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Examining the Effect of Full-Mission Simulation Training on the Safety and Education in the Maritime Sector

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ABSTRACT

Purpose: *This contemporary research assesses full-mission simulation as a training tool incorporated within the curriculum of the Arab Academy for Science, Technology and Maritime Transport with focus on operational safety and education aspects.*

Design/Approach/Methodology: *Using a structured SWOT approach in the research the internal strengths and weaknesses as well as external opportunities and threats related to the full mission tool are shown. The simulator is very effective in simulating the marine environment and providing trainees with practical exercises, however, there are problems such as high usage costs and the risk of overwhelming the trainees. This study seeks to mitigate this problem by proposed a concurrent use of virtual reality (VR) interoperability with full-mission simulator. This is expected to improve the quality of the training, cut down the training costs and increase the capability of developing different scenarios. Combining these systems in training and simulation proposes wide advantages including an efficient and logical program that ensures efficient outcomes.*

Findings: *From the study VR integration is the way forward in addressing the challenges faced currently and helping the Academy remain on top of maritime education and training development.*

Key-words:
Simulation based training , AASTAT. Marine full-mission simulator , SWOT analysis , Using V.R virtual realty in marine training , The role of Augmented realty A.R in ships maintenance training.

INTRODUCTION

Real ships equipment is the most efficient way to teach maintenance and the operation of ship electrical and automation systems. It is a pre-requisite according to the convention for the proper maintenance and operation of these systems, or at least raising of the existing need. Hence, the need to equip seafarers, such as the onboard electro-technical officers and the marine engineers, with the state of art modern marine equipment and automation systems, is impressive (Hontvedt, 2015). Such bodies are advocated by categorization of primary bodies of which helps inboard teaching. Inasmuch as marine electro-technical systems tend to dominate the non-distracted operations, there is never sufficient time to carry out the virtual absentees of sea electrical systems and make their demoralizing (Zinchenko et al., 2019).

The simulator system fully reproduces the working modes of ships and carries out engineer actions for the automated equipment and systems on ships. It encompasses all-round training on the principles and practices of monitoring, control and management of mechatronic systems which include principal investigation of the parameters, their modification and depiction. Due to its very many functionalities, the simulator enables numerous operational, controllership, and managerial structures for the exercise of many functional failures being practiced. It accentuates the functional usage of automatic control systems under emergencies and drills relevant to watch-keeper's behavior for fault identification, problem finding, and equipment repair (Connolly, 2018).

In consequence, the full mission simulator complex (FMS), whose functional purpose is the professional training and the qualification testing of the marine specialists, in particular, the electro-technical officers and marine engineers, is completely in adherence to the requirements which are stipulated in the electrical and electronic sections as well as the Control Systems and competencies requirement for such professionals (Nosov et al., 2019). The simulator addresses the needs of practical training as well as the needs of the competence assurance system of engine room personnel. It mimics the actual working environment such that the trainees acquire and demonstrate maintenance and repair skills and perform satisfactorily in competence tests. The simulator creates managed working conditions including emergencies or operational events and makes it possible to reproduce numerous operational events (Zinchenko et al., 2020).

Inside the simulator, students operate a power plant and separate electromechanical plants both in automatic and manual modes. The operational parameters can be monitored using the actual manual controls or a computer workstation. In addition, the simulator has on-line access to the materials intended for teaching, learning and referential purposes (Rystedt et al., 2018).

Consequently, this paper attempts to support the case for the use of full mission simulators in the training of sea farers through an examination of the potential impact they have in relation to the development of the skills and abilities of electro-technical officers and marine engineers.

LITERATURE REVIEW

The present section reviews the existing literature explaining the importance of the use of training simulations supranational as applied specifically to seafarers through an application of full mission simulators. These studies are aimed at the effect of the use of these simulations by seafarers across various nations over the years. The literature reviewed extends within the period from 2017 to 2022.

Sanfilippo (2017) advances a comprehensive multi-sensor fusion system for the Offshore Simulator Centre AS. The main objective of this framework is to improve the risk management processes in the designing, execution and evaluation of sophisticated sea operations with the use of innovative risk-evaluation methods. Not only could the system obtain information from the simulator scene, but also from the subject matter which consists of audio, video, biometric data, and other sensor data. The current research highlights the role of briefing and debriefing in training, and the value of this study is in the incorporation of these activities into the suggested structure.

Sellberg (2017) uses 34 different articles from several journals for the evaluation of the application of simulators in maritime education and training. As a result of this review, it is possible to classify three fundamental spheres of research: education, human factors and maritime professions. The research underlines a lack of knowledge about the kind of instructional designs that lead to effective learning through simulations and suggests that further research is necessary to boost practice-based evidence.

