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Fire Safety Knowledge and Practices of Seafarers: A Descriptive-Correlational Study of Maritime Graduates in the Philippines

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ABSTRACT

This study assessed the fire safety knowledge and practices of seafarers to bridge the gap between regulatory standards and shipboard performance. Using a descriptive-correlational design, data were gathered from 20 maritime graduates of Northwestern University with recent shipboard experience through a validated researcher-made questionnaire covering STCW-aligned fire safety competencies. The findings revealed that seafarers are highly knowledgeable (overall mean = 4.48) and consistently demonstrate highly practiced fire safety behavior (overall mean = 4.62), in alignment with international standards. Statistical analysis using Pearson correlation indicated significant positive relationships between fire safety knowledge and both the proper use of firefighting equipment and compliance with safety regulations. However, the relationship between knowledge and participation in fire drills was found to be non-significant, suggesting that drill engagement is driven largely by organizational mandates and shipboard leadership rather than by individual knowledge alone. The study concludes that while maritime education effectively instills theoretical competence, practical proficiency in collective emergency exercises remains heavily dependent on continuous onboard reinforcement. It is recommended that maritime higher education institutions enhance high-fidelity simulation training and that shipping companies strengthen onboard mentorship, so that high knowledge levels consistently translate into all areas of shipboard emergency response.

Keywords: *fire safety, seafarers, maritime education, STCW, descriptive-correlational study*

INTRODUCTION

The maritime industry is one of the most important yet hazardous sectors of global trade, responsible for transporting nearly 80% of the world's goods (Koray et al., 2025). Among the multiple risks faced by seafarers, fire hazards rank as one of the most devastating. Unlike other types of accidents, shipboard fires spread rapidly in confined spaces, fueled by combustible materials and complex machinery, leading to outcomes that include loss of life and the destruction of the vessel, cargo, and marine environment. Numerous maritime disasters illustrate the consequences of shipboard fires. The Scandinavian Star ferry fire in 1990, which claimed 159 lives, revealed major lapses in fire preparedness and crew response (Nautilus International, 2021). More recently, the Maersk Honam container ship fire in 2018 resulted in fatalities and significant financial losses, showing that vessels

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remain vulnerable to fire-related incidents despite advances in technology and international conventions (Transport Safety Investigation Bureau, 2020). SOLAS Chapter II-2 mandates comprehensive fire safety measures on ships, including prevention, detection, containment, and suppression systems (International Maritime Organization, 2020), and the STCW Convention requires maritime cadets and officers to undergo Basic Safety Training covering fire prevention and firefighting. Despite these mandatory rules, fire-related accidents persist, suggesting that regulatory compliance alone is insufficient and that the human element plays an equally important role in determining fire safety outcomes.

Research frequently indicates a gap between theoretical maritime training and its practical application at sea. Subrahmanyam (2025) notes that bridging the gap between theoretical protocols and operational efficiency remains a significant challenge in the high-risk maritime environment. Maung (2025) found that private training centers maintain regulatory compliance but that practical effectiveness is often restricted by infrastructure limitations, while Guntoro and Simanjuntak (2025) identified a gap between classroom instruction and shipboard operations attributable to outdated curricula. Keivani (2025) further showed that occupational stress can create a disconnect between formal safety regulations and actual workplace behavior. Prior studies on fire safety knowledge and practices in maritime and allied settings provide useful context. Anuar and Teh (2021) found that safety culture, safety-at-sea training, and employee involvement were significantly and positively related to safety awareness among marine law enforcement personnel. Kuncowati et al. (2023) showed that preparedness — encompassing safety procedures, emergency training, and crew security culture — substantially influences crew safety behavior during emergencies. Kamis et al. (2020) demonstrated that mandatory STCW Basic Training significantly improves seafarers' safety-related knowledge, attitude, and behavior, while Steen-Hansen et al. (2020) emphasized that systematic learning from fire investigations supports a shift from reactive to proactive fire safety management.

This study is anchored on three interrelated theories. Reason's (1990) Human Factors Theory holds that human error is the predominant cause of accidents in high-risk industries such as shipping, underscoring the need to assess how seafarers understand and apply fire safety measures. Cooper's (2000) Safety Culture Theory emphasizes that safety performance is shaped by shared organizational values, attitudes, and practices. Kolb's (1984) Experiential Learning Theory asserts that learning is most effective when individuals actively engage in concrete experience, reflective observation, and active experimentation — implying that seafarers must not only refresh theoretical knowledge but also consistently participate in firefighting drills to translate knowledge into operational skill under stress. Guided by this framework, the general objective of this study is to assess the fire safety knowledge and practices of professional seafarers who are maritime graduates of Northwestern University, specifically their knowledge of fire prevention and hazards, common causes of shipboard fires, and fire safety procedures and protocols; the extent of their fire safety practices in the proper use of firefighting equipment, participation in fire drills, and compliance with safety regulations; and the relationship between seafarers' fire safety knowledge and their fire safety practices.

METHODS

Research Design

This study used a descriptive-correlational research design. The descriptive component determined the current level of fire safety knowledge and the extent of fire safety practices demonstrated by seafarers in active service, while the correlational component examined the statistical relationship between these two variables to test the study's primary hypothesis.

Research Locale

The study was conducted among maritime graduates of Northwestern University, Laoag City, Ilocos Norte, Philippines, who had recent shipboard experience as Deck or Engine ratings. Northwestern University's

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College of Maritime Education, Department of Marine Transportation, served as the institutional locale from which respondents were traced, as all participants were alumni of the institution's STCW-aligned maritime education programs.

