarers using the MOODLE of KSMA. The research methods used in the study are as follows: theoretical methods as an analysis of literary sources, which highlight the theoretical background of blended and interactive learning, as well as comparison, generalisation and systematisation of the information; empirical methods that include conversation, communication with experts, cadets' questioning. The study demonstrates that blended learning should be based on an interactive model with its main features such as dialogue, polylogue, mutual learning, cooperation, and "teaching others" (EdEra 2019, ONMU 2014). The study resulted practically in development of instructional guidelines for the organisation of cadets' mutual learning on the MOODLE of KSMA during performing a laboratory training in Physics, which include the following components: stages and content of training, algorithm of cadets' activities, recommendations for the teacher's activities at each stage. As a result of the experiment, it has been found that a majority of KSMA students are willing and ready for blended learning using the LMS MOODLE. The blended learning organisation in Physics with the use of e-Learning resources, and "subject-object-subject" learning has proved to be effective according to the results of cadets' survey. This model of learning during a laboratory training creates a sense of well-being for students in personal time planning and confidentiality of learning, promotes motivation to study Physics, and enhances the quality of knowledge.

Keywords: maritime professionals; Mutual Learning; MOODLE; Blended Learning; Maritime Education and Training

Maritime Society 5.0: Embracing Newly Emerging Skills and Career Pathways

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Abstract: The initiative known as "Society 5.0" was introduced by the Japanese Government as part of the Fifth Basic Plan for Science and Technology (2016–2020). Its purpose is to position humans and human intelligence as key elements in maritime systems, expanding the focus from solely emerging technologies to the collaboration between humans and technology. This initiative is considered highly significant in scientific and professional communities for the transitional process from the existing skills that define maritime professionals to new skills, envisioning not only economic and ecological but also broader societal wellbeing. Research increasingly promotes sustainability, digitalization, and resilience in the maritime industry, and consequently, within maritime professions, through the enhancement of international and national education, training, and business practice frameworks. The newly emerging skills deemed essential for maritime professionals in the near future are defined as fusion skills, according to literature findings. Such skills will be the subject of investigation in this paper, representing the first level of research.

The second level of research considers the transformation of maritime career development, influenced by changes in the labor market and the transition of the maritime profession. The newly emerging skills will be particularly contextualized with the characteristics of the target group, millennials, and Generation Z, exploring possibilities for their professional development. This work takes the form of a conceptual study based on qualitative methodology, employing systematic literature review and document analysis as primary methods.

The paper contributes to identifying common ground in the fields of human resource management, engineering sciences, and maritime marketing, offering integrated solutions to address the challenges of transitioning from previous maritime societies to Maritime Society 5.0. Furthermore, it contributes to maritime universities in making strategic decisions regarding education and training and to maritime professionals who, in certain aspects of the profession, are already living a future that has begun in this industry.

Keywords: Maritime Society 5.0; skills; maritime career

Achieving gender equality through simulator training

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Abstract: Simulators in maritime education and training (MET) have been advancing with the rise of modern technologies and industry needs. While technical benefits of using simulators for training are often emphasized, its social benefits are hardly discussed. This paper argues how simulator training is potentially beneficial to promote equal access to MET as well as achieving gender equality. A mixed method was used to conduct (1) conceptual analysis of simulator training at philosophical level; and (2) quantitative analysis of gender-segregated data on simulator instructors around the world at pragmatic level. First, the characteristics of onboard and simulator training were critically analyzed by using gender theories and philosophical inquiries, including ontology and epistemology. Second, our data sampled from six MET institutions show that simulator instructors on average were mostly men (91.7%), and women were even zero in some MET institutions. More gender-balanced teaching staff, including simulator instructors, will increase an overall awareness of gender equality and incorporate various perspectives and pedagogical inputs to teaching. The paper concludes that simulator training has social benefits of providing fair and quality education for all, including women, as well as career opportunities to work as simulator instructors who can contribute to the gender equal future of MET.

Keywords: simulator training and onboard training; social benefits; gender equality; fair and quality MET

Harmonization of non-STCW short-learning courses

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Keywords: STCW Convention, micro-credentials, short-learning courses, non-formal education, maritime competencies

Seafarers' education is always a combination of formal education and non-formal education including short-learning courses. Even before their first onboard experience they have to attend short courses needed for jobs on vessels that are prescribed by the STCW Convention. During their navigational experience seafarers on board sophisticated ships participate in numerous trainings required by the STCW Convention or their employers, i.e. the shipping companies. The number of such short-learning courses and their contents differ from each other not only for different types of vessels but also for the same type of ships owned by particular companies.

Contents, learning outcomes and duration of short-learning courses prescribed by the STCW Convention have been partially standardized. They are determined by the IMO Model Courses and serve as a recommendation for the institutions that carry out the courses. Since the IMO Model Courses are not an obligation, they are just a recommendation, their topics and duration can differ among countries. However, there is a bigger problem with short courses that are the result of requirements of the shipping companies and maritime industry, which are not prescribed by the STCW Convention. Outcomes, contents and duration of these courses are also unknown, namely, there is no review of the current situation in this field. Furthermore, competencies acquired through such trainings are also unknown and there is no methodology for their recognition and validation. However, since many of the short-learning courses are needed for certain technologies, some of these programs may become standardized.

The main goal of our research is to develop methodology for assessing and monitoring current situation and future needs of the maritime industry related to short-learning courses. Research activities in this paper refer to number, type and time frame of additional short trainings in maritime industry needed to perform various duties on board LNG carriers, crude oil tankers and cruise ships. Moreover, the activities are focused on courses' contents, outcomes and identification of competencies contained in the non-STCW short-learning courses. Two research methodologies were combined in this paper: a survey conducted among seafarers, and another one conducted within an organized focus group including the representatives of the shipping companies, maritime training centers and maritime higher institutions, master and chief officers on LNG vessels, crude oil tankers and cruise ships.

Research results refer to development of theoretical framework and identification of competencies contained in the STCW and non-STCW courses for seafarers sailing on the above mentioned three types of ships. This framework will contain details about the area competencies referring to, for example: safety, ship handling, leadership, group of competencies acquired, i.e. professional competencies or key competencies.

This research is part of the European project "Micro-qualifications in seafarers' education and training", funded by Erasmus + program under section KA220 – "Cooperation partnership in higher education".

Providing for the Future of Our Mariners: Anchoring Soft Skills in Maritime Higher Education

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Keywords: soft skills; maritime higher education; interdisciplinarity; maritime education and training (MET); transversal skills

Teaching students the technical skills they will need to operate complex vessels and navigate open waters has long been the primary goal of maritime education. Nevertheless, the ever-changing character of the maritime industry requires a comprehensive approach to education that goes beyond mere technical competence. Soft skills, often overlooked in maritime higher education, play a crucial role in shaping successful maritime professionals. It is imperative to reassess the need for non-technical skills when new operational models of shipping systems arise and develop. In the age of autonomous shipping, where an autonomous operating system assumes control and decision-making is guided by data flows, the ability of the ship and its crew to adapt to these novel work methods carries significant consequences for the safety, efficiency, and reliability of future ship operations. (Kim and Mallam 2020) In this context, this article explores the importance of soft skills in the maritime sector and suggests techniques for their successful incorporation into higher education curricula.

Numerous research studies emphasize the strong connection of soft skills with overall work performance in the maritime industry. The International Maritime Organization (IMO) has repeatedly emphasized the importance of teamwork, communication, leadership, and adaptability in preventing accidents at sea. Moreover, studies conducted by maritime academies such as the World Maritime University (WMU) suggest that integrating soft skills into maritime education enhances graduates' employability and ensures a smooth transition into the workforce.

Curricula for maritime education worldwide needs to be specifically developed to include courses that focus on the explicit development of soft skills. These activities may encompass communication seminars, leadership training, and crisis simulation exercises, which aim to familiarize students with authentic situations.

Practical experiences, such as on-board training programs, provide students with the opportunity to apply and refine their soft skills in real-life situations. These experiences can bridge the gap between theory and practice, fostering a maritime professional with a wide-range skill set.

Cooperation between technical departments and communication or psychology departments in maritime education institutions facilitates a holistic approach to soft skills development. Interdisciplinary courses can be designed to provide insights from various fields, enriching students' comprehension of the importance of soft skills in their maritime careers. Incorporating virtual reality (VR) and simulation technologies in maritime education allows students to practice and enhance their soft skills in a controlled and immersive environment. These tools can replicate challenging scenarios that help students develop effective communication, decisionmaking, and teamwork skills.

In conclusion, the changing nature of the maritime industry requires a transition from solely focusing on technical training to adopting a more holistic approach that encompasses the acquisition of soft skills. Incorporating soft skills into maritime higher education is essential for cultivating dynamic workers who possess the ability to navigate the intricate challenges of the modern maritime world. Emphasizing soft skills in the maritime sector is crucial for improving safety, efficiency, and long-term success in an ever-evolving sector.

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Analysis of Vector and Trail Modes on Marine Radar Screens

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Keywords: Collision Avoidance; ARPA; Radar Display Settings; Situational Awareness

Collision avoidance remains a matter of concern for seafarers. Further sensor integration could bring an even higher rate of target detection and track prediction, which means that the traffic analysis based on a graphical display will be even more important for the Officer of the Watch (OOW) than ever (Kenney et al., 2022). Furthermore, it is likely that for Maritime Autonomous Surface Ships (MASS), a supervisor will be monitoring multiple MASS, which requires them to grasp the traffic situation displayed on a radar screen for each vessel at one glance. A radar screen generally allows for a detection of targets that pose a risk of collision. But which presentation modes are most effective? Is it easier to identify a risk of collision with relative or with true vectors? Is it necessary to use target vectors or are radar trails alone suitable to detect a risk of collision? There is little detailed guidance on this specific question in standard textbooks, even though authors seem to favor relative vectors to determine CPA and TCPA (Bole et al., 2013). However, an earlier study by Schryver reported that the display mode seemed not to influence the assessment of the traffic situation but that officers (in contrast to masters) "were significantly more likely to take evasive action" when using true vectors while for masters the display mode seemed not to influence the decision making. The mean decision time before taking action was in general faster for relative than for true vectors (Schryver, 1983).

To further analyze this question, an online experiment was developed and the study was pre-registered with as AsPredicted on 26 July 2023 (https://aspredicted.org/81T_L88) (O'Grady, 2023). Certified officers, masters, and pilots were chosen as participants. A minimum of 36 samples was determined with a pilot study, but the final sample size was subject to counterbalancing and recruiting respective participants (which are not as easily available as for laboratory studies in a university lab). So far, 48 valid data sets have been collected, aiming at a target size of 52. Each participant looked at 40 radar screenshots; 10 different traffic situations with 9 targets were displayed in four different modes each: true or relative trails (but no vectors) and true or relative (vectors but no trails). For each situation, participants had to decide whether there was a risk of collision or not. Subsequently, participants were to select the target which had the smallest closest point of approach (CPA) in each situation as a control question.

Preliminary results suggest that with relative vectors, an OOW is more likely and faster to correctly identify a risk of collision than with true vectors. Furthermore, they are more likely to identify a risk of collision with relative trails than with true trails. In addition to that, averaged across relative and true settings, vectors proved to be more effective to identify a risk of collision compared to trails. About 60 % of the participants answered in a question prior to the experiment that they would select true trails and true vectors if they had to decide for a setting.

The study is also exploring how certain questions can be answered experimentally without using ship handling simulators or similar tools tying up significant resources. This is particularly useful if particular participants are required, who, by the nature of their work, are off-shore for considerable periods of time.

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Design and functionalities of Decision Support System regarding the risk of Epidemic threats on a sea-going Vessel

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Abstract: In the global crisis of the COVID-19 pandemic, the maritime sector once again drew attention to the issue of epidemic threats on seagoing ships. As an isolated unit, the ship may be a potential source of an epidemic. In addition to COVID-19, there are several other threats, such as Legionnaires' disease, cholera, tuberculosis, infections related to the digestive system, dengue and many others. It should be noted that there is no specialized infectious disease ward or appropriate team of doctors on a seagoing ship (Wiliams et al 2018). There is a need to implement other tools - many of them are described, for example, by IMO and other organizations at global and local levels (Brown & Johnson 2019).. The consortium led by the Maritime University of Szczecin (Poland) set itself the goal of developing and implementing a decision support system in the event of an epidemic on a seagoing ship. The tool being developed is intended to assist captains, medical officers, etc., to assess the situation and take appropriate actions quickly. The system, tentatively named DESSEV (the acronym of the project implemented under the Erasmus+ program), operates based on a knowledge base prepared by medicine and maritime personnel specialists. It is a completely autonomous system, operating online and offline. Much attention was paid to its availability and describing functional and non-functional requirements so that its use was intuitive and did not require specialized training or documentation. The main functional requirements are: entering identified symptoms into the application, processing the received information based on the knowledge base, disease classification based on the probability of belonging to a given class. The Knowledge Base as the primary dataset was obtained from different available sources, including medical and nautical data repositories. Three algorithms were applied to solve the problem: random forest, decision tree and naïve Bayes. The best performance was in the case of random forest algorithm, what is presented in the paper. After developing the knowledge base and validating the algorithms of prediction, a web application was designed and is available online at www.dessevproject.eu/app, intended to serve as a user interface for the DESSEV decision support system. As a further step, a mobile application will be coded on the basis of the development of the web application, serving completely offline.

