Chapter 4
Conceptualizing a Novel Generative Maritime Learning Management System: G-Maritime

Vedat Dogancan
https://orcid.org/0009-0009-0534-5693
Department of Maritime Transportation & Management Engineering, Istanbul Technical University, Istanbul, Turkey

Kadir Cicek
Department of Marine Engineering, Istanbul Technical University, Istanbul, Turkey & Industrial Data Analytics and Decision Support Systems Center, Azerbaijan State University of Economics (UNEC), Baku, Azerbaijan

Metin Celik
https://orcid.org/0000-0003-0107-1380
Department of Basic Science, Istanbul Technical University, Istanbul, Turkey & Industrial Data Analytics and Decision Support Systems Center, Azerbaijan State University of Economics (UNEC), Baku, Azerbaijan

ABSTRACT

The maritime industry is undergoing a transformation process along with the sustainable development goals. In this cycle, continuous maritime skill transition has become essential to ensure that seafarers and shore-based professionals remain future-ready. It is clearly stated that conventional training solutions are no longer sufficient in developing the maritime workforce. This book chapter introduces G-Maritime as

DOI: 10.4018/979-8-3373-7057-6.ch004

a novel Learning Management System (LMS) founded on Large Language Models (LLM). Conceptualizing the G-Maritime LMS, a retrieval-augmented generation (RAG) system supported with a maritime-specific LLM is provided. Moreover, the system is guided by well-established instructional design techniques (SJT, ADDIE, Bloom) that maximize the benefits of AI integration into learning and assessment environment. Therefore, G-Maritime is fundamentally capable of delivering personalized learning and assessments. In addition to conceptual proposal, the study addresses probable challenges such as compliance, certification, and accessibility. A pilot implementation roadmap is also proposed to test the system. The study offers a valuable insight for trainers, policymakers, industry professionals, and investors seeking to understand and support maritime skill transition with generative LMS solutions. By integrating domain-specific AI capabilities with personalized content delivery, G-Maritime LMS represents a scalable model for future maritime learning ecosystems. G-Maritime has potential to become an accelerator for human-centred digital transformation in global shipping.

1. INTRODUCTION

The maritime industry is undergoing a profound transformation. It has driven by rapid technological advancements, environmental sustainability imperatives, and changing operational demands (Yi, Jung, & Lee, 2025). The growing complexity of maritime systems, increased regulatory requirements, and the global shortage of qualified maritime professionals demand more efficient and innovative learning solutions. The traditional approaches often fall short in addressing the dynamic needs of maritime professionals. There is a need for advanced and effective solutions to support workforce development in an era of rapid digital and green transformation. For instance, the comprehensive review of the STCW Convention, initiated by the IMO, clearly highlights the growing need to redefine and expand the competencies required for future seafarers (IMO, Report of the Working Group, 2024). The upcoming STCW'2026 amendments will also introduce new competencies that require innovative training modules. Furthermore, the requirements of the third-party inspection regimes (i.e. SIRE 2.0, TMSA 3, Rightship) highly requires an adaptable and skill-oriented learning framework. The third-part requirements with very high compliance expectations will drive a human-centric approach in the near future. At this insight, it is necessary to align competency acquisition and assessment methods with these changing requirements. It ensures the readiness and adaptability of maritime workforce.

Ensuring human competence is vital for ensuring safety, resilience and reliability aspects of sustainable maritime transportation industry. STCW-based formal assess-