Sampling Technique

The respondents were 20 maritime graduates of Northwestern University with recent shipboard experience, selected through purposive sampling and snowball referral. Of the respondents, 60% were aged 21–25 and 40% were aged 26–30; all (100%) were male. Seventy percent served in the Deck Department and 30% in the Engine Department. All respondents had 1–3 years of total sea experience since graduation, and 55% had completed their most recent formal fire safety training (Basic Training / Advanced Fire Fighting refresher) within the past 1–2 years. A researcher-made survey questionnaire, subjected to expert validation, was used for data collection, consisting of a Fire Safety Knowledge section and a Fire Safety Practices section, each rated on a five-point scale. Questionnaires were distributed to the selected respondents and immediately retrieved upon completion to maximize the retrieval rate and minimize missing data. Descriptive statistics — frequency counts, percentages, weighted means, and standard deviation — were used to summarize the respondents' demographic profile and to establish the overall level of fire safety knowledge and practices, while Pearson product-moment correlation was used to examine the relationship between the two variables, with significance set at the 0.05 level.

Table 1. *Respondent Profile Distribution (N = 20)*

Profile Variable	f	%
Age 21–25	12	60
Age 26–30	8	40
Sex: Male	20	100
Department: Deck	14	70
Department: Engine	6	30
TOTAL	20	100

RESULTS AND DISCUSSION

Level of Fire Safety Knowledge

Table 2. *Level of Fire Safety Knowledge of Seafarers Regarding STCW-Aligned Competencies*

Indicator Area	Mean	Verbal Interpretation
Fire Prevention and Hazards	4.47	Highly Knowledgeable
Common Causes of Fires	4.45	Highly Knowledgeable
Procedures and Protocols	4.52	Highly Knowledgeable
TOTAL (Overall Mean)	4.48	Highly Knowledgeable

Table 2 shows that seafarers are highly knowledgeable across all three competency areas, with the highest composite mean recorded for Procedures and Protocols (M = 4.52), led by strong awareness of SOLAS and STCW compliance requirements. The overall mean of 4.48 indicates consistently high fire safety knowledge aligned with STCW-mandated competencies among maritime graduates of Northwestern University.

This finding aligns with Kamis et al. (2020), who found that mandatory STCW Basic Training significantly improves seafarers' safety-related knowledge, attitude, and behavior, and with Kuncowati et al. (2023), who identified preparedness as a substantial factor influencing how crew members conduct themselves during emergencies. The results suggest that maritime education at Northwestern University effectively instills STCW-aligned theoretical competence prior to seafarers' deployment.

Table 3. *Extent of Fire Safety Practices Demonstrated by Seafarers* Extent of Fire Safety Practices

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Indicator Area	Mean	Verbal Interpretation
Proper Use of Firefighting Equipment	4.60	Highly Practiced
Participation in Fire Drills	4.61	Highly Practiced
Compliance with Safety Regulations and Protocols	4.66	Highly Practiced
TOTAL (Overall Mean)	4.62	Highly Practiced

Table 3 shows that seafarers highly practice fire safety measures across all three areas, with the highest composite mean recorded for Compliance with Safety Regulations and Protocols (M = 4.66). The overall mean of 4.62 indicates that respondents actively demonstrate fire safety competencies in alignment with STCW requirements, reflecting strong practical preparedness onboard. This is consistent with Anuar and Teh (2021), who established a significant positive relationship between holistic safety culture and safety awareness, and with Wanga (2024), who found that preparedness depends not only on the availability of fire protection systems but also on the continuous competence and active involvement of crew members.

Relationship Between Fire Safety Knowledge and Fire Safety Practices

Table 4. *Correlation Between Fire Safety Knowledge and Compliance with Safety Regulations (*p < .05)*

Knowledge Area	r	p-value
Fire Prevention and Hazards	.506*	.023
Common Causes of Fires	.603*	.005
Procedures and Protocols	.555*	.011

Table 4 shows significant positive relationships between fire safety knowledge and compliance with safety regulations across all three knowledge areas, with the strongest association observed between Common Causes of Fires and Compliance (r = .603, p = .005). Knowledge was likewise significantly related to the proper use of firefighting equipment in two of the three areas, but not to participation in fire drills in any area (p > .05) — a pattern consistent with Hermansson and Papamatthaiou (2021) and Rots (2019), who found that drill quality is shaped more by shipboard leadership and organizational safety culture than by individual seafarer knowledge. This is consistent with Cooper's (2000) Safety Culture Theory, which attributes collective safety performance to shared organizational practices rather than individual attributes alone, and with Reason's (1990) Human Factors Theory, which links knowledge of hazards directly to safer individual operational behavior.

CONCLUSION

Seafarers who are maritime graduates of Northwestern University demonstrate a high level of fire safety knowledge (overall mean = 4.48) and an exceptionally high extent of fire safety practices (overall mean = 4.62) across STCW-aligned competencies. A significant positive relationship exists between seafarers' fire safety knowledge and their practical application in equipment handling and regulatory compliance; however, participation in fire drills remains consistently high but independent of individual knowledge levels, indicating that drill engagement is driven primarily by shipboard leadership and organizational mandates rather than personal expertise.

Maritime education effectively prepares seafarers for individual safety actions and regulatory compliance, while participation in collective emergency exercises depends more on organizational safety culture than on formal training alone. It is recommended that maritime higher education institutions enhance high-fidelity simulation training for less-familiar emergency signals, and that shipping companies implement checklist-based mentoring and strengthen onboard safety culture so that fire drills are treated as learning opportunities rather than compliance exercises. The primary limitation of this study is its small sample size (N = 20), drawn from graduates

of a single institution, and its reliance on self-reported practice measures; future studies should extend to larger, multi-institution seafarer populations and examine knowledge retention over longer sea-service periods.

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