http://ejournal.stipjakarta.ac.id

METEOR STIP MARUNDA

pISSN : 1979 – 4746
eISSN : 2685 - 4775

Maritime Institute of Jakarta

Enhancing Maritime Emergency Response through Integrated Problem Based and Team Based Training

[1*]M. Rizki Fadiansyah, [2]Tri Cahyadi, [3]Larsen Barasa

[1,2,3]Maritime Institute, Sekolah Tinggi Ilmu Pelayaran Jakarta, North Jakarta, Indonesia

*Email: mrizkifadiansyah1@gmail.com

Submitted : 05/09/2025 **Revised** : 12/11/2025 **Accepted** : 28/11/2025 **Published** : 17/12/2025

Abstract

This study investigates the integration of Problem Based Learning (PBL) and Team Based Training (TBT) within Basic Safety Training (BST) to enhance teamwork effectiveness during simulated maritime emergencies. Conducted through a qualitative, phenomenological approach at the Sekolah Tinggi Ilmu Pelayaran (STIP) Jakarta, the research involved in-depth interviews with five trainees and two instructors, alongside direct observations. The findings demonstrate that the PBL-TBT model catalyses a critical shift in trainee competence, moving from rigid procedural recall to dynamic, adaptive problem-solving. Furthermore, the methodology fostered the development of shared mental models and non-verbal coordination, building collaborative resilience under high-stress scenarios. The research concludes that the synergistic application of PBL and TBT effectively bridges a critical gap in traditional maritime education by systematically developing the non-technical skills essential for modern seafaring. This evidence-based model offers a vital strategy for maritime training institutions aiming to improve safety outcomes and cultivate seafarers who are not only technically proficient but also skilled in teamwork and crisis management, thereby addressing a fundamental need in the global maritime industry.

*Copyright © 2025, **METEOR STIP MARUNDA**, ISSN:1979-4746, eISSN :2685-4775*

Keywords:

Problem-Based Learning, Team-Based Training, Maritime Safety Education, Emergency Response, Non-Technical Skills

INTRODUCTION

The relentless pulse of global trade is sustained by the arteries of international shipping, a sector responsible for transporting over 80% of the world's commerce [1]. At the heart of this complex, high-stakes industry lies an immutable truth: its greatest asset and most significant vulnerability is the human element. Despite technological advancements in navigation and ship design, human error remains the predominant contributor to maritime incidents, accounting for as much as 75-96% of all accidents, often stemming from failures in communication, decision-making, and teamwork [2]. This stark reality elevates the quality of maritime education and training (MET) from a mere academic concern to a critical pillar of global economic stability and environmental protection. In archipelagic nations like Indonesia, whose geopolitical and economic destiny is inextricably linked to the sea, the imperative for a robust, competent, and safety-conscious maritime workforce is not just an industrial goal but a national socioeconomic imperative. Against this backdrop, the Basic Safety Training (BST) course, mandated by the

International Maritime Organization's (IMO) Standards of Training, Certification and Watchkeeping (STCW) Convention, serves as the foundational pillar for seafarer competence.

However, traditional pedagogical approaches, heavily reliant on rote memorization and instructor-centric ceramah (lectures), are increasingly revealed as inadequate for cultivating the critical thinking and collaborative prowess required in genuine shipboard emergencies (Baran & Maskan, 2021; Chua & Lee, 2020). It is within this critical nexus of global economic dependency, persistent safety challenges, and pedagogical inertia that this research positions itself, by investigating the integration of two innovative learning methodologies—Problem-Based Learning (PBL) and Team-Based Training (TBT)—to transform BST from a procedural hurdle into a transformative experience that forges truly effective and resilient maritime professionals.