This article describes the DESSEV decision support system, defines the requirements, and summarizes conclusions based on a series of simulations using the system. DESSEV enhances the control on vessels by accurately recognizing diseases and providing mitigating actions throughout the risk management process. It offers independent and reliable support in maritime pandemic control. Nevertheless, it should be noted at the outset that further activities in this area, including interdisciplinary ones, are worth conducting. The DESSEV system is also intended to become the basis for further solutions of this type, especially given the emergence of further serious health crises.

Keywords: outbreak, epidemic, seagoing vessel, COVID-19, decision support system

Word list of research in decarbonization in the maritime industry – a case study on lexical analysis of technical corpora

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Abstract: This study examines a suite of software tools for lexical analysis tailored to the emerging field of decarbonization in maritime transport. Given the technical nature of this domain, mastering its terminology poses a challenge, especially for non-native English speakers.
Conducted within the framework of the national project "Decarbonization of the Maritime Sector – Green Boka Bay, DeMS – GBB," led by the Faculty of Maritime Studies Kotor (University of Montenegro), the study aims to delineate the specific English terminology of this area. To achieve this, a corpus of 21 relevant scientific papers, comprising 251,114 running words or tokens, was compiled.
Our analysis is aimed to extract specialized lexicon pertinent to decarbonization. Through the exclusion of commonly occurring General English (GE) terms from further examination, we present a refined word list encompassing 47 technical headwords or word families from research papers on decarbonization in the maritime industry. Moreover, we measure the prevalence of academic vocabulary and explore alternative features offered by lexical analysis software.
This paper concludes with a reflection on the study's constraints, its educational implications, and outlines avenues for future research.

Keywords: decarbonization; corpus; word list; technical vocabulary; software

E-Learning in Maritime Higher Education

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Keywords: online, e-learning, maritime, higher, education, COVID-19

With the development of Internet services, online education is also becoming an increasingly present phenomenon. It was additionally and unexpectedly stimulated by the emergence of the COVID-19 pandemic, which accelerated the transition to e-learning. In the newly created conditions, institutions had to supplement classical learning methods or completely adapt them to distance learning to ensure the safety of their students and teaching staff by creating a "new normal" environment. The definition of e-learning as "a learning method that requires the use of multimedia and provides access to interactive training on the Internet" is appropriate for the above context. E-learning is a term used to describe all online learning, including academic and professional training. One advantage of e-learning represents the availability and possibility of using different forms (media) of teaching materials, such as written texts, audio recordings, videos, interactive quizzes, etc. Technological progress has not only increased the base of teaching materials, but also enabled the availability of e-learning and those to whom traditional education may not have been available. By applying e-learning, it has become possible to change and supplement classic (contact) education methods with new online methods, creating a new hybrid model and becoming a necessary resource for students and Higher Education Institutions (HEIs) worldwide, including Maritime Higher Educational Institutions (MHEIs).

The aim of the research carried out and presented in this paper is to create guidelines for distance learning and the use of information and communication technologies in MHEIs. After the COVID-19 pandemic, all teachers gained experience in online teaching, face-to-face teaching and hybrid teaching both STCW and nonSTCW courses. The attitudes of teachers, based on their experience during the COVID-19 pandemic, on the ways of acquiring prescribed competencies and their verification, can significantly contribute to the development of guidelines for distance learning and the use of information and communication technologies in higher education maritime institutions.

The paper analyzes the results of research conducted within the E-NAUT project, which aims to promote inclusive and functional distance learning and e-learning, while respect the basic features and specifics of seafarers' education and the standards of the STCW Convention. Teachers and students from maritime colleges, as well as key stakeholders and experts in seafarers' education participated in the research. This included representatives from shipping companies, first deck officers and captains on ships with gross tonnage over 3000. The results of the research will map STCW competencies in nautical study programs that can be acquired through distance learning, e-learning and face-to-face teaching. Given that the research is based on the international standards of the STCW Convention, the conclusions, guidelines and recommendations resulting from the project can be applied within any study program in the nautical field, in Europe and the world.

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Enhancing Professional Development through Foreign Language Communicative Competence in Navigation and Ship Handling Specialists

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Keywords: foreign language communicative competence; navigation and ship handling; professional development of specialists in navigation, developing language proficiency.

This scientific study delves into the critical realm of foreign language communicative competence and its paramount role in advancing the professional development of specialists in navigation and ship handling. In an era of heightened globalization within the maritime industry, effective communication emerges as a linchpin for operational seamlessness and safety at sea. Employing a comprehensive approach to language proficiency development, this research unfolds within the context of professional training for specialists engaged in navigation and ship handling.

The systematic methodology adopted encapsulates a meticulous step-by-step process, emphasizing the formation of motives, values, knowledge, and practical skills inherent to foreign language communicative competence. Traditional teaching methods intertwine seamlessly with innovative approaches such as projectbased learning, interactive techniques, and technological integration, fostering a holistic and immersive learning environment.

The core components of competency framework considered in this study include:

- Navigational Terminology Acquisition: an in-depth analysis of the acquisition of specialized terminology crucial for precise communication in the field of navigation and ship handling.
- Practical Application in Maritime Contexts: an investigation into how communicative competence is refined through practical applications, simulation exercises, and real-world scenarios encountered at sea.
- Cultural Sensitivity: an exploration of the importance of cultural awareness in forming communicative competence, particularly within the context of the diverse maritime environments specialists may encounter.

The methodologies explored, ranging from immersive language training to simulation-based learning and beyond, represent not mere educational tools but transformative experiences. These approaches go beyond theoretical knowledge, bridging the gap between academia and real-world application, ensuring that specialists are not only well-versed in language but adept at navigating diverse and dynamic scenarios.

Collaborative problem-solving workshops, cross-cultural communication seminars, and gamification bring an element of engagement and interaction, fostering teamwork and cultural sensitivity. Linguistic case studies provide a window into the challenges encountered in maritime operations, allowing specialists to hone their problem-solving skills. Multimedia language resources add a layer of versatility, accommodating different learning styles and providing a rich tapestry of language exposure.

As the maritime industry continues to evolve and globalize, continuous professional development remains a cornerstone. The emphasis on ongoing language training ensures that specialists remain not only competent but agile in adapting to the ever-changing communication demands of their profession.

In essence, this research synthesizes the diverse methodologies, highlighting their collective impact on enhancing the communicative competence of navigation and ship handling specialists. It underscores the pivotal role of a comprehensive approach in fostering effective communication skills and contributing to the continuous professional development of specialists in the maritime industry. The study concludes by emphasizing the ongoing relevance of linguistic proficiency in shaping the future of professionals in navigation and ship handling.

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Absenteeism in Maritime Education: Insights, Challenges, and Innovative Solutions

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Keywords: Absenteeism; Maritime Education and Training; polytechnic studies, teaching innovation

Students' attendance at classes is a measure that reflects students' enthusiasm for the course and their status in the university (Westerman, Perez-Batres, Coffey and Pouder, 2011). A multitude of studies have explored the reasons of absenteeism at higher education institutions and have investigated the correlation between class attendance and academic achievement at the university level (Shaaban and Reda, 2021; Moores, Birdi and Higson, 2019; Pappu, Vandrangi and VizayaKumar, 2006; Keyser, 2019; Summers, Higson and Moores, 2021 & Deng, Jianjun, Jing and Zitong, 2021). University-level absenteeism is influenced by various factors, ranging from academic self-perception and attitudes towards teachers to academic performance. Workrelated absenteeism is also linked to stress, group size, commitment, and job satisfaction. It is essential to discern the specific importance of these factors.

The STCW convention provides the international minimum standards for maritime education and training and the minimum requirements for the competences of seafarers (IMO, 2010). IMO also adapted standard models of competence-based training to this convention. Even though all this knowledge and skills are well specified, attendance is only required for some specific maritime courses. Due to the importance of classroom attendance to comply with the STCW, this paper presents the results of the teaching innovation project titled "Active methodologies for face-to-face and participatory learning (ASAP-UPC)" and seeks to quantify current levels of absenteeism, identify its main causes and propose initiatives to improve classroom attendance at the Barcelona School of Nautical Studies (FNB-UPC). The project is structured into three distinct stages: initially, gathering and analyzing student data; secondly, redesigning teaching methodologies to mitigate absenteeism; and lastly, implementing these methodologies to minimize absenteeism, while also evaluating the effectiveness of their implementation.

In the first stage, students are asked about their interest in attending classes, skill development throughout their maritime education, and their perception of the skills required for a career in a maritime field. Information is gathered through both online surveys and in-person interviews (Figure 1 and Figure 2). Results reveal heightened absenteeism in large groups of students at the Bachelor's degree level. Many students express dissatisfaction with in-face-to-face classes, due to their theoretical heaviness and a perceived imbalance between theory, experimental practice, and problem-solving components. Additionally, students perceive a lack of connection to maritime professional needs. Additionally, contracting companies are queried about the skills they seek in prospective employees. In the second stage, each course coordinator designs an improvement action and, in collaboration with the teaching team, they propose enhancements based on identified good practices. Proposals to improve classroom attendance are categorized into three groups: (1) Specific follow-up activities, which include tasks such as quizzes, exercises, tutorials, group assignments and follow-up questionnaires; (2) Teaching innovation activities, which involve incorporating innovative teaching methods such as collaborative activities, the flipped classroom approach, and an increase in laboratory practices and (3) Modification of the syllabus, a proposal for reducing some theoretical contents and introducing more hands-on activities. In the final stage, guided by group reflections, good practices are formulated and integrated into a database. The proposed good practices are expected to be a turning point not only to motivate students but to foster a more significant learning, which can be transferred among Maritime Education and Training Institutions (METIs).

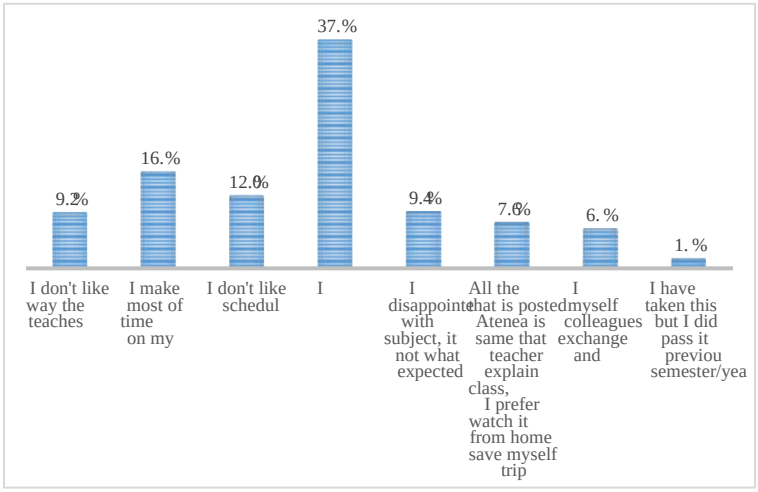

Figure 1. Reasons for non-attendance in classes according to the interviewed students

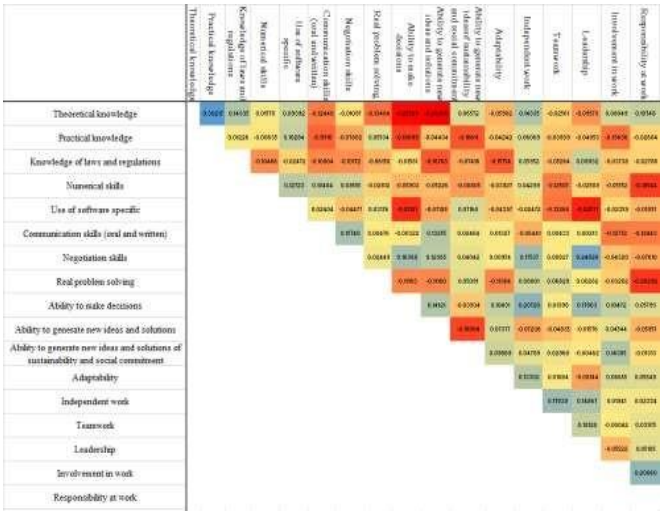

Figure 2. Correlation between proposed competencies according to the interviewed students

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Gender mainstreaming practices in METIs: Some case studies

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Keywords: gender mainstreaming; Maritime Education and Training (MET); Education of Global Maritime Professionals (GMPs), Maritime Education and Training Institutions (METIs); case studies

Abstract: The existing gender imbalance, discrimination and difficulties that female students face in Maritime Education and Training (MET) constitutes a widespread concern. To address this situation, Maritime Education and Training Institutions (METIs) have turned to gender mainstreaming looking for strategies and practices that may bring about possible solutions. This paper reviewed existing literature to identify specific case studies on in-depth gender mainstreaming actions undertaken in different METIs. Seven case studies were selected to illustrate specific interventions and practices to mainstream gender and their possible applicability and transferability across institutions. The results of the analysis show that the interventions presented combine different strategies and approaches, but no standard procedure to mainstream gender. However, most proposals describe some common or overlapping practices like the importance of networking and mentoring programmes, considering female students' expectations and motivations for enrolling in MET, rethinking recruitment and, most importantly, reviewing the maritime curriculum incorporating more gender-inclusive practices. Additionally, most of the interventions analysed reveal benefits for female students and, frequently, also for all students. Hence, most case studies agree to promote the development of gender strategic plans for METIs. In sum, such practices should be extended and transferred across METIs for fostering more inclusive MET environments.