Sellberg (2018) is concerned with training buildings simulation regarding all its phases. Such solution is implemented by Al-Tadawi B2 and Al-Bina real estate in Abu Dhabi.

Azzawi (2014) mentions that such possibilities are adequate for aiding education and training. The author, however, points out that these possibilities reflect the inherent potential of learners to make sense of connections between broadly defined ideas and more situational specific details, as it applies across all stages of training.

Sharma Ranak, Adam, and others (2018) classify the maritime occupations as among the most hazardous, so the authors see the need for operator preparation using simulator training. The research stresses the importance of developing instructional approaches that take into account the peculiarities of the structure and activities of the maritime industry and suggests computer supported collaborative learning to advance maritime education and training.

Hjelmervik et al. (2018) observe that people who, because of their training, undertake more complex problem solving in stages performed better than those who were introduced to complex problems too early in their training. The researchers doubt the assumption that new challenging features would not be incorporated within training simulators without the sufficient amount of research because technology and computer capacity enable this. Performance on complex tasks, however, improves when the interface is subsequently enhanced in terms of functional fidelity during the training.

Benedict et al. (2018) examine how fast time simulation can be used in the case of maritime training. It is concluded that this type of technology holds quite a promise for application in both shortings and de-briefings, as well as while teaching and learning maritime education. Different experiments carried out in various maritime centres of learning illustrate the benefits of using fast time simulation for simulator-based training enhancement.

Sellberg and Lundin (2018) explore simulators in maritime centers for training purposes, in particular, in terms of assisting in the training of navigation. The investigation makes it clear that instructional support during simulations is an evolving process of applying adequate judgment on the relevance of proposals to actual work. It was also explained how time relates to the improvement of students' learning experiences in the course of the simulation.

Pham (2019) regards simulation-based training as one of the most effective methods of enhancing the competencies of seafarers within the context of maritime education and training (MET). Nevertheless, the study points out that in the maritime industry, simulation-based training is quite often not taken to its full advantage, as it is poorly applied most of the time. Mallam and others (2019) explore the influence of technological development on maritime education and training, particularly looking at virtual, augmented, and mixed reality. The paper elaborates upon maturing haptic interaction technologies in HMD immersive environments for applications of MET and operations, which may act as disruptive marine simulator technology.

Nazir et al. (2019) assess the improvement of execution regarding the differences of maritime simulator within Europe through qualitative methods specifically semi structured interviews with various institutions. This study demonstrates the variability of training in the use of simulators even if the integration of simulator training within the curriculum is more or less the same due to some common appreciation and adoption of similar approaches within European institutions.

Markopoulos et al. (2019) write about the design and construction of virtual education technologies for the purposes of the training on marine safety. During this study, the designers of the system introduce for the first time a prototype of the Mar. VR training system intends for general use in a variety of naturally occurring settings such as office, training center and even onboard ship.

Yushan et al. (2020) conduct a qualitative multiple case study in which they study the extendable simulators in use at three firms. The study pointes to the inconsistency of the simulators used in research and the application of the models developed and claims that the simulator is the medium linking marine research institutions and industries.

Markopoulos and Luimula (2020) present a new virtual training system designated Immersive Safe Oceans Technology for the training of safety procedures in the maritime industry. Restoration of mariner competency is achieved by presenting four new training episodes which illustrate professional usage of this technology in implementing training of maritime personnel where virtual reality applications played an important role.

Liu et al. (2020) develop the use of a head-mounted display for human factors evaluations and an LNG firefighting VR simulator for training. The study concludes that the (VR) environment is suitable for training since the trainees are able to experience stress and concentrate as they would.

Wahl (2020) tries to understand when and where the learning takes place in the computer-based simulation training, computer-supported collaborative work. It is observed that the quality and fidelity of training is affected by trainer-trainee interaction, task characteristics and simulator technology.

Ernstsen and Nazir (2020) scrutinize the validity and reliability of a computer-aided performance assessment (CAPA) tool in the marine pilotage industry. It is found that CAPA is far more reliable than normal evaluation of technical competencies in the evaluation of training and evaluation methods.

Senčila et al. (2020) evaluate the possibilities to use Full Mission Bridge simulation for investigations of safe passage conditions with regard to different seaport constructions. The simulations are stressed as crucial components in promoting safe and navigable waters even when complicated seaport development procedures are being undertaken.

Lee and Duffy (2021) carry out a systematic literature review of sailing, aviation, underwater, and ground transportation simulator applications. It is evident that simulator-based learning is critical in the training of a crew and in the prevention of accidents, but it was important to point out that not enough attention is paid to using simulation for land-based transportation.

