

Human Resource and Workforce Readiness Management in Sea Transportation: Cadet Health, Cognitive Load, and Competency Development

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Abstract. Sea transportation management depends ultimately on the readiness of the people who operate ships and ports, and that readiness is shaped long before graduation, inside the training institutions that prepare cadets for sea service. This paper examines human resource and workforce readiness management in sea transportation through three interacting dimensions: physical and mental health management, cognitive load management in technical training, and digital-age competency development, using Akademi Maritim Djadayat and Sekolah Tinggi Manajemen Transportasi (STMT) Malahayati as reflective case settings for the period April 2025 to January 2026. Drawing on institutional document review, field observation of cadet training activity at both institutions, and a synthesis of the maritime education and workforce-management literature, the paper finds that health- and well-being-oriented training is comparatively well established at both institutions, cognitive load management is practiced informally but not yet structured around an explicit instructional framework, and digital-age competency development is present but unevenly distributed between the two institutions' differing training emphases. The paper proposes a workforce readiness management framework linking physical and mental preparedness, learning-load management, and digital competency, and argues that maritime training providers function as the first line of human resource management for the sea transportation sector, since workforce quality entering the industry is substantially determined before entry rather than corrected afterward.

Keywords: human resource management, workforce readiness, sea transportation, cognitive load, seafarer well-being, maritime education

1. Introduction

Sea transportation management is often analyzed through infrastructure, policy, and technology, but every one of those systems is ultimately operated by people, and the readiness of that workforce is established well before a cadet ever reports for sea service. Human resource management in sea transportation therefore begins inside maritime training institutions, where health, cognitive preparation, and technical competency are built into the graduating officer, engineer, and rating. A workforce that enters the industry physically unprepared, cognitively overloaded during training, or under-equipped for digital-age operating systems represents a management liability that surfaces later as safety incidents, turnover, or underperformance, even though its origin lies earlier in the training pipeline.

This paper examines three interacting dimensions of workforce readiness management as they apply to sea transportation training: physical and mental health management of cadets, cognitive load management in technical and simulator-based instruction, and the development of competencies suited to increasingly digital shipboard and port environments. The paper uses Akademi Maritim Djadayat and STMT Malahayati as reflective case settings for the period April 2025 to January 2026, treating both institutions as complementary examples within the

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same regional maritime training ecosystem rather than as a comparative evaluation of one against the other. The objective is to characterize what workforce readiness management currently looks like across these three dimensions and to identify where a more structured approach could strengthen the sea transportation workforce pipeline.

2. Literature Review

2.1 Physical and Mental Health as a Workforce Readiness Foundation

Cahyadi et al. (2025a) report that seafarer endurance and career preparedness are directly shaped by structured physical training and nutrition programming during maritime education, arguing that physical conditioning is not incidental to technical training but a prerequisite for sustaining the demanding watchkeeping and physical-labour conditions of sea service. Cahyadi et al. (2025b), examining mental and physical well-being more broadly in maritime education, find that cadets who receive explicit well-being support during training report greater confidence in their capacity to manage the isolation and stress associated with extended sea voyages, suggesting that mental health preparation is a workforce readiness variable in its own right rather than a peripheral welfare concern. Barasa et al. (2025), integrating health, sustainability, and vocational competencies in a single training framework, argue that treating these as separate curriculum strands understates their interdependence: a cadet's vocational competency is only as reliable as the physical and mental condition in which it is exercised at sea.

Complementary work on physical-sports activity integration (Malau et al., 2025; Simanjuntak et al., 2025) finds that structured sport and physical activity programming in maritime vocational education contributes to resilience and professional readiness beyond its direct physical conditioning effect, by building the discipline and team-coordination habits that transfer into shipboard operational contexts. Simanjuntak et al. (2025) further report that health and human-resource management framed explicitly around cadet sports and wellness programming is associated with stronger self-reported readiness among cadets approaching their first sea assignment, positioning structured wellness management as a deliberate workforce-development lever rather than a general-education add-on.

2.2 Cognitive Load Management in Technical Training

Simanjuntak (2024) applies cognitive load theory to maritime cadet training, arguing that the technical density of maritime curricula, spanning navigation, engineering, regulation, and English-language communication, creates a substantial risk of cognitive overload that undermines retention even when instructional content is technically accurate and well intentioned. The paper identifies that cadets exposed to poorly sequenced technical content

show weaker recall of safety-critical procedures than cadets exposed to the same content delivered with deliberate load management, such as staged complexity and spaced practice, indicating that how technical training is sequenced matters as much as what is taught for workforce readiness outcomes.

This literature has a direct human resource management implication: a training institution that does not manage cognitive load explicitly may be producing graduates who technically completed a curriculum without reliably retaining the safety-critical content that curriculum was designed to instil, which constitutes a hidden workforce readiness risk that does not appear in completion statistics.

