Training and assessment research on maritime simulation in Norway

Simulators are often used in Maritime Education and Training (MET) to provide opportunities for seafarers to acquire technical, procedural, and operational skills while avoiding both the risks and the expense that accompany on-the-job training. The Centre of Excellence in Maritime Simulator Training and Assessment (COAST), led by Professor Salman Nazir from the University of South-Eastern Norway, employs research-based methods in its role as a leading provider of simulator training and assessment methods for maritime education.

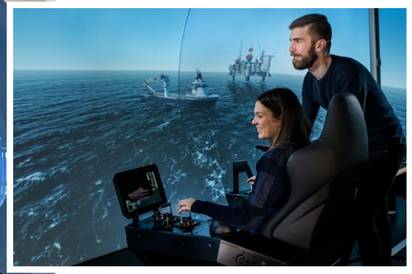
The Centre of Excellence in Maritime Simulator Training and Assessment (COAST) in Norway is a leading provider of simulator training and assessment methods for maritime education. COAST is a consortium of four Norwegian maritime education partners – the University of South-Eastern Norway (the host institution), Western Norway University of Applied Sciences, Norwegian University of Science and Technology, and UiT The Arctic University of Norway. The Centre, led by Professor Salman Nazir from the University of South-Eastern Norway, investigates research-based methods and focuses on both technical and non-technical skills. COAST is advancing knowledge and solutions on assessment methods whilst educating future seafarers to cope with current and future challenges in the maritime industry.

Furthermore, COAST is fulfilling the need for empirical research to investigate what happens during simulator-based learning, and to explain how students and instructors interact and channel both knowledge and experiences for training and assessment.

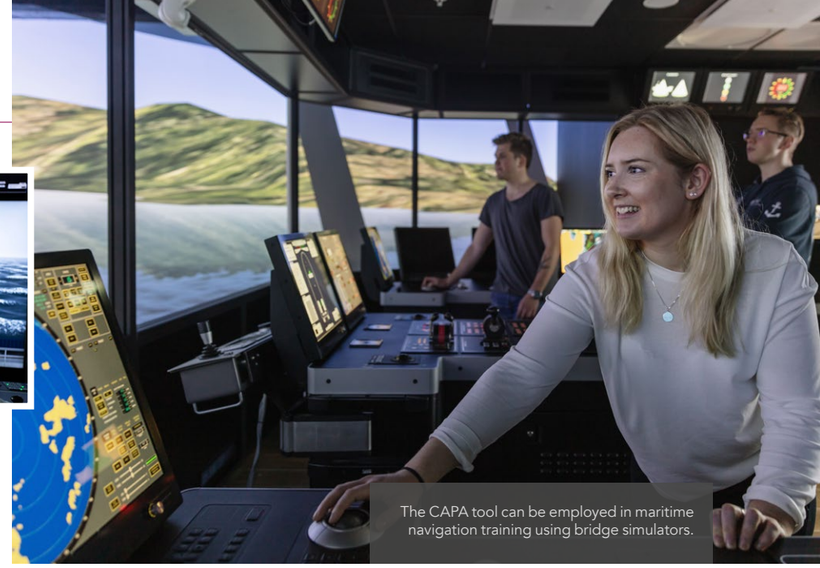
SIMULATION FIDELITY AND STUDENT SELF-EFFICACY

Since the 1960s, simulators have been used extensively as training tools that mirror real-life scenarios. Originating within the healthcare domain, the use of simulators has spread to all other safety-critical domains due to their effectiveness in training. Simulators are often used in Maritime Education and Training (MET) to provide opportunities for seafarers to acquire technical, procedural, and operational skills while avoiding the risks and the expense that accompany on-the-job training. It has been inferred that computer-generated simulations and those simulators with higher realism are likely to produce better training outcomes than traditional training methods.