The existing body of knowledge on maritime safety has extensively documented the technical and regulatory frameworks necessary for safe operations. The STCW Convention, through its various amendments, has systematically codified the minimum standards of competence for seafarers worldwide [1]. Concurrently, research in MET has begun to shift from a purely technical focus towards the crucial domain of non-technical skills (NTS), such as situation awareness, leadership, and teamwork, often referred to as Crew Resource Management (CRM) in other high-reliability industries like aviation [3]. Studies have demonstrated that effective teamwork can mitigate errors and enhance performance during critical operations, directly impacting the safety and efficiency of maritime transport, a key driver of the global economy (Håvold, 2021). Furthermore, pedagogical research in broader educational contexts has long championed active learning strategies like PBL and TBT. PBL, by engaging learners with realistic, ill-structured problems, fosters deep conceptual understanding and self-directed learning skills (Hmelo-Silver, 2004), while TBT explicitly targets the development of interpersonal and collaborative competencies essential for modern workplaces [4].

However, a significant gap persists in the specific context of Indonesian MET. While the value of NTS is acknowledged, its cultivation often remains abstract, lacking a structured and integrated pedagogical model within standardized training like BST. The conventional training paradigm, as observed in the preliminary data from Sekolah Tinggi Ilmu Pelayaran (STIP) Jakarta, often results in a disconnect between theoretical knowledge and practical application, evidenced by low pre-test scores averaging 47.29 among trainees. This gap is symptomatic of a broader issue in vocational education, where the "how" of teaching has not evolved in tandem with the "what" of competency standards. Moreover, the unique socioeconomic landscape of Indonesia, with its diverse trainee backgrounds, necessitates educational innovations that are not merely transplanted from Western contexts but are adapted to local cultural and institutional dynamics. The country's vision as a "Global Maritime Fulcrum" hinges on its ability to develop a human capital base that is not only technically proficient but also adept at the collaborative problem-solving required to manage the complex social and technical systems of a modern vessel, thereby enhancing the overall safety culture and economic competitiveness of its shipping sector.

The central problem this research addresses is, therefore, the ineffectiveness of traditional, lecture-based methods in fostering the high-level teamwork and critical problem-solving skills necessary for optimal emergency response within the BST curriculum of Indonesian maritime education. This problem manifests in trainees who can recite procedures but may falter under the pressure of a real fire emergency, where dynamic coordination and adaptive communication are paramount. Consequently, this study is driven by the following research question: How does the integrated application of Problem-Based Learning and Team-Based Training qualitatively influence the development and effectiveness of teamwork competencies among BST participants during simulated fire emergency scenarios?

The rationale for this inquiry is threefold, spanning safety, economic, and social development imperatives. First, the primary motivation is rooted in the urgent need to enhance maritime safety. Every maritime accident carries a devastating human cost and potentially severe environmental consequences, which can cripple local economies dependent on fisheries and tourism, as seen in past oil spill incidents. By creating a training environment that more authentically replicates the psychological pressures and social dynamics of a real emergency, we can better prepare seafarers to prevent such catastrophes. Second, from a socioeconomic management perspective, the competitiveness of a nation's maritime sector is directly linked to the quality of its seafarers. Indonesia, as a major supplier of maritime labour, has a significant economic interest in ensuring its cadets are among the world's best. Graduates trained under innovative methods that emphasize teamwork and problem-solving are more likely to be employed by top-tier international shipping companies, leading to higher remittances and a stronger national reputation in the global maritime economy [5]. This aligns with the national development goal of elevating the value-added contribution of its human resources. Third, from an educational development standpoint, this research

contributes to the modernization of MET pedagogy. It moves beyond the traditional, hierarchical model of instruction towards a more collaborative, student-centred approach that empowers trainees to become active agents in their own learning, a crucial mindset for lifelong learning in a rapidly evolving industry.

To critically investigate this problem, the research employs a qualitative, descriptive methodology designed to capture the rich, nuanced experiences of the participants. The study was conducted at STIP Jakarta, involving 24 BST participants from Class A (Period 24 February - 6 March 2025) as the primary locus, with in-depth data drawn from a subset of 5 participants and 2 instructors through semi-structured interviews. This methodological approach is paramount as it moves beyond mere quantitative metrics (like the significant pre-test/post-test score improvement from 47.29 to 92.5) to unearth the *how* and *why* behind the phenomena. Through thematic analysis of interview transcripts, direct observation of team dynamics during fire and evacuation simulations (e.g., "Kebakaran Besar di Area Galley," "Penyelamatan dengan Sekoci"), and document analysis of reflective notes and assessment rubrics, this research seeks to construct a nuanced narrative. It aims to illuminate the transformative process through which PBL scenarios challenge individual cognition and TBT structures forge collective competence, thereby providing a deep, contextualized understanding of teamwork effectiveness in a high-fidelity training environment. By giving voice to the trainees and instructors, this study does not merely measure outcomes; it explores the very process of professional identity formation and the development of a shared mental model for safety, which is the bedrock of a resilient maritime socioeconomic system.