Pan et al. (2021) adopt actor-network theory in the context of training curriculum and utilization of simulators in training institutions, offshore entities and along sea coast line authorities. The study claims that the distribution of students, professors and industry utilizes the self-network formed by the marine industry usage of simulators.

Voloshynov et al. (2021) present analytical evaluation of the most common and effective practices of VR simulator application in the education process of future sailors. The study provides a summary of advancement of VR technology for use in professional competency development of the marine workforce and the possibilities of virtual education courses in maritime learning.

Aronsson et al. (2021) study simulator fidelity regarding the time critical, distracted and dynamic nature of an operational scenario as viewed from an activity theory lens. There are gaps between the intended training and its real application; this raises the concern of designing training programs that are well structured and have training objectives that can be evaluated and attained.

Kim et al. (2021) and others also address the changes brought by COVID-19 pandemic into the simulators-based trainings and education for the maritime sector. A SWOT analysis of the challenges provides useful recommendations on action steps that MET stakeholders can take to mitigate existing challenges and enhance better strategies in future.

Belev et al. (2021) investigate the relationship between the current shortcomings of the available maritime training and the prospects of maritime industries' evolution. The study urges the use of tactical perspectives and alternative methods of instruction in training sea industry practitioners in anticipation to their change.

Mansuy et al. (2021) conduct a qualitative study of real-time ship maneuvering simulators during nautical studies design. The study distinguishes the real-time simulation (simulations conducted in an actual timeframe) from fast time simulation focusing on pros and cons of dealing with both methods.

Hjellvik and Mallam (2021) review a trend that emerges in the maritime sector which is the use of cloud-based simulation of maritime activities, which is fully software based as compared to the onboard simulation equipment. The study ascertains the role of student self-efficacy in predicting the outcome of training in cloud-based simulation environments.

Jamil and Bhuiyan (2021) study the various deep learning elements embedded in maritime simulation programs. The study sheds light on the relationship between deep learning tasks and the effectiveness of focused maritime simulation training and how things should be done differently in the future.

De Oliveira et al. (2022) undertake a systematic peer-review on the keystones of maritime simulators and identified 36 sources. The perspective of the study makes a distinction between physical and functional fidelity and observes that there may be further subjective judgment in high-fidelity simulators and that this may lead to negative training effects.

Chan et al. (2022) investigate the level of situational awareness of junior officers during navigational bridge watching using a bridge watch simulator. The study notes that most of the respondents are not familiar with the system when there are faults and thus, more training on situational awareness is necessary.

Weissenberger (2022) assesses the practice of VR simulators in the education of Norwegian Coastal Administration pilot services. The findings of the study are that the VR simulators are found to be engaging and effective as they enhance user immersion and scenario-based training for marine pilots.

During Covid-19 pandemic, Bhuiyan and Sohal (2022) review the merit of simulation-based training in a cloud environment. Their study points out some of the difficulties related to the use of cloud simulation such as the need for instructor training, access to speedy and reliable internet and creating virtual learning space.

Rakka (2022) examines the use of cloud-based simulators in Indonesian Maju Marine Education and Training in the times of COVID pandemic. This study reveals that cloud simulators are gaining considerable popularity as an alternative method in MET institutions.

Hwang and Youn's research (2022) looks at the use of simulation training for remote operators of autonomous ships. The study argues that, to teach the trainees effectively, different scenarios of navigation should be developed, suggesting ways to create bulk and pertinent scenarios using registered movements of actual vessels.

RESEARCH METHODOLOGY

At this stage a SWOT analysis is utilized to assess the efficacy of the training simulators used at the Arab Academy for Science Technology and Maritime Transport. SWOT is an abbreviation denoting Internal vat Structural Organ Echo and its External Structural Organ Echo to be undertaken for all levels of disparity of a system. A SWOT analysis helps find out the internal and external opportunities, weaknesses, threats, and strengths of the brand or any topic.

Such analysis in relation to marketing strategies has undergone a number of mutations both on the theoretical and practical levels. In a clear manner, a SWOT analysis helps to assess the internal and external factors of a business or project, and classifies them as Strengths, Weaknesses, Opportunities, and Threats. SWOT helps in initiating the internal strengths and weaknesses and external opportunities and threats of the organization. In most product development processes, the dependency and creed of arranging the four quadrants of SWOT analysis is not easy irrespective of how simple a SWOT matrix appears to be. There is some literature on the evolution of the method SWOT.