A pathway to competency by optimizing sea time and lecture time: A comparative analysis and the case of MET in Japan

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Keywords: Maritime Education and Training (MET) curricula, competency-based education, comparative analysis, Certificate of Competency (CoC)

Abstract: The ratio of sea time to lecture time in Maritime Education and Training (MET) may vary by country in accordance with the framework set by the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW), 1978 as amended. Few studies have addressed such differences in MET, emphasizing the necessity for research in achieving competency-based education by optimizing sea time and lecture time. A comparative analysis was conducted using primary data from Japan and secondary data from the UK and Australia. The research revealed that Japan emphasizes longer lecture time and shorter sea time compared to the UK and Australia due to differences in onboard training systems, such as whether they are primarily managed by an MET public agency or private sector-led systems. Furthermore, Japanese lecture credits comprise general subjects (48%) and maritime specialized subjects (52%), with 17% of the total credits for a Certificate of Competency (CoC). The study employed a case study method to present the analysis of Japanese MET, focusing on its advantages and disadvantages. These findings pose further questions about what pedagogical approaches may help the effective implementation of competency-based education in MET across countries.

Keywords: Maritime Education and Training (MET) curricula, competency-based education, comparative analysis, Certificate of Competency (CoC)

Evaluating Alignment of IMO Model Courses - Simulation

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Keywords: Maritime Education and Training (MET), STCW, IMO Model Course, Outcomes Assessment, Simulation

International Maritime Industry (IMO) model courses provide member states and other stakeholders a key resource for developing training programs in support of seafarer qualification and certification required by the Standards for Training, Certification, and Watchkeeping (STCW). This is important because it provides a benchmark for the quality of seafarer training programs. However, there is some evidence that some IMO model courses lack constructive alignment. In other words, the knowledge, understanding, and proficiency performance criteria were not aligned with the overarching aim and primary competencies for some courses (in terms of learning domain emphasis).

Periodically, the IMO reviews and then validates its model courses when there are amendments to the underlying codes, conventions, and instruments and/or new technologies are introduced. In November of 2023, the IMO's Sub-Committee on Human Element, Training, and Watchkeeping (HTW) published a list of model courses and their relative priorities and a plan for review and validation. The next two courses due for review and validation are the following:

- IMO model course 1.37: Chemical tanker cargo and ballast water handling simulator
- IMO model course 2.06: Oil tanker cargo and ballast water handling simulator

The review of these courses will take place during the intersession in 2025 and validation will occur at HTW 12 in February of 2026.

These two courses will be independently reviewed using a 5-step method for mapping domain coverage. The courses are perfect candidates because they are more advanced curses than previously reviewed using this protocol. Also, they are simulator courses and it would be expected that the preponderance of the proficiency performance criteria will be higher order (i.e., mental procedures and interpersonal knowledge skills over declarative knowledge and information). In addition, these model courses represent the highest priority for review, are next on the agenda, and offer an opportunity to share results before HTW validates them.

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Instructional feedback during maritime desktop simulation

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Keywords: Desktop simulators; Maritime Education and Training (MET); Monitoring, Learning

This study contributes to explicating mundane and sometimes taken-for-granted work practices of teaching and learning in classroom contexts by scrutinizing instructors' work in providing instructional feedback during exercises on desktop computers. The aim is to analyze the interactions between instructors and students in a learning context that uses desktop simulators as computer-supported learning tools. Specifically, the article will explore the instructional feedback of how the instructor notices students' need for support while making rounds in the classroom or while monitoring technical equipment and measuring students' performance over time. Empirically, we draw on video-recorded materials of first-year bachelor's students (n=45) engaged in maritime navigation exercises on desktop simulators. The desktop exercises replicate the radar screen, which is part of the standard equipment of a ship's bridge (Kim et al., 2021). Analytically, we perform interaction analyses to explore the relationship between monitoring, noticing, and instructional feedback in an educational context (Mason, 2009). Our findings suggest that instructors' practice of monitoring students' ongoing activities is carefully configured to the material records at hand in the classroom context, relying on both monitoring technologies provided by the simulators and their habit of making rounds between workstations in the classroom (Mason, 2009; Sellberg & Lundin, 2018). Moreover, based on the particular details of the instructors' noticing during monitoring, the instructor chose to provide a formative assessment either to individual students or to the entire group of students. Previous literature on simulator-based training have shown that the instructor's ability to recognize the connections between learning objectives and ongoing activities in the simulator is a fundamental aspect of training in full-mission bridge simulators (Sellberg & Lundin, 2017). While the materiality of desktop and full-mission simulators differs, the basic work of instructors to monitor students' ongoing activities, their noticing of critical mistakes, and intervention share similarities. More specifically, instructional feedback relies on the same ability to recognize the connections between learning objectives and ongoing activities in the simulator, as in different simulator modalities. Noticing can be seen as being attentive, aware, and sensitive to learners and the subject matter in the teaching process. It includes monitoring student performance, such as gestures, facial expressions, behaviors, and attention, and focuses on specific tasks or objects (Mason, 2009). To be effective, it is necessary to be more disciplined than to simply react to what is noticed. One can do so by paying attention to what is actually noticed, gaining access to alternative ways of acting, and preparing oneself for opportunities to take advantage of it (Mason, 2009).

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Evaluating skill requirements for maritime autonomous surface ships

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Keywords: Maritime Autonomous Surface Ships; Maritime Education and Training; Fuzzy TOPSIS

Shipping accidents led to severe consequences. Among the documented incidents, human error emerges as the primary factor responsible for such mishaps. Many studies assert that approximately 80-90% of shipping accidents can be attributed directly or indirectly to human error (Heij and Knapp, 2018; Chang et al., 2021). In response to accidents stemming from human error, there has been a growing interest in maritime autonomous surface ships (MASS) within both the maritime industry and academia. International Maritime Organisation (IMO) defines MASS as "ships which, to a varying degree, can operate independently of human interaction". Chang et al. (2021) highlighted the advantages of MASS, including enhancing safety and security, more efficient human resource management, cost savings in operations, and increasing environmental friendliness.

The primary impact of the development of MASS may lie in the required skill set (Johansen, 2018). The navigational and engineering competencies demanded by MASS differ significantly from those required in conventional ship operations. Addressing the challenge of providing a comprehensive Maritime Education and Training (MET) programme for MASS at universities or training centres that aligns with industry needs poses a potential concern.

Despite several studies on MASS (e.g. Chang et al., 2021; Li and Yuen, 2022), research on the essential skills/MET specific to MASS is limited (e.g. Sharma and Kim, 2021). Given the significant differences in operations between MASS and conventional ships, there will be an emerging need for new and enhanced skills in the maritime workforce of the future. This research aims to address this gap by identifying and assessing the future skills essential in the context of MASS and the associated Body of Knowledge.

After a systematic literature review, four categories are identified and each category includes three skills: (1) Technical and Digital Competence, including digital skills, autonomation and systems, and engineering skills, (2) Operational and Managerial Competence, including operational skills, maritime expertise, and emergency management, (3) Interpersonal Skills including leadership, adaptability and flexibility, and communication and collaboration, and (4) Higher-Order Thinking Skills (HOTS) including-e problem solving, decision-making, and critical thinking.

In order to evaluate the importance of the identified skills, a questionnaire with a seven-point Likert scale was designed and will be sent to maritime experts from both the industry and academia. Four criteria will be weighted regarding integration of MASS into Maritime Education and Training, including Regulatory Compliance, Ease of Integration into Training, Training Feasibility (including cost effectiveness), and Ease of Assessment. The identified 12 skills will then be ranked under each criterion. After data collection, the Fuzzy TOPSIS (Technique for Order of Preference by Similarity to Ideal Solution) will be utilised to prioritise the identified skills.

This research is expected to draw increased attention from both the maritime industry and academia to the significance of essential skills for Maritime Autonomous Surface Ships (MASS). Furthermore, we anticipate that this research will offer a fresh perspective for academia, sparking additional discussions on the subject of MASS.

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Empowering women and girls for an equitable maritime industry: An explorative paper on sustainable maritime development in South Africa

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Keywords: Women empowerment, maritime industry, sustainable development, explorative and quantitative

Empowerment of women has been one of the strongest drivers of social evolution over the past century and is acknowledged as essential for addressing all the global challenges facing humanity (International Labour Organisation, 2018; The Millennium Project, 2015; World Bank, 2015). Gender equity has entered the global consciousness and is guaranteed by the constitution of 84% of the world's nations, while "the international women's bill of rights" (CEDAW) has been ratified by most countries except for seven countries. Countries are reforming, and the empowerment of women continues to be viewed as one of the strongest drivers of social evolution over the past century and is acknowledged as essential for addressing the global challenges facing humanity. Women are increasingly engaged in decision-making, promoting their own views and demanding accountability not only in traditional female-dominated industries (namely, services and banking) but also within the maritime industry.

Sustainable Development Goal 5 is to "achieve gender equality and empower all women and girls", according to the United Nations (United Nations, 2015). One of the key targets under goal 5 is to "ensure women's full and effective participation and equal opportunities for leadership at all levels of decision-making and capacitate as well as train women for managerial positions". The South African maritime industry remains a very maledominated sector, and compared with other sectors, the integration and participation of women has been slow (Cele, 2003; Transnet, 2019). Cele (2003) and the IMO (2019) identified the relevance of sea experience to many shore-based jobs means the resource of women with appropriate skills is limited and will continue to act as a long-term constraint on the representation of women in the maritime sector as a whole and that still remains the case.

The paper uses a quantitative research approach to explore empowerment initiatives and the impact thereof for women in the South African maritime industry. A random sample of women in the maritime industry were approached and completed a questionnaire that discovers the causal relationship on the capacity and the tole of women in the maritime industry. The sample consists of women in ship owning companies, maritime associations, maritime training institutions as well as frontline operational sectors: port operators; cruise; bunkering; and the workboat industries including fishing, offshore, towage, and dredging. Innovation, training and capacity building for women and girls in maritime will promote empowered local communities, youth and women and accelerate economic growth. Increased opportunities for education and leadership and an increased share of women climbing up higher ranks within the maritime industry will promote a sustainable maritime industry.

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E-Learning Capacity-Building – The Case of IMO's Integrated Technical Cooperation Program

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Keywords: Capacity-building, Self-paced learning, Blended-learning, Participatory Design, IMO

Purpose: The International Maritime Organization (IMO) is augmenting its Integrated Technical Cooperation Program through new e-learning courses. The development started as a pilot project and three courses on the IMO Member State Audit Scheme (IMSAS), Oil Pollution Response, and Biofouling. It has then continued with courses on the Maritime Single Window, International Safety Management, Ballast Water, and the London Convention. This study aims to showcase the usefulness of the e-learning course modalities to build the capacity of maritime professionals. Furthermore, the aim is to analyze the participatory development process and how to sustain it. The first set of objectives is to evaluate the open enrollment self-paced course modality to enable training at a scale, and how the courses can be reconfigured to a blended-learning modality to achieve additional higher intended learning outcomes. The second set of objectives is to understand how the educational, technical, and subject matter experts needed to collaborate to develop the courses, and how the development entailed application and infrastructure development that was informed by usage.

Methods: The report is a case study of how the officers at IMO's technical cooperation division and specialized departments worked with e-learning specialists at the World Maritime University to develop and deliver the courses. Several methods were employed to achieve the objectives, including comparing the constructive alignment between the Intended Learning Outcomes and learning activities and assessments; analyzing learning data and course evaluations; and mapping the development process into a sustainable and participatory learning process framework.