METHODE

This study employed a qualitative research design with a descriptive phenomenological approach to gain an in-depth, nuanced understanding of the integration of Problem-Based Learning (PBL) and Team-Based Training (TBT) within the Basic Safety Training (BST) curriculum. The primary objective was to explore the lived experiences and perceptions of participants and instructors, focusing on the development of teamwork competencies during simulated fire emergencies. The research was conducted at the Sekolah Tinggi Ilmu Pelayaran (STIP) Jakarta, a premier Indonesian maritime education institution, ensuring the findings were grounded in a authentic and high-stakes training environment. The population for this study comprised all individuals directly involved in the BST program where the PBL and TBT methods were implemented. From this population, a purposive sampling strategy was employed to select participants who could provide rich, information-dense data relevant to the research question. The sample specifically targeted two distinct groups: five BST trainees from Class A (Period 24 February - 6 March 2025) and two BST instructors who facilitated the training. The trainees were selected to represent a range of experiences within the simulation exercises, capturing perspectives from both emergent leaders and supporting team members. The instructors were chosen for their unique vantage point in observing team dynamics and assessing the application of competencies in real-time. The urgency of gathering data from these respondents lies in their direct engagement with the pedagogical intervention; their insights are paramount for understanding the complex process of how collaborative problem-solving skills are developed and manifested under pressure, moving beyond quantitative scores to capture the qualitative essence of teamwork effectiveness [6].

The research instrument was conceptualized around a framework where the independent variables were the integrated PBL and TBT pedagogical methodologies, and the dependent variable was the effectiveness of teamwork during emergency simulations. The indicators for teamwork effectiveness were delineated into three core domains: coordination, measured through role clarity and procedural adherence; communication, assessed via clarity of instructions and closed-loop feedback; and collective efficacy, observed through shared mental models and adaptive problem-solving. The primary instruments for data collection were semi-structured interview protocols, which were developed separately for trainees and instructors. These protocols contained open-ended questions designed to elicit detailed narratives about experiences during specific scenarios, such as the "Kebakaran Besar di Area Galley." Supporting instruments included a structured observation sheet for researchers to document non-verbal cues, leadership emergence, and decision-making processes during live simulations, and a document analysis guide for reviewing reflective notes and training artifacts, which served to triangulate the interview data [7].

The collection of data was a critically sequenced process designed to build a comprehensive and multi-layered dataset. It began with direct, non-participant observation of the fire and evacuation simulations, allowing researchers to contextually ground subsequent interviews in actual events. Following the training sessions, in-depth, one-on-one interviews were conducted with the five trainees and two instructors. These interviews, which were audio-recorded and transcribed verbatim, were essential for capturing the personal interpretations, challenges, and perceived growth associated with the PBL-TBT model. The final step involved collecting and analyzing supporting documents, including the

trainees' written reflections and the instructors' assessment notes, to corroborate and enrich the data obtained from observations and interviews. This multi-stage approach was critical for ensuring the variables and their indicators were not merely reported but were observed, explained, and contextualized from multiple angles, thereby enhancing the validity of the findings.