They employ both a number of ways to enhance the sharing of ideas between different people and to organize the thinking process towards specific orders (Brad and Brad, 2015).

To conduct SWOT analysis qualitative research is needed and therefore focus group discussions are carried out. Five focus group discussions are conducted with 15 expert and seafarers who train students in the use of full mission simulator at the Arab Academy for Science, Technology and Maritime Transport and the subjects are asked on a full-mission simulator (the simulation that is made use of within the AASTMT). These focus group discussions consist of six questions, which may be categorized as follows:

How do you rate the training system of simulation in the AASTMT?

What are the advantages of full-mission simulation?

What are the disadvantages of full-mission simulation?

What is the case in favour of full-mission simulation?

What is the case against full-mission simulation?

What are the prospects for further development of the training simulation system at the Academy?

SWOT ANALYSIS

This section analyzes the collected data from the five focus groups for the aim of identifying the points of strengths, weaknesses, opportunities and threats of full-mission simulator. Accordingly, this section is divided into four sub-sections.

Strengths

The focus group yields various development strength points, which are being put up. The strength points discuss the need of this simulation since it is an effective tool of trainings where seafarers learn how to interact with all the necessary instruments inside the ship, undergo specialized training with new crafts and ship equipment as well as navigational areas. It also imparts physical and technical training to the trainees as well as assessment of how well they perform certain artistic tasks in the process of troubleshooting. The focus groups also mention Engine Room Simulator and the engine room department discipline training. All these concluding observations are put forward by the focus groups in the following ways.

Three-dimensional simulation of a ship and all its functional instruments and displays fully enclosed in the ship. Helping to gain experience with interactive representation and shipment of teamwork abilities for seamen. Understanding the neighborhood ship and its customers in relation to ships in the proximity and analyzing the weather scope. Takes care of most of the regulatory gaps and challenges to workplace learning principles since high level of fidelity is maintained. A practical categorization of functionalities for offering new crafts, ship equipment encouraging safe case scenarios for navigation only to specialists training only.

Useful device for assessing sailing risk during seaport construction or improvements. High degree of physical and behavioral fidelity. Provided a high level of functionality including real time computer simulation for training in navigation. Development of Engine Room Simulator is motivated with a goal of teaching, training, and assessment of the personnel from the Engine department. Core physical and technological knowledge. Employee tracking as well as measuring and reporting performance objectively. Assure the progress of activities as well as troubleshooting.

Weaknesses

Arguments against full-mission simulator usability are also analyzed through the focus groups. Two main weaknesses that took the stage are subjective elements such as the high costs, the high time consumption and the high energy materials consumption. These two aspects deal with the hardware aspect of the simulation. Weakness stems from such pain points:
It takes a long time and a lot of resources to make changes by adding new features.

Need a large and expensive hardware, hardware room and constantly manpower to utilize.

Effective segregation of individual outlooks and inputs with the aim of getting a complete picture of the ocean based on the ship movement.

A lot of attention is paid to the stimulating elements such as the external environment, stress and time.

Opportunities

Besides individual interviews, opportunities are defined through the focus group discussions. The opportunities refer to the capacity of this simulation to work together with other devices or simulations, e.g. virtual reality, dynamic selection, artificial intelligence and other devices which help in the training and collecting the trainees' data. Opportunities also mention the experience enhancement of how new or unexpected situation might be incorporated to measure the trainees' adaptation towards this situation. In the last one, attention is directed towards eye tracking. Opportunities that are derived from the focus groups are as follows:

Simulations on-board aid in the generation of scenarios.

Simulations on-board aid in evaluating the extent of skills and coordination the trainees will employ.
There is a possibility of interfacing this with more sophisticated technologies, virtual reality for instance.
Dynamic Selection is incorporated. This will enhance the understanding of students of credible facts about the other types of vessels and some additional ones.
There is a possibility of eye-tracking among learners.
There are opportunities to implement artificial intelligence.
Other training will involve interaction with electronic devices which helps learners understand the effectiveness of the trainees in their daily tasks.

Threats

The final feature to be pulled out from the SWOT analysis concerns the threats to the training system ability and the main weakness feature in any exercise simulation training system through the last couple of years must be conclusively the Corona Virus, where it brings to complete halt most of the simulation options that depend on land operations. Another factor that is equally critical is the constraining factor of economic resources, where full-simulation model is already going to incur huge amounts of costs, that absence in the economic resources could cause the simulation to halt. Focus groups also mention lack of technology resources, lack of information and trainees' credibility to act as a serious barrier to the implementation of the full-mission simulations. The following points are mentioned in the focus groups.