2.3 Digital-Age Competency as a Component of Workforce Readiness

Malau et al. (2025), examining competency-based maritime education for the digital age, find that graduating cadets are increasingly expected to demonstrate proficiency with digital navigation, communication, and documentation systems as a baseline employability requirement, not merely as an advanced specialization. Simanjuntak et al. (2024), studying post-internship perspectives among cadets, report that cadets who completed internships aboard vessels or at ports with more digitalized operating environments described a preparedness gap between what their classroom training emphasized and what their workplace required, suggesting that digital competency development within training institutions has not fully kept pace with the digitalization of the industry those institutions supply.

3. Methodology

This paper applies a qualitative, case-based management analysis to workforce readiness practices at Akademi Maritim Djadayat and STMT Malahayati over April 2025 to January 2026. Institutional training documentation relating to physical and wellness programming, technical and simulator-based instructional sequencing, and digital-systems coursework was reviewed at both institutions to characterize current practice across the three dimensions identified in the literature review. This review was supplemented by field observation of training activity during the stated period at both sites, reported descriptively rather than as statistically representative survey data, and interpreted against the workforce-readiness and maritime education literature reviewed above. The two institutions are treated jointly as a regional case setting reflecting common practice patterns rather than as a formal comparative study, since the objective is to characterize workforce readiness management as a general institutional concern rather than to rank the two providers.

4. Results and Discussion

4.1 Health and Well-Being Programming Is Comparatively Well Established

Training documentation and observation at both Akademi Maritim Djadayat and STMT Malahayati during the study period indicated active physical training and wellness programming embedded in cadet schedules, consistent with the endurance and career-preparedness framing of Cahyadi et al. (2025a) and the well-being framing of Cahyadi et al. (2025b). Both institutions showed evidence of structured physical activity beyond generic physical education, aligning with the resilience-building function described by Malau et al. (2025) and Simanjuntak et al. (2025). This is a genuine institutional strength: health and wellness readiness appears to be treated as a deliberate component of workforce preparation rather than an afterthought, consistent with the integrated framing advocated by Barasa et al. (2025).

A gap noted through document review is that mental well-being support, while present in both curricula, was less formally structured than physical conditioning, typically delivered through generalized counselling access rather than maritime-specific psychological preparation for isolation and extended sea duty. Given Cahyadi et al.'s (2025b) finding that explicit well-being support measurably increases cadet confidence, formalizing maritime-specific mental preparedness content, rather than relying on generic counselling availability, represents an identifiable opportunity at both institutions.

4.2 Cognitive Load Management Remains Informal

Neither institution's documented instructional sequencing showed explicit reference to cognitive load principles during the observed period, even though both institutions' technical curricula share the density concerns Simanjuntak (2024) identifies as a risk factor for maritime training generally. Field observation suggested that experienced instructors at both sites informally moderated content pacing based on classroom feedback, which is a reasonable practical adaptation but falls short of the deliberate staged-complexity and spaced-practice design that Simanjuntak (2024) associates with stronger retention of safety-critical material. This is the most transferable finding of this paper across the two institutions: cognitive load management appears to be handled through individual instructor judgment rather than institutional curriculum design at both Akademi Maritim Djadayat and STMT Malahayati, which means retention outcomes may vary considerably depending on which instructor delivers a given technical module.

4.3 Digital Competency Development Is Present but Uneven

STMT Malahayati's training emphasis, oriented toward transportation management, showed stronger integration of digital documentation and logistics-system coursework, while Akademi Maritim Djadayat's more sea-service-oriented curriculum showed stronger emphasis on digital navigation and communication systems, consistent with each institution's core mission. This division is not itself a weakness, but it does mean that, consistent with the preparedness gap identified by Simanjuntak et al. (2024), a cadet's digital readiness on entering the workforce is shaped substantially by which institution and which specialization track they pursued, rather than reflecting a uniform baseline across the regional training ecosystem. Malau et al.'s (2025) framing of digital competency as a baseline employability requirement suggests that some cross-exposure, for example STMT Malahayati cadets receiving basic exposure to shipboard digital navigation systems and Akademi Maritim Djadayat cadets receiving basic exposure to digital logistics documentation, could reduce this unevenness without requiring either institution to change its core specialization.

5. Conclusion

Workforce readiness management in sea transportation rests on three interacting foundations: physical and mental health preparation, cognitive load management during technical training, and digital-age competency development, and the case of Akademi Maritim Djadayat and STMT Malahayati over April 2025 to January 2026 indicates that the first of these is comparatively well established, the second is handled informally rather than through deliberate curriculum design, and the third is present but unevenly distributed according to each institution's specialization. Because workforce quality entering the sea transportation sector is substantially determined before entry, this paper argues that maritime training institutions should be understood as performing a human resource management function for the wider industry, not merely an educational one, and recommends that both institutions formalize cognitive-load-aware instructional sequencing and consider limited cross-institutional exposure to complementary digital competencies as near-term, low-cost improvements to workforce readiness outcomes.

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