A simulator's 'fidelity' is the extent to which it can replicate the experience of a real work environment. Advances in simulation technology mean that the maritime industry must adapt to higher fidelity simulators. Simulator cost, however, generally increases with improved fidelity, so practical and economic constraints must also be considered. COAST researchers have examined the effect of simulation fidelity on students' self-efficacy (belief in their own ability) in a comparison study of two types of engine room simulator training: the lower fidelity simulation training using a desktop computer, and the higher fidelity training employing immersive virtual reality (VR). The research team observed a group of marine engineering students performing tasks using both simulators. Exit interviews were carried out to elicit the students' self-efficacy levels and their perceived skill development with each of the different simulators. Analysis of the results revealed that students experienced higher motivation with immersive training simulators. They also preferred this VR training mode over the traditional training method (Renganayagalu et al, 2019).



Simulators can help seafarers to acquire technical skills while avoiding the risks and expenses that accompany on-the-job training.



The CAPA tool can be employed in maritime navigation training using bridge simulators.

DISTRIBUTED SITUATIONAL AWARENESS

Chemical, nuclear, and transportation industries are made up of many nested sub-systems where effectual coordination and communication are essential to ensure that continuous operations are carried out safely. It is essential that each operator working within these subsystems has an accurate understanding of what is going on. In terms of the human factors involved, situation awareness describes the operator's level of awareness of the situation that they are engaged in. Contrastingly, distributed situation awareness (DSA) takes a system perspective, shifting the focus of situation awareness away from individual operators on to the joint cognitive system made up of human and technological agents. DSA is a property of collaborative systems and inherent in the interaction between all elements of the system, not just the individual operators working in it.

Previous experimental studies carried out by the COAST researchers assess the effect of different training methods on the performance and DSA of industrial operators. One study involves a comparison of conventional training with a traditional classroom PowerPoint presentation with advanced training in a 3D virtual-reality immersive environment. The research team found that participants maintained DSA and were able to perform better when trained in 3D virtual environment as opposed to the traditional training methods. Their investigation also supports the need for the inclusion of DSA in the training of industrial operators to cultivate safety management. This study can be valuable for research in the maritime domain as well as the process industry as both are complex sociotechnical systems.

EMERGING DIGITAL TECHNOLOGIES

The maritime industry is experiencing a wave of automation. Digital technologies, including virtual reality (VR) and augmented reality (AR), are transforming education and training practices. In his role as the Head of the Training and Assessment Research Group (TARG), Nazir, together with the TARG researchers, discuss how maritime training and certification practices will have to be revised and adapted in line with technological advancements and market demands. Emerging digital technologies in simulation are becoming more evident in MET which promises to deliver more immersive learning environments that will facilitate trainees in developing suitable digital and information processing skills.

Skill acquisition is a particularly promising applications of VR. Within the contexts of professional skill and safety training, the TARG research team is investigating how VR can be used for training cognitive skills, including spatial memory, procedural skills, and psychomotor skills. VR is a good alternative when on-the-job training is impossible or unsafe. Moreover, affordable, easy-to-use head-mounted display systems offer immersive, experiential learning with new training and learning opportunities.

VARIATIONS IN MARITIME SIMULATOR TRAINING ACROSS EUROPE

Across the globe, maritime institutions have adopted simulator training to make their training more efficient while at the same time reducing cost. The International Maritime Organization (IMO) has published its guidelines for the model course in an attempt to promote uniformity in simulator-based training for maritime operations. Institutions implementing this training, however, have to accept the constraints that accompany the resources available to them and apply them accordingly. Subsequently, variations can exist among different institutions' simulator training courses. The research team has performed a comparative study exploring the variations in the design of courses provided by European full mission simulator training

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institutions. An extensive review of the literature was carried out to establish the relevant performance indicators. Then semi-structured interviews were carried out with representatives from the participating institutions. Analysis of the interview transcripts revealed that while some simulator training appears to be standardised, with comparable procedures and comprehension of the IMO's model course, the implementation of these courses is open to interpretation and varies according to each institution's available infrastructure. The researchers found that these disparities pose a challenge to standardised training (Nazir et al, 2019).