Findings: The findings show how the self-paced learning modality works in a range of lower to higher intended learning outcomes. The courses are divided into e-lessons and e-exercises to give the learners an understanding of the course concepts, and then have them apply their knowledge and analyze the outcome. So far, approximately 10000 students from 188 countries have enrolled in the self-paced courses, and the completion rate exceeds industry standards. In the blended-learning modality, the e-lessons and e-exercises were used to prepare for and support the instructor-led activities (onsite or online) to achieve additional higher learning outcomes, compared to the self-paced courses and IMO's original regional training courses. This can be related to a flipped learning approach, where the instructors could spend less time explaining basic concepts to the students and more time engaging them in discussions and workshops on cases and scenarios. The findings furthermore show the value of the participatory development approach to build e-learning development and delivery capacity. The projects only specified the self-paced learning modality, but because of the close-knit development collaboration, the IMO officers learned how to reconfigure their courses in the blended learning modalities. At the same time, there were project management considerations, especially about the workload implications of participating in the e-learning development.

Value: The IMO e-learning courses show how e-learning can enhance training for the safety, security, and environmental performance of international shipping. The development illustrates cutting-edge e-learning technology applications such as self-paced gamified and adaptive learning in Massive Open Online Courses on the one hand and blended learning based on constructivist principles on the other. In this way, the report also provides application and development insights to Maritime Education and Training Institutions and associations, such as the International Association of Maritime Universities, to develop their own e-learning courses.

The Next Generation of Maritime Workforce and the Challenges to Maritime Education

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Keywords: *Maritime education; maritime professional; workforce development; education; maritime academies; blue economy*

Maritime Transportation is one of the oldest modes of transportation **proving essential services** of moving large quantities of freight and passengers across continents and enabling trade and cultural exchange. In that endeavor, there are specific navigation skills and technical knowledge involved in the actual operation of vessels. As a consequence, the sector has traditionally framed maritime education efforts in training and preparing the professionals to safely operate vessels. In the last decades, the introduction of internet-based technologies (i.e. AIS, GPS) and the increasing concern of environmental impact of shipping activities (i.e., Sulphur content in marine fuels and invasive species in ballast water) are among of ***the main drivers of technological and regulatory changes*** that are challenging maritime business. These challenges associated with increasing impact of maritime supply chain issues (such the port congestion witnessed in California) represent ***transformational trends*** that call for a review of maritime education. The urgency to revisit maritime education is aggravated by a significant number of working professionals' retirement predicted to happen in the next couple of years, as a consequence of age and work conditions. In the context of the **Blue Economy** (which essentially fosters the sustainable development of the oceans and coastal zones), this research addresses some of these major trends and their **combined effect with an increasing need for qualified maritime professionals** that goes beyond the basics of complying with regulation. The idea is to ***expand the concept and the practice*** of maritime education that could directly assist present and future maritime transportation professionals. This is an exploratory study at its early stage and focused on higher education opportunities in the U.S.

Charting New Courses: Reimagining Information Literacy in Maritime Education and Training

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Keywords: Maritime education and training; STCW; information literacy; situational learning

Maritime education in universities acknowledges a divide between academic learning and hands-on, skills-based instruction in compliance with the IMO International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW) (Manuel 2017; International Maritime Organization 2017). This perceived divide can affect the operations and curricula of maritime institutions of higher education, creating a sense among students and instructors that academic disciplines are disconnected from the core maritime curriculum. Information literacy has traditionally been perceived as an academic discipline, involving library and/or web-based research, and the evaluation and use of information from text-based resources. Recent scholarship, however, recognizes that human cognition encompasses physical, situational, and social aspects instead of being a purely individual activity (Paul 2022). The Association of College & Research Libraries Framework for Information Literacy, adopted in 2016, is in line with these developments, and has moved to a broader view of information literacy, acknowledging the social and societal aspects of information retrieval and use (Association of College & Research Libraries 2016). In the maritime context, successful vessel navigation relies on cognition that is cultural and distributed, such as Bridge Resource Management, not purely individual (Hutchins 1996). Maritime emergency situations can require multiple types of information literacy: selecting and understanding text-based rules, procedures, manuals and/or regulations; using physical information, gathered through the senses; awareness of the limits and opportunities of the specific environment; and social interaction and communication. These activities are not usually acknowledged to be examples of information literacy in action, creating a false appearance of division between STCW knowledge and competencies, and this academic discipline. Better integration between academic and traditional hands-on marine education provides a scaffold for future maritime educators to respond to emerging problems and technological developments, thus enhancing mariner competence, safety, and dependability.

This paper undertakes a review of deck-department STCW standards from the perspective of information literacy, broadly defined, and examines implications for the maritime curriculum. We will analyze STCW deck assessments and outcomes, and identify the type of information involved from a cognitive science perspective, and how this information is used. One outcome from the research will be to develop information literacy curricula based on the unique characteristics of maritime education and training as a discipline. Improving our understanding of information literacy instruction and deck-department STCW can offer a path towards more effectively integrating, and improving, the academic and vocational aspects of maritime education and training. Furthermore, valuing the advanced nature of cognition in the maritime context, and the relevance of academic training to mariners' development, results in more complete and wellrounded education for the maritime student.

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Can Permanent Orienteering Courses in the woods help students of marine navigation develop their skills necessary for safe watchkeeping on the ship's bridge at sea?

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Keywords: navigation; orienteering course; situational awareness; reasoning and learning by analogy; maritime education and training

In autumn 2023 the project "Green Control Point" was completed at the Gdynia Maritime University in cooperation with the Gdansk Forestry Agency, commencing a pilot program for the students of maritime faculties aimed at analogy-based learning concerning the development of skills necessary for safe watchkeeping on the ship's bridge at sea. The project refers to the global concept of Permanent Orienteering Courses. There can be observed strong analogies between reasoning, problem-solving and behaviors during lonely land navigation in the wooded forest area and independent watchkeeping on the ship's navigational bridge at sea. The analogy provides students with an anticipatory schema and they can take benefit from such a process when they have to comprehend a new concept during their formal studies. While orienteering is an excellent source of recreation and fun, it can also help to train perceptiveness, improve skills in route planning (variety of solutions, route choice, optimization), decision making, comparing, selecting and verifying information obtained from a map and the surrounding environment, or develop the independence (selfreliance) especially required for the deck officers (ship navigators) on watch during sea passage.

A network of permanent orienteering courses has been developed over a 9 square kilometers area of the woods within the Gdynia city limits and adjacent to the University. The orienteering courses are made up of wooden posts that will serve as control points (waypoints) to be found by participants as they navigate their chosen route. The project aims to make the forests available for learning and exercises in field navigation, and orienteering for sport, tourism or leisure purposes, including developing map reading skills, an understanding of their limitations and using a compass. Making use of the detailed maps provided the orienteering courses present opportunities to improve the students' navigation skills, spend time in the open air and enjoy the beauty of nature all year round. Orienteering is an activity which can be done at all times of the year, in various weather conditions, during the day or even after dark with a headlamp (reflective markers have also been installed on the controls).

Various types of maps to a scale of 1:10,000 for the areas with courses of varying difficulty and length, descriptions of the cartographic symbols used and the characteristics of the orienteering courses have been prepared and can be freely downloaded from the Gdynia Maritime University website. There is also an optional control card traditionally used to verify that the correct control points have been visited by punching a pattern in each corresponding box on the control card. Alternatively control points can be 'marked off' by scanning the QR codes on each of the wooden posts using the smartphone application as well as a dedicated smartphone app with vector maps.

Overall, the pilot educational program also aims at complementing the traditional classes and additional courses at the University as well as those that are based on the modern advanced technologies, for example, the navigational bridge simulators, ECDIS.

Long COVID: How Norwegian Cruise Line Holdings Struggled to Ride a Post-Pandemic Wave

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Keywords: Leadership; Motivation; Executive Compensation; Crisis Management; Maritime Business

On July 1, 2023, Harry J. Sommer took over as President and CEO of Norwegian Cruise Lines Holdings Ltd. (NCLH). During the COVID pandemic, the cruise line industry was hit particularly hard. After losing nearly all operational revenue and being denied a government bailout, the industry appeared on the verge of mass bankruptcy. Miraculously, a post-pandemic surge in cruise demand pulled the industry from the abyss. Cruise lines that only months ago appeared on the verge of collapse now attracted billions of dollars in investor capital amid projections of sustained growth (see figure 1). Even as industry-wide post-pandemic opportunities emerged, internal challenges limited NCLH's ability to capitalize on these and the company's stock market performance languished relative to its closest rivals. Facing pressure from investors to improve company performance, Sommer looked to his management team to make sense of a complex and dynamic strategic environment.

This case study presents an exploratory analysis of NCLH and challenges readers to imagine themselves leading a firm through a crisis. The cruise line industry is a particularly interesting opportunity for inductive analysis because the industry is dominated by three firms -NCLH, Royal Caribbean, and Carnival- who are largely undiversified and focused on the cruise industry. At the beginning of 2020, all three firms lost about 80% of their market value (see figure 1). As industry revenues recovered, stock market performances among the three firms revealed that managers at Royal Caribbean had positioned themselves for success following the COVID19 pandemic, while managers at NCLH had not (see figure 2). This case analysis attempts to understand why, despite large post-pandemic capital investments and a sustained surge in cruise line demand, NCLH's stock market performance lagged. By providing an opportunity for readers to apply fundamental motivational theory like equity theory and expectancy theory, this case analysis helps readers to imagine how these elements might affect overall strategic firm management. This case also encourages readers to debate the strategic value of investing in capital equipment versus investing in human capital. Through this lens, readers are introduced to a range of fundamental management challenges, while also learning about distinctive difficulties faced by managers of maritime businesses that require large, frequent capital investments.

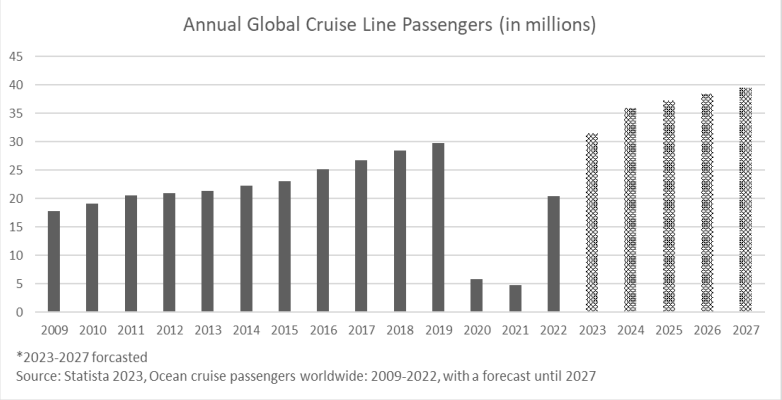
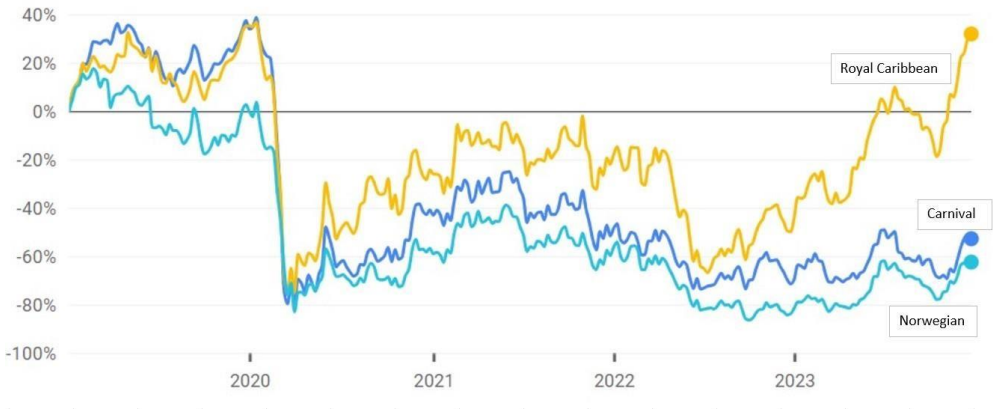


Figure 1



Source: Google Finance – December 29, 2023 (five-year history)

Figure 2

The emergence of privately owned Port and Terminals in Africa: Their Effectiveness and Shortcomings

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Keywords: Ports and Terminals, privatisation, Effectiveness, Shortcomings, Government and Africa.