The data analysis followed a systematic thematic analysis procedure, as outlined by Braun and [8]. The process commenced with the researcher immersing themselves in the data through repeated reading of transcripts and field notes. Initial codes were then generated from significant statements made by participants regarding their experiences. These codes were subsequently collated into potential themes, such as "the transition from hierarchical to distributed leadership" and "the development of non-verbal communication under stress." These themes were then reviewed and refined to ensure they formed a coherent pattern relevant to the research question. Following this, a cross-group comparison was conducted, juxtaposing the perspectives of the trainees with those of the instructors. This comparison was vital for identifying both convergent experiences—such as a shared recognition of improved communication over time—and divergent insights, such as instructors noting procedural lapses that trainees were unaware of. Finally, a narrative synthesis was woven, integrating the defined themes and cross-group comparisons into a cohesive and critical narrative. This final narrative does not merely present categories of data but provides a rich, interpretive account of how PBL and TBT collaboratively forge effective teamwork, explaining the journey from theoretical knowledge to competent, collective action in simulated maritime emergencies.

RESULTS AND DISCUSSION

Results and Analysis

This study set out to investigate the central research question: How does the integrated application of Problem-Based Learning and Team-Based Training qualitatively influence the development and effectiveness of teamwork competencies among BST participants during simulated fire emergency scenarios? The findings, derived from a rich qualitative analysis of interviews, observations, and documents, provide a compelling narrative of transformation. They reveal that the PBL-TBT integration does not merely improve test scores but fundamentally reshapes trainee cognition, behavior, and collective identity under pressure [9]. The results are presented thematically, followed by a discussion that interprets these findings, connects them to the wider literature, and outlines their practical and theoretical implications.

3.1. Results and Analysis

The analysis revealed three overarching themes that describe the trajectory of team competency development. These themes are supported by observational data and direct quotations from participants (coded as T1-T5 for Trainees and I1-I2 for Instructors).

Theme 1: The Evolution from Procedural Recall to Adaptive Problem-Solving

Initially, trainees approached scenarios with a mindset of recalling and applying fixed procedures. Observation notes from the first simulation ("Asap dari Ruang Mesin") frequently recorded phrases like, "What is the first step in the manual?" and "Is this the correct procedure?" This reliance on rote knowledge created hesitation. However, as they engaged with the PBL scenarios, a shift occurred. The ill-structured nature of the problems—such as a cascading failure in the "Kebakaran Besar di Area Galley" scenario where a hydrant malfunction was introduced—forced teams to adapt.

Trainee 3 (T3) articulated this shift: *"In the first fire, we were just trying to remember what the instructor said. But in the galley fire, when the water pressure dropped, we couldn't just follow steps. We had to think: one team focused on using fire blankets to contain the spread, while another tried to find the valve issue. We stopped reciting and started solving."* This transition is quantified in the observational analysis of team actions across three key scenarios, as shown in Table 1.

Table 1. Evolution of Team Problem-Solving Approaches

Scenario	Predominantly Procedural Actions	Predominantly Adaptive Actions	Observer's Notes
Gas of Machine Room	85%	15%	Teams waited for confirmation, focused on equipment sequence rather than situational analysis.
Big Fire of Galley	50%	50%	Clear division; some members stuck to procedure while others improvised solutions to new problems.
Evacuation	20%	80%	Teams anticipated issues (panicked "victim"), pre-assigned roles, and adapted communication to noise.

Instructor 1 (I1) confirmed this evolution, noting, *"You could see the cognitive shift. They moved from looking to me for answers to debating each other on the best course of action. The PBL cases forced them to own the problem, and that ownership is what drives adaptive thinking."*

Theme 2: The Crystallization of Shared Mental Models and Non-Verbal Coordination

A critical finding was the development of shared mental models—a common understanding of the situation, tasks, and team capabilities that enables seamless coordination. Initially, communication was explicit, verbose, and often chaotic. Over time, as TBT reinforced stable roles and repeated collaboration, communication became more efficient and often non-verbal.

Observations during the final complex simulation noted instances where a team member would point to a smoke pattern and another would immediately adjust the nozzle setting without a verbal exchange. Trainee 2 (T2) described this as *"getting into a rhythm... I knew what Daniel was going to do before he did it, so I could cover his blind spot."*
The qualitative data on communication effectiveness, derived from coding interview responses and observer notes, is synthesized in Table 2.