VARIATIONS IN METHODS AND STATE-OF-THE-ART TOOLS

With approximately 1.6 million seafarers across the world (Mallam et al, 2019) and the demand for highly skilled seafarers and officers still growing, the need for effective and efficient education and training has never been greater. The researchers have observed the variation in methods and state-of-the-art tools employed in maritime simulator training in different institutions. They also note how new, highly automated ship operations require highly technical seafaring skills. It is, therefore, likely that even more continual development and training will be required both during mariners' formal education and throughout their career. With the variety of ships, such as manned, unmanned, shore-side control, semi-autonomous and fully autonomous ships, sharing waters, different competencies and skill sets will require continual development. Adopting these technologies provides new opportunities for maritime education and training facilities, as well as for simulator and technology companies together with shipping companies, to provide optimised MET programmes and tools to support operators for increasing their operational efficiency both on land and at sea.

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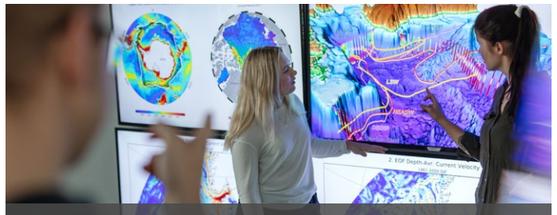
The researchers warn, however, that employing complex simulations with increased fidelity and additional technology does not necessarily correlate with improved trainee performance and advised that providers investigate their suitability prior to deployment. Their studies have revealed that although innovative technologies provide new training possibilities, new features that can complicate tasks should not be introduced in the early stages of training without adequate investigation.

REDUCING SUBJECTIVE BIAS

Human assessors are often prone to assessment bias and research frequently recognises the need for human assessors to accomplish more consistent performance evaluations. TARG has been exploring different solutions to these issues from a maritime simulator training perspective. Jorgen Ernsten in his PhD, under the supervision of Professor Nazir, developed a computer-aided performance assessment (CAPA) tool to reduce instructors' subjective bias during the assessment of maritime simulator training. The CAPA tool can be employed in maritime navigation training using full-mission bridge simulators. It is particularly useful for assessing pilotage operations.

MOVING FORWARD

The research team believes that pedagogy should keep pace with advances in simulation technologies, such as VR, AR, and cloud simulations, to provide efficient training for future seafarers. Further research into the effective integration of modern technologies in maritime training with particular focus on pedagogical aspects, including self-directed learning, scaffolding and team training, will help alleviate both existing and future challenges. Nazir hopes that this research 'will unleash the potential of maritime researchers and at the same time raise the competence of maritime educators in Norway and beyond'.



New, highly automated ship operations require highly technical seafaring skills. Pedagogy needs to keep pace with these advances.

The main consortium of COAST.

Behind the Research

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Research Objectives

The Centre of Excellence in Maritime Simulator Training and Assessment (COAST), where Professor Nazir is the scientific leader, provides innovative simulator training and assessment methods for maritime education.

Detail

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Salman Nazir is a professor at the University of South-Eastern Norway, in the Department of Maritime Operations. He is the Head of Training and Assessment Research Group (TARG) as well as the Scientific Leader of the Centre of Excellence in Maritime Simulator Training and Assessment (COAST) in Norway.

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Personal Response

What initially prompted your interest in maritime simulator training?

"How humans perform in complex, demanding operations while interacting with the dynamic environment has fascinated me for several years – for instance, how people deal with dynamic information provided by agents (both human and machine) and how they make sense of continuously changing data to make the right decision. I started with operator training and performance assessment in the process industry and realised that maritime operations require similar skills and training, especially in terms of operator roles, such as seafarer and engine room operators. The maritime industry lays the groundwork for several other industries. Without optimal maritime operations, the global supply chain can be disrupted. Take, for example, the EverGiven container ship blocking the Suez Canal and causing a global shipping traffic jam that disrupted global trade. Thus, ensuring that seafarers are equipped with optimal skills (both technical and non-technical) via innovation in simulator training and performance assessment has been the motivation behind my work in this field."

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