Ports and terminals have always been publicly owned assets. However, towards the end of the 20th century, some government in the world found it difficult to cope with the challenging demands of high volumes of cargoes at ports and terminals accompanied by technological and capacity requirements. As a results, two demands called for huge investments in both infrastructure and IT capabilities. Therefore, since government are faced with diverse financial demands from their constituencies, their budget allocation constraints, they couldn't cope with such demands notwithstanding the political interference, hence there has been an increasing appetite from the private sector to acquire such ports and terminals from the government all over the world, even though others opted for private/public partnership, but majority went for full privatisation. Growing demand for imports and exports created a fresh impetus for private companies to acquire such opportunities in order to increase their assets base and revenue streams. Since private sectors operate in a highly competitive environment, effectiveness becomes the key driver and differentiator, notwithstanding the shortcomings that will come with the new territory. However, in most if not all the port and terminal take overs, the private sectors investment seemed to have paid off as some studies and research have shown increased container volumes, improved revenues, improvement in vessel traffic, improvement in capacity and lastly, secure and safe handling of containers with the use of state-of-the-art equipment. That was made possible due to private sectors' ability to access funding, unlike the public sector. By so doing, private sector managed to attract more businesses and improve service delivery to existing and new customers. Infrastructure and capacity improvement in ports and terminals calls for more traffic of vessels. This is the type of effectiveness that publicly owned port couldn't achieve.

With regards to shortcoming, some of the sale of these ports and terminal came up with stringent conditions that can make the life of a new owner difficult to operate unhindered. The common example is the condition of holding to the rights of the old company workers. Agreeing to trade union participation and involvement in managerial decisions, keeping the same head count for certain period and inability to right sizing or retrenchments.

Due to high investment private sector makes in ports and terminal infrastructure, failure could be fatal if private sectors mismanage their new investments which can result in bankruptcy and closure. Again, the delays in government concessions could hamper the good intention and investment made by private sector, issuing of new licenses, are amongst other shortcomings. The extreme weather conditions cannot be predicted months in advance and once they happen, the service becomes hampered, and customers and shipping are the ones paying the price. The paper uses a quantitative research approach to expand on privatization of ports and terminals in Africa as well as the effectiveness and shortcomings thereof.

Are extras just extra? Extra-curricular activities and the attainment of GMP BoK Learning Outcomes

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Keywords: Global Maritime Professional; Student clubs; Body of Knowledge; Extra-curricular

Abstract: The International Association of Maritime Universities (IAMU) launched the Global Maritime Professional (GMP) Initiative and introduced the inaugural edition of the Body of Knowledge (BoK) in 2019. This marked a significant effort to support Maritime Education and Training (MET) institutions in equipping their students for an evolving future (IAMU, 2019). This study aimed to determine the potential impact of extra-curricular activities in the attainment of the learning outcomes in BoK. Specifically, the research explored the motivation and participation in clubs of students to achieve the learning outcomes of Tier A in the affective domain of the following focus areas: Leadership, teamwork and discipline; Effective (interpersonal) communication; Decision-making and proactivity; and Professionalism and ethical responsibility. Five hundred nineteen (519) students of the Maritime Academy of Asia and the Pacific (MAAP) were surveyed, including 44 Midshipmen-in-Charge (MIC), who were also interviewed, to gain the students' perception as well as their motivation in joining clubs. The results showed that MAAP students joined clubs to pursue their interest and passion, to develop their skills and to grow personally. Moreover, the MIC agreed that joining clubs and the exposure and experience in clubs' activities led the student members to achieve the learning outcomes set by this study. The findings imply that the activities of the different clubs of MAAP were deemed contributory to developing global maritime professionals; hence, said activities and similar endeavors are suggested to be facilitated and enhanced to meet the changing landscape of the maritime profession. Moreover, it is recommended to explore other focus areas in BoK where student clubs may have a potential impact on attaining their learning outcomes.

Industry 5.0: The Critical Element in Shaping the Future of Maritime Workforce and MET Institutions

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Keywords: Industry 4.0, MET, Simulation, Maritime training, Autonomous shipping, MASS, Seafarer, Remote Operator, Marine Simulator

The Fourth Industrial Revolution (Industry 4.0) is redefining work and reshaping all industries including the maritime industries. Industry 4.0 implementation in the maritime domain is leading the shipping to the remotely controlled and autonomous ships. The introduced technological advancement will disrupt the shipping business and how ships will be operated. The IMO defined different modes of operation for autonomous shipping under the framework of MASS (Maritime Autonomous Surface Ships). In line with the IMO's recent development of a non-mandatory, goal-based MASS Code, the role of seafarers is being redefined and the title has been suggested to change to Remote Operator (RO) to reflect the transformation. Digitalization and advanced technologies in maritime sectors such as embedding IoT, AI, and autonomy on board ships will bring new roles and responsibilities for the ship operators. Onboard advanced technologies will introduce a fresh approach to sensing the environment and situational awareness which is different from what today's seafarers are familiar with. The ships' RO of tomorrow need to possess new skills and competencies for developing situational awareness through digital sensing. This entails many of the currently required competencies such as watch-keeping, communication, and teamwork to change and evolve from traditional to the emerging one. The safety and efficiency of future of shipping depends on upskilling the workforce to develop and adopt the novel skills and competencies in addition to the existing ones. This calls for research in the field of human factors and the maritime education and training (MET) to ascertain the characteristics of the future workplace and the role of those future seafarers/remote operators. Further, as Industry 4.0 advances the technology onboard ship it is revolutionizing the educational technologies available to the MET institutions. For example, simulators prove to be the most effective training tool, were introduced to the maritime industry decades ago however, Industry 4.0 is revolutionizing simulation with the introduction of virtualization and technologies such as AR, VR and mixed reality. These innovations immensely improved the realism of the simulated environment. Further, the future simulators combined with real-time data feed and digital twin from the actual workplace will provide the affordances to not only to simulate but duplicate the onboard ship environment for the in-context training. This article explores the concept of Industry 5.0 and how it will shape the future shipping and role of seafarers/Remote Operators and discusses the importance of MET and maritime training institutions in the process.

Ship Handling Training using Manoeuvring Prediction

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Keywords: Ship-handling; Simulator Training; Manoeuvring Prediction; Fast-time simulation

In ship handling training several manoeuvring prediction technologies are used to have a better insight into the development of ships motion. Predictions are supportive for several purposes of the safety and the sustainability of ship navigation. There is a historic development from very simple methods based only on the measurement of current ship motions up to innovative e-navigation related technologies where complex models of ship manoeuvring dynamics are used to forecast the response on commanded ruder, engine or thruster application or even external effects as wind and shallow water immediately for a suitable time period of the future motion.

In the paper the already known technologies will be compared with potential new methods from single up to multiple prediction and step ahead prediction with unrivalled extension of the decision horizon. The SAMMON software system for “Simulation Augmented Manoeuvring Design, Monitoring & Conning” will be used to analyse the different prediction methods. This system has been developed and matured over years, and promising experiences were made at the Maritime Simulation Centre Warnemuende MSCW. The software is based on the innovative “Rapid Advanced Prediction & Interface Technology” (RAPIT) to simulate the ships motion with complex dynamic math models and to display the ships track immediately based on Fast Time Simulation in an Electronic Navigational Chart.

Using this technology provides insights into the potential benefits of the prediction methods discussed for effective simulator training covering not only aspects of safe but also energy efficient and emission-minimized manoeuvres. The benefits for increasing the effectiveness of lecturing and simulator training using these methods are obvious specifically for complex manoeuvring systems and will be made visible in this paper by using ships both with twin screw and azimuth propulsion for discussion of the manoeuvring effects.

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From Simulation to Reality: Practical Challenges of Maritime Autonomous Surface Ships and the Exploration of AI-enhanced Decision-making Architecture

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Keywords: autonomous ships; reality simulation; deep reinforcement learning; large language model

Autonomous maritime navigation decision-making is a highly complex and challenging field, requiring solutions to issues such as reliability of situational awareness, uncertainty of human factors, rationality of decision bases, and accessibility of control systems. Current research often relies on overly simplified simulation environments or single, specific datasets, limiting the generalizability of algorithms and models. Additionally, while full-scale experiments provide real-world data, their costs are often prohibitive due to the long tail effect and corner cases. This paper reviews various challenges in autonomous ship decision-making and proposes an AI-enhanced front-end and back-end architecture for autonomous maritime navigation. The front-end uses real sea condition data and a dynamics physics engine to build a scalable maritime situational awareness environment, providing a unified interface for state space representation. The back-end, based on historical spatiotemporal data, trains different offline decision control models, continually optimizing decision models through environmental feedback signals, thus enhancing the system's practicality and adaptive capacity in complex sea conditions.

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Policy / Political Aspect

Integrating public policies to increase digital skills among the MET faculty

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Keywords: public policy; policy coherence for sustainable development; maritime education and training (MET); digital skills

New transitions in digitalization and decarbonization in shipping have raised a concern about seafarer skill gaps in the future. Digital skills are listed as a major skill gap among seafarers, anticipated in the Transport 2040 study (WMU, 2023). This trend is not limited to the maritime industry. Increasing demands on digital skills and the shortage of skilled labor are common challenges worldwide. For example, one-third (32%) of the European population lacks basic digital skills and the European Commission (EC) calls for collective efforts through policy measures. From the perspective of public policy, digital skills are considered as critical enablers in geopolitical, societal, economic, and environmental sustainability (European Commission, 2023). The European Framework for the Digital Competence of Educators details 22 competences organized in six areas joining the educators' professional skills, including digital skills (Redecker & Punie, 2017). This demonstrates how digital skills are important for improving education to a more innovative level where educators' pedagogical skills and competencies elevate teaching and learning with digital resources and assessment, leading to increased learners' digital skills. Indeed, many countries around the world have developed public policies to build capacity in digital skills across the nation's industries (WMU, 2023). However, the extent to which the maritime industry is consciously active under the public policy of digital skills is unknown. Further, it is the focus of this paper to discuss how maritime education and training (MET) can benefit from a public policy framework to increase digital skills among the MET faculty.

The concept of policy coherence for sustainable development (PCSD) was coined by the OECD in 2016. PCSD is critical for balancing economic, social, and environmental areas in sustainability while mitigating negative effects on the well-being of people here and now, elsewhere and later (OECD, 2023). PCSD inspires how MET can support public policies when promoting digital skills. The study employs research methods of document analysis and a case study approach. Ukraine was chosen as a case study as their teachers have relatively low levels of digital skills and this country continues online education after the COVID-19 pandemic due to the geopolitical situation. Document analysis was conducted based on the review of public policy documents on digital skills in the EU and Ukraine and identified policy gaps. A case study was supported by a survey on teachers' digital skills from two Ukrainian universities.

The results reveal that 1) the average age of the surveyed university teachers in Ukraine was about 46 years and they had completed their education when digitization was at the early stage of its development; 2) digital technologies were poorly implemented in higher education processes due to the old-fashioned education approaches and teaching methods; and 3) there is no evidence that Ukrainian MET institutions developed a policy on digital skills which are aligned to the national and EU public policies. These results exhibit opportunities for Ukrainian MET to learn from other countries where their regional and national policies on digital skills are integrated into MET. This integrated policy approach supported by PCSD is important when countries desire to participate in maritime transitions, including the People-Centered Clean Energy Transition (Kitada et al., 2023).

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Autonomous Vessels and Fairways – The Nordic Law approaches

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Keywords: MASS Code; autonomous vessel; fairways; safety issues; pilotage

The International Maritime Organization (IMO) is currently preparing the MASS Code which is to become part of SOLAS Convention. Maritime Safety Committee (MSC) has established an international Working Group (IWG) which is working between the Committee sessions and Legal Committee has established its own IWG to work on issues related to autonomous MASS vessels on the Conventions under its auspices. Also Facilitation Committee (FAL) is starting its work on autonomous issues. The Joint IWG for all these Committees has also been established in order to monitor the common issues concerning MASS vessels in order to create coherence and common concepts for the work of these Committees and IWG´s. The author of this article works as a Finnish representative in these Committees and participates also in national work concerning the legal demands that will face the use of national coastal fairways in relation to use of autonomous surface ships (MASS).

The MASS Code will be implemented in SOLAS first as voluntary instrument in 2026, but it will enter into force as mandatory instrument 1.1.2028. This means that it will be automatically enforced by all nations which are parties to SOLAS Convention. At the same time all these nations have to prepare national legislation also in relation to use of autonomous vessels in their coastal fairways as the autonomous shipping has to be made possible for international traffic. This means that legislators need to follow closely the work of the IMO when preparing the laws for use of their fairways. However, there is no guidance for making this legislation by the IMO as IMO is still working under the general rules for the use of autonomous vessels. The issues which need to be considered nationally are for example requirements concerning the use of fairways, surveillance by the authorities on the safety issues, granting permissions for use of autonomous vessels on fairways, arranging pilotage, environmental risk assessment, salvage response etc.