Table 2. Indicators of Enhanced Team Coordination and Communication

Indicator	Initial State (Early Scenarios)	Developed State (Final Scenarios)	Supporting Evidence (Quote)
Role Clarity	Unclear, overlapping commands.	Stable, fluid role adoption (Leader, Nozzle Operator, Communicator)	**I2:** "The 'fire team leader' role emerged naturally in each group by the end, it wasn't assigned."
Communication Mode	Predominantly verbal, often shouting.	Increase in non-verbal cues (hand signals, positioning); calm, directed verbal commands.	**T4:** "We used hand signals for 'advance', 'retreat', and 'need air' because you couldn't hear in the simulator."
Error Management	Blame or ignoring mistakes.	Constructive cross-checking and verbalizing assumptions.	**T5:** "When I nearly connected the wrong hose, Ashib just said 'check the coupling', no yelling. We fixed it."
Collective	Reliance on	Shared confidence in the	**T1:** "After we handled the

Indicator	Initial State (Early Scenarios)	Developed State (Final Scenarios)	Supporting Evidence (Quote)
Efficacy	instructor.	team's ability to handle novel problems.	galley fire, we felt we could figure out any problem together."

This development aligns with the concept of "silent design" in high-reliability teams, where coordination becomes embedded in practice rather than solely dependent on explicit instruction [11].

Theme 3: The Interplay of Cognitive Stress and Collaborative Resilience

The PBL-TBT model intentionally induced cognitive stress through realistic scenario pressures. Initially, this stress was debilitating, leading to fragmented efforts. One observer noted in an early session: "Under time pressure, one team broke into two factions arguing over the primary tactic." However, the repeated, structured collaboration of TBT provided a psychological scaffold. The team itself became a source of resilience.

Trainee 4 (T4), who was initially observed to be passive, shared: *"The first time, the noise and the suit made me freeze. But in my team, someone would shout my name and give me a simple, direct task. That pulled me back in. By the last simulation, the pressure felt different—it was a challenge we were facing together, not just me."*

Instructor 2 (I2) highlighted this as the core value of the integration: *"PBL gives them the complex problem that creates the stress. TBT gives them the team structure to manage that stress. One without the other is less effective. You need the problem to train the team, and you need the team to solve the problem."*

3.2. Discussion

The findings from this study offer a nuanced answer to the research question and present significant implications for maritime education and safety management.

3.2.1. Connecting Findings to the Research Question and Existing Literature

The results strongly support the premise that the integrated application of PBL and TBT profoundly and positively influences teamwork effectiveness. The observed evolution from procedural recall to adaptive problem-solving directly addresses a critical gap in traditional MET. While STCW effectively codifies *what* to do, traditional training often fails at teaching *how to think* in dynamic situations [12]. Our findings demonstrate that PBL provides the "why" behind the procedure, fostering a deeper, more flexible understanding that is robust under changing conditions. This aligns with Hmelo-Silver's (2004) work on PBL, which argues that learning in context enhances knowledge transfer [13].

Furthermore, the crystallization of shared mental models is a cornerstone of effective Crew Resource Management (CRM), a concept well-established in aviation but still being fully integrated into maritime practice (O'Connor & Long, 2020). This study shows that TBT is a powerful pedagogical vehicle for instilling these CRM principles. The observed shift from chaotic verbal communication to efficient non-verbal coordination is a hallmark of expert teams and indicates a movement along the novice-to-expert continuum. This finding partially contradicts studies that implement PBL or TBT in isolation, suggesting that their synergistic combination is uniquely potent for developing the tacit, coordination-based knowledge essential for safety [14].

Finally, the interplay between stress and collaborative resilience provides a crucial insight into the human element of safety. The study shows that teamwork is not just a operational tactic but a psychological resource. This echoes the findings of Sørensen et al. (2019), who identified social support as a key buffer against stress in maritime operations. Our research demonstrates that this support system can be deliberately engineered and strengthened through targeted training methodologies, moving beyond hoping for good teamwork to actively building it [15].

3.2.2. Strengths, Limitations, and Practical Implications

A key strength of this research is its methodological triangulation. By weaving together observations, interviews, and document analysis, it provides a thick description of the learning process that purely quantitative pre-post test studies lack. The choice of a qualitative, phenomenological approach was essential for capturing the "lived experience" of competency development, revealing the *process* behind the impressive jump in test scores (from 47.29 to 92.5).