The technical requirements must be in line with the other requirements, especially relating to navigational aids and interoperability of systems and software when assessing the traffic on fairways. According to IMO resolution the electric charts need to be in line with S100 standards by 2029 and the autonomous vessels must be able to exchange information with traditional vessels and between MASS vessels already by 1.1.2028 at latest. The national legislation on mandatory pilotage on fairways must legislate how the pilotage of autonomous vessels is to be arranged. The ship owners must be able to demonstrate on paper in their applications that the autonomous vessel is at least as safe as a conventional vessel before it is entitled to get a permission to enter the national fairways. The permission requirements for how this can be guaranteed is currently under development and will be analyzed in the paper.

The basic legal framework for these issues has already been established in Norway, but the laws in other Nordic countries are still being prepared in different stages. Nordic Maritime Codes are close to identical, but the legal framework for the use of fairways is different in all Nordic countries. Norway, which has first established legislation on use of autonomous vessels on its fairways, can be used as guidance but not as direct model for creating laws and regulations in other Nordic countries. Research on these issues will be presented on how the changes which are demanded by 1.1.2028 can be reached by legislative efforts in these Nordic jurisdictions.

Public Private Partnership Horizons in Maritime Education and Training

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Keywords: public private partnerships; P3; maritime education and training, MET, marine economy

The United States marine economy is an expansive industry and service network experiencing a pace of innovation not witnessed in decades. The marine sector is a foundational construct of the United States economy supporting manufacturing logistics, energy production, security and defense, and a broad spectrum of consumer goods and services, both regionally and nationally. Public-private partnerships, known as P3s have factored throughout the country's maritime history. P3s have provided a key to unlocking the advantages and advances of private enterprise for public benefit in transportation infrastructure, higher education and the maritime sector. This paper identifies a sample of P3 projects presently in development/construction that support the United States marine economy. The authors have developed a categorical framework to identify the maritime structural attributes of the projects and discuss the comparison of projects in the regional and demographic context within the United States. The P3 summary framework is a benchmark for the comparison of maritime projects under development domestically. The authors' analytic review of the P3 projects creates an awareness of the tangential engagement of P3's in both the maritime and education domains and sets to describe the crossover opportunity for innovation in maritime education and training and public private partnerships in the United States.

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Technological Aspect

Scale Development to Measure the Cybersecurity Perception of Maritime Industry Employees and a Sample Application on the Istanbul - Türkiye Region

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Keywords: maritime industry; scale development; cybersecurity; human factor

The rise in global population, improved living standards, increased investments, and reduced trade barriers have amplified reliance on industry. Within this landscape, maritime transportation stands out for its pivotal role in domestic and international trade. It emphasizes sustainability, cost-effectiveness, operational efficiency, and environmental friendliness, forming a crucial underpinning for global economic connectivity and the intricate web of the international supply chain. Shipping and ports collectively manage a significant share, exceeding 80% of the world's merchandise trade and over 70% of its total value. Disruptions in the supply chain, stemming from various sources such as economic shifts, political unrest, natural disasters, cybersecurity breaches, the COVID-19 pandemic, and more recently, the conflict in the Black Sea region, underscore the critical nature of maritime transport. It serves as a vital conduit capable of transmitting disruptions throughout supply chains, potentially stalling global trade and business operations (UNCTD, 2022). As we approach 2030, the maritime transportation sector is on the brink of notable advancements in big data analysis, wireless communication, power supply, ship propulsion, and the development of smart ships and autonomous systems (LRGL, 2015). However, this technological leap also brings along negative implications. While offering growth prospects, technological advancements have exposed the sector to cyberattacks, raising concerns about potential disruptions to critical infrastructure in the future (Fitton et al., 2015). The global rise in cybercrime poses a significant threat to all industries, including maritime transportation. Recent security breaches have highlighted risks to human safety, the environment, and financial losses for shipping companies. For example, in November 2017, Clarksons, a global shipbroker, suffered unauthorized access, leading to a decrease in stock value (Kapalidis, 2020). Similarly, in June 2017, A.P. Moller-Maersk faced a major business-disrupting cyber incident caused by the "NotPetya" malware (Parizo, 2019), (Progoulakis et al., 2021).

The maritime transportation sector presents a significant cybersecurity risk while exhibiting a low level of awareness in this field. Given the crucial role of human actions in ensuring cybersecurity, industries closely linked to human elements may face heightened risks compared to other sectors (Hasanspahić et al., 2021). In the maritime industry, where human errors contribute significantly to error rates, establishing awareness levels for cybersecurity is crucial to mitigate potential vulnerabilities. Hence, this study seeks to create a tool to gauge the cybersecurity awareness of maritime transportation employees. To achieve this, a 5-point Likert scale with 43 questions was developed from a larger pool of 500 questions, with input from experts. The scale was then tested for validity and reliability. It was subsequently used in Istanbul, Turkiye, a hub for maritime sector employees, to assess their cybersecurity awareness levels. The results showed that while IT personnel demonstrated high awareness, others had lower awareness levels, both at the organizational and individual security vulnerability levels. This scale is valuable for evaluating companies' cybersecurity awareness, helping them identify strengths and weaknesses and implement necessary measures. Future research could use the scale to explore regional and sectoral differences in cybersecurity awareness. Recommendations include using larger sample sizes for future studies to enable more comprehensive comparisons and further enrich the literature on this topic.

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Spatial database creation applicable for global path planning in integrated navigation systems

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Keywords: spatial database; global path planning; electronic navigational chart; integrated navigation system; route planning

Global and local path (GPP, LPP) planning is very actively researched for different vessels and manning levels (Vagale et al. 2021). To employ planning algorithms or workflows, an environment model must be created, which is not commonly based on Electronic Navigational Chart (ENC), although it is the official and standardized representation of maritime environment (Šakan et al. 2022). ENCs are used in Electronic Chart Display and Information System (ECDIS), a component of an Integrated Navigation System (INS), the software platform fusing ECDIS, radar, sensor data and functions including route planning (Svilicic et al. 2019) with GPP considered as a part thereof. ENCs were created primarily for human interpretation, however with intended usage not solely for navigation. Closed and proprietary navigational and research software, ENC format limitations, scarce availability of free ENC file formats and complex usage outside of regulated frameworks contribute to limited number of ENC based GPP research approaches (Šakan et al. 2022), usually based on single or few ENC objects (Liang et al. 2021). Therefore, the purpose of this study was to create an open-source methodology based on spatially extended object-relational database, programming languages and libraries with geographic information system to manage ENC objects used for static environment modelling and GPP applicable in INS or broader context. We created the navigable area and environment model using ENC objects and hexagonal hierarchical grids from Uber's H3 Hexagonal Hierarchical Geospatial Indexing System library (Bousquin 2021). For evaluation, we used ENC objects from different usage bands and scales for area between the ports of Savannah and Charleston in the USA with results confirming the open-source methodology applicability, along with possibilities for further research and development.

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On Cyber-Security of GMDSS

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Keywords: maritime cyber-security, GMDSS, navigation safety

The maritime ship-to-shore and ship-to-ship communications have been increasingly relied on cyber technologies. However, benefits provided by the cyber technologies are traded off with a risk that cyber vulnerabilities could be exploited, resulting in the secure communication disturbance. Consequently, the management of maritime cyber security risks has been taken an important part in the safety and security of shipping (IMO 2017, IMO 2022).

The Global Maritime Distress and Safety System (GMDSS) is a global network of automated communications which enables ships in distress situations to alert rescue services efficiently (IMO 2019, Valčić 2022). The International Maritime Organization (IMO) has set up the obligation for all SOLAS ships for full implementation of the GMDSS by the 1st of February 1999. The GMDSS system integrates terrestrial and satellite communication services (IMO 2019, Kent 1990).

In this work, we study cyber security risks of a GMDSS system (Fig. 1), comprising of VHF/MF/HF stations, Inmarsat-C ship earth station and NAVTEX receiver. The GMDSS radio station is IMO compliant for sea area A3 and allocated with MMSI number 238068000. Cyber vulnerabilities of the GMDSS radio station are identified and analyzed utilizing a cutting-edge software solution (Svilicic 2019a, 2019b, 2022). The details of the GMDSS radio station, experimental study and identified cyber vulnerabilities together with feasible resolutions will be presented.

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Figure 1. The IMO compliant GMDSS radio station, allocated with MMSI number 238068000, with a laptop connected for the identification of cyber vulnerabilities.

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Autonomous launch and recovery of nearshore ROV based on USV

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Keywords: remote operated vehicle (ROV); unmanned surface vehicle (USV); launch and recovery; wireless remote interaction

The remotely operated vehicle (ROV) finds widespread application owing to its portable and flexible human-computer interaction control in ocean exploration and underwater operations. However, its cable working mode imposes constraints on its operational range, and the launch and recovery process is heavily dependent on operators.

In response to this challenge, an unmanned surface vessel (USV) relay platform is designed to facilitate the launch, recovery, and remote wireless interaction of the ROV. The autonomous relay platform incorporates an automatic cable laying device for collecting and releasing communication cables. Additionally, a hornshaped docking device is introduced to secure the ROV operation. To enhance robustness and visual feature recognition, artificial feature markers are manually affixed to the underside of the autonomous relay platform. Besides, a specifically designed ROV is developed to collaborate effectively with the relay platform. Within the designed ROV, a software and hardware framework based on the robot operating system (ROS) is implemented to facilitate efficient data transmission among various functional modules. Furthermore, the dynamic and kinematic models of both the ROV in the ocean and the USV on the surface of the ocean are established based on the Fossen method. This enables real-time calculation of control signals, with due consideration given to the role of the cable. Finally, a visual servo method, based on monocular images, is proposed and implemented on our deployment and retrieval platform.

Simulation and real-world experiments demonstrate that the proposed USV relay platform effectively enhances the efficiency of autonomous launch and recovery of ROVs within a range of 20 km nearshore. The integration of the USV relay platform and ROV facilitates wireless remote interaction between ROVs and operators, showcasing promising engineering application scenarios.

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Navigating Tomorrow:

Designing a Simulator Scenario for AI Training Data Collection

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Keywords: Navigation; Artificial; Intelligence; Decision; Support

The modern ship bridge, equipped with extensive instrumentation, often lacks integration, which may lead to cognitive overload for the bridge team (Man et al., 2023). This hampers situational awareness and can lead to misinterpretations during navigation and collision avoidance.

To address cognitive overload, academia and industry have made substantial efforts in research and innovation, particularly focusing on systems for situation awareness and collision avoidance. However, existing solutions are limited in their compliance with all navigation rules (COLREGs, 1972) and notably falls behind in integrating the concept of "Good Seamanship" as discussed by Crockcroft & Lameijer (2011) in the comments to rule 2 or as mentioned in COLREGs rule 8. Difficulties complying with these aspects of COLREGs was also found by Aylward, et al. (2022) in their analysis of the system Advanced Intelligent Maneuvering (AIM).

Thus, the technological frontier lies in an Advanced Navigation Assistance System that operates in alignment with the principles of "Good Seamanship" as well as the rest of COLREGs. This system should not only ensure regulatory compliance but also empower human navigators to effectively resolve navigation scenarios using sound judgment and expertise. This is what the project AI-NAVIGATOR tries to achieve with the use of artificial intelligence. See figure 1 for a project overview.

The AI-NAVIGATOR project aims to develop an Advanced Navigation Assistance System (ADNAV) that integrates "Good Seamanship" with IMO COLREGs to enhance safe navigation.

This paper focus on the development of a simulator scenario and a data collection protocol as a part of Work Package 4 (WP4). The simulator scenario and the data collection protocol are designed for collecting data on how humans react to complex situations requiring usage of COLREGs rule 2 and “good seamanship”. Guidelines for constructing both the scenario and a scoring system are developed and applied in the specific context of the AI-Navigator project to create data from which the AI can learn.

The guidelines established to create the learning simulator scenario will also inform the development of the validation scenario. The validation scenario will be different from the learning scenario but will assess the same variables using the same scoring system. However, the actual validation process falls outside the scope of this paper.

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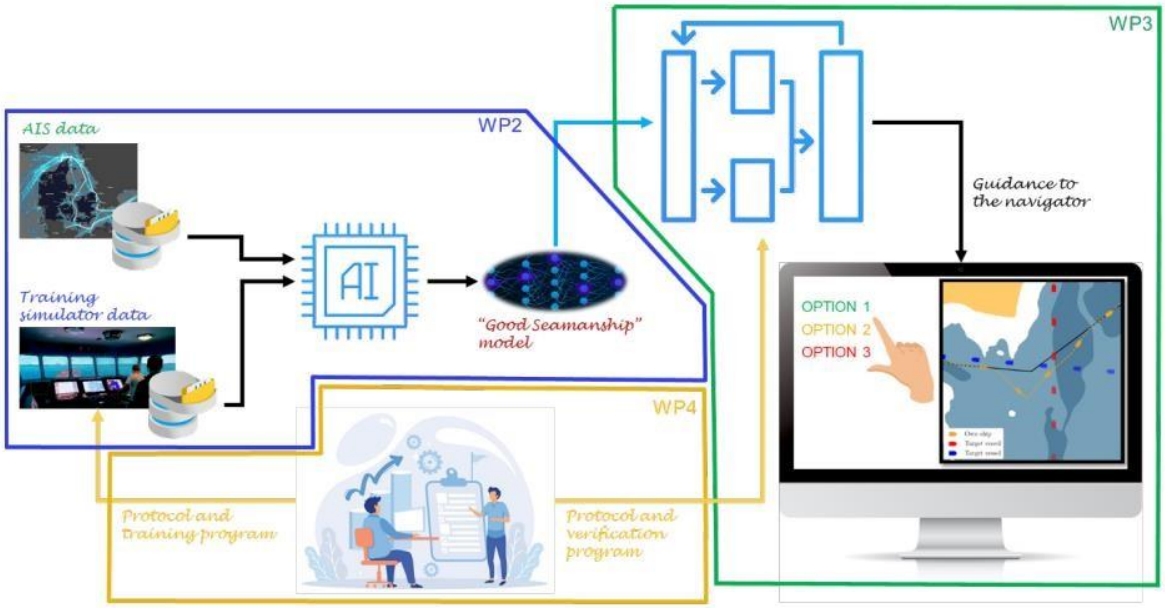

Figure 1. Visualization of the research concept of AI-NAVIGATOR

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Pareto Analysis of ISM Code Deficiencies

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Abstract: The International Safety Management (ISM) Code concerns safety at sea and marine environment protection; primarily regarding SOLAS class vessels. The main purpose of this paper is to highlight the importance of reviewing the outcome of ISM external audits and port inspections as well as analyzing accident reports with a view to improve safety at sea and marine environment protection. The paper focuses on the outcomes of some 50000 Administration and Recognized Organizations (RO) noted non-conformities and over 100000 deficiencies observed by Port State Control Officers (PSCO) during their inspections. Included is a sample selected from some 300 accident reports to establish the root causes of non-conformities, deficiencies and accidents at sea.

In reviewing the root causes and contributing factors to the accidents, audit non-conformities and inspection deficiencies, the paper makes an attempt to find those with highest frequency of occurrence by applying Pareto analysis. This paper concludes with a taxonomy model identifying the key factors contributing to accidents, nonconformities noted by Administration or ROs, as well as deficiencies observed by PSCOs when inspecting ships.

Keywords: Maritime Safety, Accidents at sea, ISM Code Audits, PSC Inspection

Analysis of impact of safety parameters on increased safety levels with autonomous ships

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Abstract: Shipping is facing new challenges of the successful development of autonomous ships as well as new trends of more economical sailing speeds that can be justified for ecological and economic reasons, resulting in increased ship dimensions. Increasing ship dimensions would have an impact on the final implementation of autonomous ships for commercial purposes. The advantage of autonomous ships that are unmanned or low-manned will reduce the number of people at risk at sea. Even when autonomous navigation does not reduce the number of accidents, this means that safety at sea will be increased. In fact, increased safety is one of the primary perceived drivers for autonomous shipping, although this safety increase has not been quantified in academic literature.

Additional efforts regarding safety should be emphasized on collision avoidance at sea where seafarers on board conduct this part. Seafarers keep a proper lookout, use navigation aids, and communicate tools with other approaching vessels to make an agreement regarding collision avoidance manoeuvre (WMU, 2022). This paper systematizes safety parameters that are of special importance and that contribute to the improvement of advanced autonomous navigation in autonomous commercial merchant ships and how these parameters should be upgraded on higher level in critical navigation areas. Additionally in this paper authors proposes new model in correlation with safety levels with present level of development for autonomous ships and navigation.

Keywords: safety parameters; autonomous ships; levels of safety; model; ship collisions;

Unmanned ships: appropriate solution or cause for concern?

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Keywords: MASS concept; operational reliability; concept viability; industry impact

The shipping industry has traditionally been regarded as the lifeline of the global economy (Stopford, 2009). As part of the transportation chain, ships are an indispensable component. Numerous international conventions and laws aim to ensure their safety, the protection of the environment and the lives of seafarers. However, human error has proven to be a weak point in this system (Schröder-Hinrichs et al, 2012; Mišković et al, 2018). The industry has recognized the problem and numerous legislative changes have been introduced, including greater automation and digitalization of ship systems (Turan et al., 2016). Nevertheless, the available statistical data shows that no suitable solution has been found to mitigate the problem (EMSA, 2022). The impetus for improvement came from the industry and by the International Maritime Organization (IMO, 2018) in the form of the guidelines for the Maritime Autonomous Surface Ships (MASS); first for unmanned and then for autonomous ships. What both concepts have in common is the exclusion of seafarers from the ships along with the benefits (e.g. Burmeister, 2014). However, there are still numerous uncertainties (Felski and Zwolak, 2020; Kim et al., 2020; Ziajka-Poznańska and Montewka, 2021). The aim of this paper is to discuss the operational requirements for future unmanned ships and the associated risks. On this basis, this paper examines the operational and financial viability of the concepts, their affordability and the potential economic impact on the shipping and related industries. Among the fundamental issues considered are the requirements relating to the installation of basic navigation, machinery and cargo equipment. As there will be no crew on board, the requirements for maintenance of the ship's machinery and equipment and their costs are also presented (Figure 1). In addition, it should be noted that any installed equipment raises the issue of maintenance to be carried out in the absence of the ship's crew by the shore service and/or while the ship is in dry dock. In both cases, this means an increase in costs for the owner. From this it can be concluded that there are a number of unknowns associated with the ship's equipment that can affect the acquisition cost of the vessel. It is also clear that this concept is associated with a variety of risks. It is therefore legitimate to ask which insurance company is willing to do this and at what price. To summarize, in addition to its positive characteristics, the concept also has a negative side in terms of costs, which are largely unknown. The issues of financial viability and affordability are therefore subject to detailed analysis. However, should the concept become established, it is to be expected that the main burden of costs will be passed on to the end consumer, the customer, which in turn will have an impact on the global economy.

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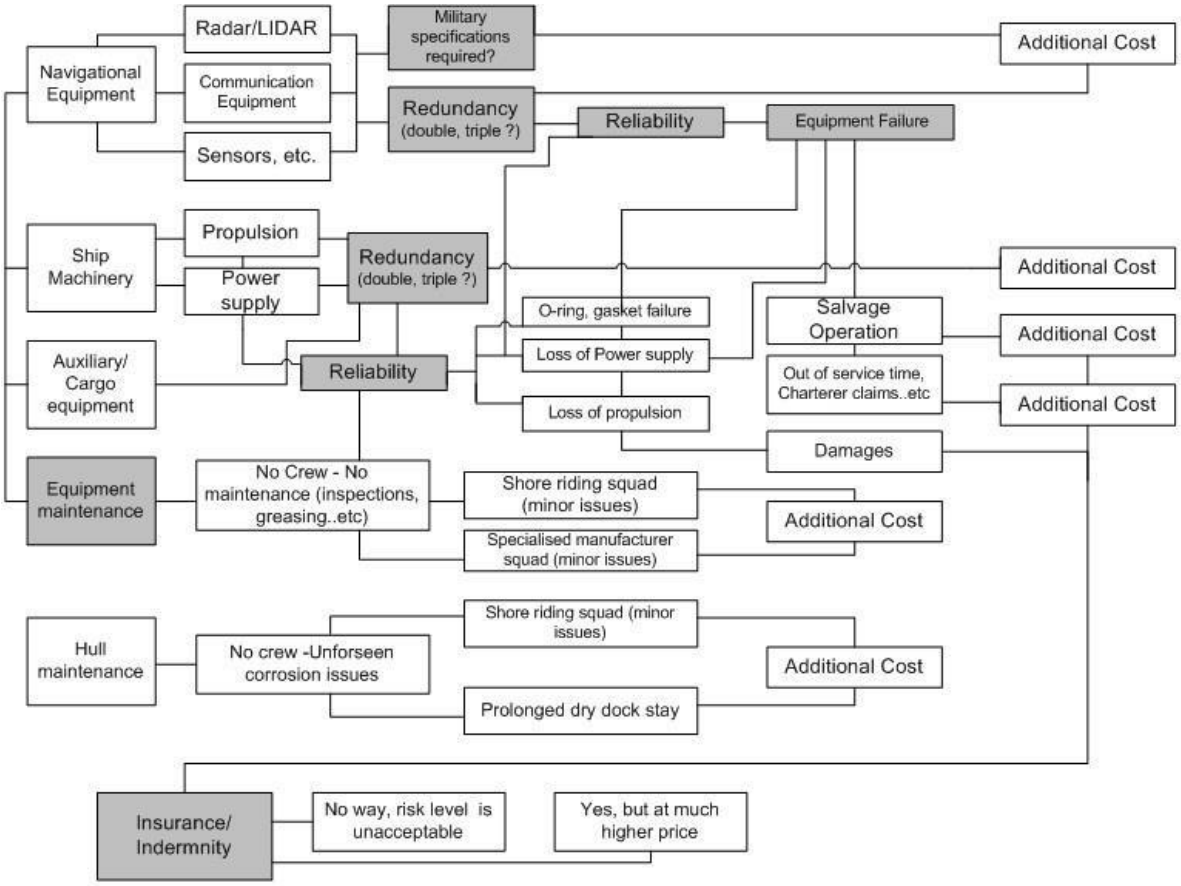

Figure 1. Flowchart of future requirements, related risks and associated costs for unmanned ships

The Nuclear Merchant Mariner (NMM): Designing a Framework for Education and Training

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Abstract: The global maritime industry is currently undergoing a period of planning focused on reducing the carbon footprint of the worldwide shipping fleet numbering more than 100,000 vessels and associated operations. Innovations focused on "decarbonization" are driven largely by goals set by the International Maritime Organization (IMO) to reach net-zero greenhouse gas (GHG) emissions from international shipping by 2050 and to ensure an uptake of alternative zero or near-zero GHG fuels by 2030 along with indicative checkpoints for 2030 and 2040. Nuclear energy features prominently in this strategy. Maine Maritime Academy, in collaboration with industry leaders engaged in maritime nuclear technology design, development and deployment, is answering this call to formulate contemporary methodologies, materials and facilities for educating and training maritime nuclear professionals, including but not limited to seafarers and logistics specialists. This roadmap for maritime university education and training encompasses technology, as well as both marine engineering and transportation operations that include curriculum, laboratory, and specifically tailored industrial co-ops, internships, and sea time. The protocols will address the need for developing students in accordance with amended Standards of Training Certification and Watchkeeping (STCW) for the Nuclear Merchant Mariner (NMM).

Keywords: nuclear; merchant mariner; STCW;

Navigating the Future: Multi-Stacking Ensemble Learning for Sustainable Maritime Trajectory Prediction

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Abstract: In the transformative landscape of maritime applications, Artificial Intelligence plays an inevitable role in revolutionizing the shipping industry. The accuracy of vessel trajectory predictions becomes paramount for ensuring safety, operational efficiency and informed decision-making. This research introduces the Multi-Stacking Ensemble Learning (MSEL) model, a novel Artificial Intelligence driven approach designed to not only enhance the precision but also to promote sustainability in vessel trajectory predictions within the Maritime Transportation sector. The research undergoes meticulous data preprocessing by eliminating the limitations of using raw Automatic Identification System (AIS) data for collision avoidance. By concentrating on route pattern extraction, port extraction and trajectory clustering, the research aims to enhance the reliability of predictions for sustainable Maritime Transportation. MSEL is an innovative ensemble framework which integrates diverse prediction models by combining route pattern classification and trajectory forecasting. Experiments on open source AIS dataset after pre-processed the raw information was carried out and the results showcased the novel architecture MSEL's superior performance over benchmark models in long-term prediction accuracy. The ensemble learning paradigm equips MSEL to effectively capture intricate vessel movement patterns and contributing to its outstanding performance in diverse maritime scenarios. MSEL architecture will acts as a significant contributor to sustainability-driven forecasting within maritime trajectory prediction methodologies

Keywords: Vessel Trajectory; Predictive Analytics; Ensemble Learning; AIS; Artificial Intelligence

Difficulties in Collecting and Analyzing Data to Monitor Ship Movements in Recreational Boating

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Keywords: recreational boating; movement pattern; tracking devices; qualitative research; data preprocessing

Nautical tourism/recreational boating is one of the most important factors for the growth and development of many countries. In this context, nautical tourism, like any other activity, has numerous positive and negative impacts that are reflected in environmental, economic and social aspects. One of the prerequisites for the sustainable development of nautical tourism lies in the planning of the nautical offer itself, which is only possible if the purpose and scope of the individual voyages of the targeted vessels and their transportation routes are known. As recreational craft are not required to be equipped with an automatic identification system (AIS), the movement patterns of vessels between marinas and ports often remain unregistered and unknown. When assessing the movements of recreational craft and the method of data collection, it should be noted that part of the data (route) can be obtained using a GPS tracking device (if installed), which can determine the position at a given time based on the GPS system for satellite positioning and the GSM/GPRS network. The reasons why sailors choose a particular destination, on the other hand, can only be determined through qualitative research (questionnaires, interviews). The aim of this article is to analyze the advantages and disadvantages of the two methods (tracking devices and qualitative research) for collecting data on the routes of pleasure craft. The strengths and weaknesses of both methods are analyzed on the basis of practical examples. On the one hand, the difficulties in conducting qualitative research on the routes of recreational boaters and the reasons for choosing a particular destination in the Adriatic are presented. At the same time, the difficulties in preprocessing the raw data collected with the GPS tracker are analyzed. All previous researches (U.S. Coast Guard, 2012; Pallotta, Vespe and Bryan, 2013; Arguedas, Pallotta and Vespe, 2014; Swedish Transport Agency, 2016; Fernandez Arguedas, Pallotta and Vespe, 2018; Dalton *et al.*, 2020; RTI International, 2020) use one or another method of data collection, but the fact is that both types of research in synergy can give a truthful and complete picture of the movement of recreational boaters and the reasons for choosing a particular destination.