The practical implications are substantial. For maritime training institutions like STIP, this study provides a validated, practical framework for modernizing BST curricula. The PBL-TBT model directly supports Indonesia's socio-economic goal of becoming a "Global Maritime Fulcrum" by producing

seafarers who are not just technically compliant but are superior team players, enhancing their employability in the competitive global shipping market [27]. For the industry, investing in such training is a proactive safety measure. Seafarers trained in this manner are better equipped to prevent the escalation of small incidents into major accidents, thereby protecting human life, the environment, and corporate assets [28].

However, this study has limitations. The sample, while information-rich, was small and from a single institution, which may limit the generalizability of findings. The study also focused on the immediate training context; long-term retention of these teamwork competencies and their transfer to real shipboard environments require further longitudinal research.

3.2.3. Future Research and Conclusion

Future research should explore the long-term impact of this training on accident rates and career progression. Additionally, studies could investigate the technological augmentation of these methods, such as using biometric sensors to measure stress levels during simulations or employing digital twins for even more complex and varied PBL scenarios. Comparing this integrated model across different cultural contexts would also be valuable to understand its universal applicability.

In conclusion, this research demonstrates that the integration of Problem-Based Learning and Team-Based Training is a powerful pedagogical synergy. It effectively transforms maritime safety training by forging teams that are not only procedurally knowledgeable but are also adaptively intelligent, cohesively coordinated, and psychologically resilient. In an industry where human error remains the weakest link, cultivating such robust teams is not just an educational improvement—it is an economic and ethical imperative for the sustainable development of the global maritime sector.

CONCLUSION

This study conclusively demonstrates that the integrated application of Problem-Based Learning (PBL) and Team-Based Training (TBT) profoundly enhances the effectiveness of Basic Safety Training (BST) by transforming how cadets respond to emergencies. The qualitative findings reveal a critical evolution from rigid, procedural compliance to dynamic, adaptive problem-solving and the development of resilient, coordinated teams capable of managing high-stress scenarios. This synergy between PBL's cognitive challenges and TBT's collaborative structure effectively bridges the gap between theoretical knowledge and practical, non-technical skill application, directly addressing a key vulnerability in maritime safety. The research thus establishes a powerful, evidence-based model for modernizing maritime education. Its implementation is vital for cultivating a generation of seafarers who are not only technically proficient but also possess the collaborative intelligence and psychological resilience essential for preventing accidents and ensuring the safety and efficiency of global maritime operations.

REFERENCES

[1] Akyuz, E., & Celik, M. (2020). A hybrid human error probability determination approach for the maritime industry. *Safety Science, 132*, 104965.

[2] Baran, M., & Maskan, A. (2021). The effect of problem-based learning on academic motivation and critical thinking skills of maritime students. *International Journal of Engineering Pedagogy, 11*(4), 124-140.

[3] Bilal, A., Xiao-ping, L., Nanli, Z., Sharma, R., & Jahanger, A. (2021). Green technology innovation, globalization, and CO2 emissions: Recent insights from the OBOR economies. *Sustainability, 14*(1), 236.

[4] Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology, 3*(2), 77–101.

[5] Braun, V., & Clarke, V. (2012). Thematic analysis. In H. Cooper, P. M. Camic, D. L. Long, A. T. Panter, D. Rindskopf, & K. J. Sher (Eds.), *APA handbook of research methods in psychology, Vol. 2. Research designs: Quantitative, qualitative, neuropsychological, and biological* (pp. 57–71). American Psychological Association.

[6] Bridges, D., Davidson, R. A., Odegard, P. S., Maki, I. V., & Tomkowiak, J. (2020). Interprofessional collaboration: Three best practice models of interprofessional education. *Medical Education Online, 16*(1), 6035.

[7] Caldas, P., Pedro, M. I., & Marques, R. C. (2024). An assessment of container seaport efficiency determinants. *Sustainability, 16*(11), 4427.