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Enhancing Realism in Maritime Simulators through Operational Data and Machine Learning

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Keywords: Maritime Simulator; Machine Learning; Operational Data; Realism

This paper is about the search for a method to apply an innovative technique to increase the realism of maritime simulators. The objective is to improve simulated ship models by integrating Operational Data, derived from real-world ship movements like sea trials, into the simulator model using Machine Learning techniques. The motivation behind this is to address the limitations of traditional hydrodynamic-based simulator models.

The importance of simulator realism is underscored by Saus et al. (2010), who found a correlation between the size of simulators and perceived realism, influencing the effectiveness of training. Additionally, De Oliveira et al. (2022) suggest that higher accuracy in full mission simulators prevents distractions caused by inconsistent predictions. However, the impact on student performance, especially those early in their maritime careers, is uncertain.

Hydrodynamics is mainly about optimizing vessels for speed, stability, and fuel efficiency by considering flow patterns. As Bertram (2011) emphasizes, this includes resistance and propulsion, seaworthiness, ship vibrations, and manoeuvring. Early prediction of a ship's manoeuvring behaviour is crucial during the design phase, but those formulas are also used in simulators for training. Simulator models based on Operational Data to predict ship movement might be more accurate and might therefore accommodate more transfer of knowledge to the real world. In order to examine this, we first need to find a way to incorporate this data into the simulators. Expressing a ship's state involves parameters like position and orientation during manoeuvres. Six ship motions (surge, sway, heave, roll, pitch, and yaw) are influenced by the rudder (primarily on yaw) and propulsion (primarily on surge). External factors like wind, currents, and interactions also impact ship movements.

The methodology involves applying Machine Learning algorithms to fill the Ship Database File within Kongsberg simulators without requiring any changes to the way the simulator normally works. An additional challenge is to create a method that does not only work for Kongsberg simulators but also for other platforms. Insights from industry experts, including instructors and model developers at leading institutions contribute to understanding current practices in simulator model development. The theoretical framework explores not only existing literature on simulator realism, ship movements, and hydrodynamics, but also various types of Machine Learning techniques. Furthermore the paper describes multiple challenges, like sourcing suitable data, model creation, and Machine Learning algorithm selection. The envisaged solutions include using real ship data, potentially collected through self-recording, creating both hydrodynamic and graphic models, and experimenting with algorithms like Support Vector Regression (SVR) and Neural Networks.

This innovative project not only offers a direct application for creating more realistic simulator models but also indirectly contributes to advancing simulator technology. By integrating Operational Data through Machine Learning, the proposed method could potentially enhance the overall quality of maritime simulator training.

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Subsea Cables and their seminal importance in communications

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Keywords: Subsea Cables, Communications, Technology

Subsea cables have been used across the oceans since 1866, providing essential and reliable communications. Their development has fostered major advancements in international communications. Since the introduction of the first telephone cable (TAT 1) in 1956, cable usage has grown exponentially. Following the development of the first fiberoptic cable (TAT 8) that was laid in 1988, under-sea cables now transmit ninety-five percent of all telephone and internet traffic. Enhanced subsea cable performance has met the demand of a worldwide communication system that has grown exponentially, especially since the internet's growth. Reliable subsea cable's performance ensures the reliable cost-effective communication that underlies corporate finance and international trade.

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How to Choose the Right Lab Equipment? – A Decision Support Framework for Investment in Energy Conversion and Storage Technologies for Engineering Educations

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Keywords: Sustainable Energy Technology; Decision Support; Engineering Education; Learning Outcome; Life Cycle Cost

Energy technologies are changing: Turbines, boilers, internal combustion engines and supporting systems, electrical motors and installations have been the work horses of the industrial revolution in the 20th century. However, increasing concerns on global warming due to anthropogenic greenhouse gas emissions, are stipulating a much-needed change in our energy systems, to rely on renewable sources rather than the burning of fossil fuels. This fundamental change in the source of energy impacts all sectors or industries where fossil fuels are used as feedstock or fuel. While Power to X technologies will have an important role in this regard, there is a plethora of competing technologies with varying functionality and price (Nady et al., 2022).

The prevalence of laboratory work in engineering studies is based on the general premise, that engineers are practically minded and that understanding the working principles of machinery and plants may well be supported by practical work in laboratories (Edward, 2002).

Given the multitude of emerging and competing technologies in relation to the sustainability transitions, we feel that a structured approach to qualifying laboratory equipment investments is needed. Therefore, we propose a decision support framework to aid universities, engineering colleges and maritime academies, to ensure that equipment investments meet a set of defined criteria and may be quantitively weighted against other technologies or solutions. Further, by establishing an objective framework, we aim to facilitate the process of fund raising, for the purpose of ensuring that laboratories meet the needs of future alumni.

The framework considers aspects of:

- educational value – will the availability of the equipment enable students in acquiring relevant skills, knowledge, or competencies?
- technological readiness level – how close is the technology/product to being commercially available?
- legal matters – are there obstacles to purchasing, installing, or operating the equipment?
- life cycle costs – what are the cost of installing, maintaining, and operating?
- operation and safety – can e.g., start-up time fit with course planning? Are there concerns of safety for teachers or students?

Initially the framework is intended to provide decision support on energy conversion and storage technologies such as: electrolysis, biogas, gas transport and storage, batteries, flywheels, heat pumps etc., but may be used in a broader sense to evaluate investments in laboratory equipment. A graphical representation of the proposed framework mechanism is shown in Figure 1.

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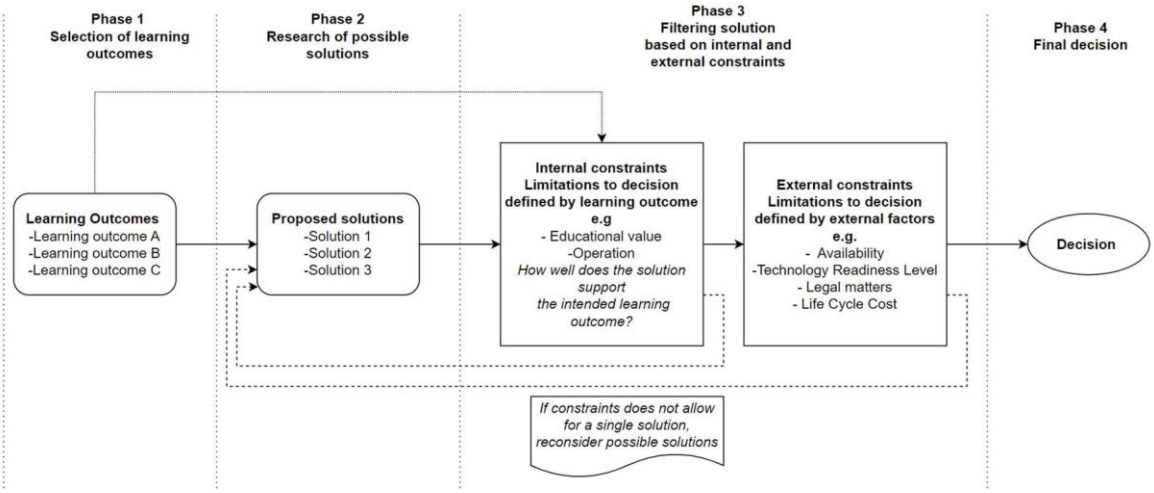

Figure 1 - Decision Support Framework

Wind-assisted propulsion system operating mode optimization

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Keywords: wind-assisted propulsion system, optimal control, main engine, fuel consumption.

Like every other sector, the shipping industry needs to decarbonize in line with the Paris Agreement, but its emissions continue to grow. The IMO MEPC 80 session adopted the 2023 IMO Strategy on Reduction of GHG Emissions from Ships, with enhanced targets to tackle harmful emissions. The revised IMO GHG Strategy includes an enhanced common ambition to reach net-zero GHG emissions from international shipping close to 2050, a commitment to ensure an uptake of alternative zero and near-zero GHG fuels by 2030, as well as indicative checkpoints for 2030 and 2040. There are several types of wind-assisted propulsion systems (WAPS) that have been developed for the maritime industry; still others remain in development. These systems differ not only in terms of maturity, costs involved and fuel savings potential, but also in terms of their suitability for specific ship types. Optimizing ship's speed is one of the most effective ways to increase the economic efficiency of a fleet and reduce energy costs without requiring additional capital investments. Therefore, the task of choosing the most advantageous speed is of paramount importance in the design and operation of ships. The problem of optimizing speed for transport ship's with WAPS is no less acute. For such ships', its solution requires a specific approach, however, the proposed methods and the conclusions obtained are applicable to all types of sea going ships'. The problem can be rightfully considered at three stages: designing the ship, planning the voyage and its actual execution. This paper presents research results related to the optimization of ship's speed in operational conditions, that is, to the second and third of these stages. The presence of two types of propulsors: propellers and wind propulsors (WP), - on the ship determines the possibility of regulating the power of the main engine (ME) depending on the thrust of WP. The thrust provided by the WP can be used both to reduce fuel consumption and to increase the ship's speed.

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Disruptive technologies in the maritime industry

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Keywords: Maritime industry, disruptive technologies, sustainable solutions, shipping

The maritime industry contributes greatly to global trade and commerce as the majority of goods are carried across the world. It is the key driver of economic growth. The maritime industry is vital in that it is essential for global trade, it acts as a major source of employment and it is important for environmental protection. There has been an increase in the global demand for shipping. This means that the increasing demand leads to greater economic output. However, the maritime industry is faced with some challenges. These challenges include the impact on the environment which is a popular topic within the maritime industry. Furthermore, the digitalization that comes with the disruptive technologies within the maritime industry comes with advantages and disadvantages within the industry. It is for this reason that this paper seeks to understand the advantages and disadvantages of disruptive technologies within the maritime industry in order to find sustainable solutions. This paper is a conceptual paper where literature will be gathered on the disruptive technologies that currently present itself within the maritime industries. The results will highlight the disruptive technologies and their contribution to the maritime industry and to ensuring sustainable shipping. Recommendations will be put forward which will contribute to the literature within the field and policy makers within the maritime industry.

Advancing Maritime Education: The Impact of Simulator Training on Cadets at the Italian Shipping Academy

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Abstract: This study explores the integration of simulators in training both engineer and navigation cadets at the Italian Shipping Academy. It focuses on how these modern educational tools evolve maritime training methodologies, preparing the next generation of maritime professionals for the dynamic industry landscape. The paper highlights the comprehensive practical training offered by simulators, which effectively replicate realistic maritime scenarios for engineering and navigational training.

Analyzing the Italian Shipping Academy's approach, the study also provides detailed insights into the implementation and effectiveness of simulator-based training across various maritime disciplines. It examines how simulators enhance cadets' grasp of complex operations, safety protocols, navigation, and engineering principles, with an emphasis on their responses in high-stress situations—a key aspect of ship conduct. Additionally, the study addresses the integration challenges of simulators into educational curricula and the strategies developed to overcome these obstacles.

Crucially, the paper underscores the long-term benefits of early simulator training in reducing accident risks and its economic implications. The conclusion offers strategic recommendations for optimizing simulatorbased training, aiming to better equip engineer and deck navigation cadets for the industry's multifaceted challenges and demands.

Keywords: maritime transport, simulator-based education, cadets, educational technology