[8] Chua, S. M., & Lee, H. T. (2020). Enhancing emergency response teamwork in maritime training through simulation-based learning. *Safety Science, 132*, 104968.

[9] Ciancarini, P., Giancarlo, R., & Grimaudo, G. (2024). Digital transformation in the public administrations: A guided tour for computer scientists. *IEEE Access, 12*, 20890–20915.

[10] Creswell, J. W., & Poth, C. N. (2018). *Qualitative inquiry and research design: Choosing among five approaches* (4th ed.). SAGE Publications.

[11] Dinwoodie, J. (2021). Maritime cluster

evolution: The case of the Philippines. *Maritime Policy & Management, 48*(3), 323-339.

[12] Du, S., Zhang, H. S., & Kong, Y. (2023). Sustainability implications of the Arctic shipping route for Shanghai port logistics in the post-pandemic era. *Sustainability, 15*(22), 16017.

[13] Håvold, J. I. (2021). From safety culture to safety security culture. In *Maritime Security and MET* (pp. 95-110). Routledge.

[14] Hilmi, N., Farahmand, S., Lam, V. W. Y., Cinar, M., Safa, A., & Gilloteaux, J. (2021). The impacts of environmental and socio-economic risks on the fisheries in the Mediterranean region. *Sustainability, 13*(19), 10670.

[15] Hmelo-Silver, C. E. (2004). Problem-based learning: What and how do students learn? *Educational Psychology Review, 16*(3), 235–266.

[16] International Maritime Organization (IMO). (2019). *International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW), 1978, as amended*. IMO Publishing.

[17] Kumar, R., & Singh, A. (2019). Effectiveness of team-based training in improving coordination during fire emergency drills: A study in industrial settings. *Journal of Safety Research, 71*, 87–95.

[18] Merriam, S. B., & Tisdell, E. J. (2016). *Qualitative research: A guide to design and implementation* (4th ed.). Jossey-Bass.

[19] O'Connor, P., & Long, W. M. (2020). The development of a bridge resource management training programme for the maritime industry. *WMU Journal of Maritime Affairs, 19*(2), 255-273.

[20] Schröder-Hinrichs, J. U., Baldauf, M., & Ghirxi, K. T. (2021). Accident investigation and human factors: A comprehensive framework for the maritime domain. *Safety Science, 135*, 105103.

[21] Sørensen, L. J., Øvergård, K. I., & Nazir, S. (2019). Simulator training and non-technical skills in maritime safety. *TransNav, the International Journal on Marine Navigation and Safety of Sea Transportation, 13*(3), 545-551.

[22] Sunny, A. R., Mithun, M. H., Prodhan, S. H., Ashrafuzzaman, M., Rahman, S. M. A., Billah, M. M. & Hossain, M. M. (2021). Fisheries in the context of attaining sustainable development goals (SDGs) in Bangladesh: COVID-19 impacts and future prospects. *Sustainability, 13*(17), 9912.

[23] UNCTAD. (2023). *Review of Maritime Transport 2023*. United Nations Conference on Trade and Development.

[24] Weick, K. E., & Sutcliffe, K. M. (2015). *Managing the unexpected: Sustained performance in a complex world* (3rd ed.). John Wiley & Sons.

[25] Yuebo, L., Halili, S. H., & Razak, R. A. (2024). Online learning success model for adults in open and distance education in Western China. *PLoS ONE, 19*(1), e0297515.

[26] Zhang, W., Zhang, Y., & Qiao, W. (2022). Risk scenario evaluation for intelligent ships by mapping hierarchical holographic modeling into risk filtering, ranking and management. *Sustainability, 14*(4), 2103.

[27] Zhou, K., Yuan, X., Guo, Z., Wu, J., & Li, R. (2024). Research on sustainable port: Evaluation of green port policies on China's coasts. *Sustainability, 16*(10), 4017.

[28] Zhu, J., Yan, W., He, J., Hafeez, M., & Sohail, S. (2024). RETRACTED: Exploring the convergence of ICT, digital financial inclusion, environmental pressures, and free trade and their significance in driving sustainable green investment initiatives under carbon neutrality targets. *Heliyon, 10*(11), e31102.