The challenge of using this simulation during the period of Covid 19.
The unavailability of financial resources that can provide for the use of the simulation.
Technological resources are limited.
There are limitations with the amount of information.
It will lose its validity for the students.
Evaluation of Deployment Activities of the Full-Mission Simulator and Augmented Reality Interactivity

Strengths and Opportunities

One of the most common verbs used to describe the full mission simulator is that it helps to reproduce the actual operational environment. As such, the trainees can obtain practical oriented expertise in a safe environment. Such qualifications can be enhanced because the simulator is combined with many other high technologies, such as VR.

When blended with the use of fully functional mission simulators, virtual reality offers an effective training platform that can portray emergency situations and complicated navigational as well as engine room activities with even a higher level of fidelity. This combination not only enhances the trainees' situational awareness, but rather helps in creating new techniques in training which were not possible earlier. For instance, VR may cause learners to perform unexpected actions outside the things being rehearsed in training, such as causing bad weather or equipment breakdown to see how well the trainees function under stress.

Weaknesses and Threats

Despite the strengths, the analysis also reveals closer weaknesses and threats regarding the pool of the full-mission simulator available on the market. Significant obstacles such as exorbitant costs, long lead times, and extensive resources needed for upkeep and modification exist. Such financial and operational requirements could curtail the number and range of training exercises that would be carried out, which in turn would affect the skills acquisition of the seafarers on a continuum basis.

A further major problem policy is that in some circumstances the learners can be crowded by the external factors like noise, limited time within the simulator, and the pressure of undertaking the drills, which do not entirely reflect the situation in real life. More so, the danger of not having enough money and lack of technology particularly spreading out to during the period of COVID 19 adds to the hurdles of embracing and sustaining the full mission simulator.

Table 1: SWOT Analysis of Full-Mission Simulator Implementation

Category	Details
Strengths	- High fidelity in simulating real-world scenarios. - Accurate replication of ship conditions and instrumentation. - Provides hands-on experience in a controlled environment. - Allows for advanced troubleshooting and technical training. - Supports specialized training in new crafts, ship equipment, and navigational areas. - High level of physical and behavioral realism.
Weaknesses	- High costs associated with maintenance and updates. - Significant resources required to operate and update the simulator. - Potential for overwhelming trainees with external distractions and stress. - Time-intensive process for adding new features.
Opportunities	- Integration with advanced technologies such as VR. - Development of new training modules using VR. - Enhanced situational awareness through immersive training. - Ability to simulate rare and complex scenarios. - Improved data collection and analysis through integrated systems.
Threats	- High financial and operational demands. - Economic constraints, especially during pandemics like COVID-19. - Technological limitations and reliance on outdated systems. - Loss of credibility if simulations do not adequately prepare trainees for real-world challenges.

Integration with Virtual Reality as a Strategic Response

Among these challenges, a more radical approach where virtual reality is integrated in the full-mission simulator as a way out is suggested. It saves physical facilities since training is real to a high degree, thus taking up less costs than in the physical resources. This model also provides the possibilities in overcoming unforeseen and rare scenarios, which in most times may be hard to achieve in the capabilities of traditional simulator systems.

Moreover, using VR helps address some of these operational issues by allowing learners to train in an environment that is less chaotic and overwhelming than real situations, where they are likely to get lots of disturbances and unnecessary pressure. Taking into account the use of VR, the Academy can upgrade the training programs, which will help seafarers navigate the ongoing shifts of seas better.

In conclusion, it is true that the full-mission simulator at the Arab Academy for Science, Technology and Maritime Transport Sports Sciences exhibits some clear advantages in the training of seafarers for real life, however, its integration with virtual reality is necessary to address the weaknesses and threats that have been identified. Such a union serves not only to improve the efficiency of the training offered, but also helps the Academy keep pace with the developing technologies in the field of maritime education and training.

Table 2: Impact of Integrating Virtual Reality with Full-Mission Simulator

Aspect	Impact
Cost-Effectiveness	- Reduces the need for extensive physical resources, potentially lowering operational costs. - Allows for more frequent updates and scenario development without significant financial investment.
Training Realism	- Enhances the realism of training by simulating immersive and interactive scenarios. - Allows for the introduction of unexpected variables, such as sudden weather changes or equipment failures.
Trainee Experience	- Provides a more controlled and focused training environment, reducing the likelihood of distractions and stress. - Enhances engagement and retention through immersive experiences.
Flexibility and Adaptability	- Offers greater flexibility in developing training scenarios, allowing for the simulation of a wider range of situations. - Enables the Academy to quickly adapt training programs to emerging maritime challenges and technologies.
Long-Term Sustainability	- Improves the sustainability of training programs by reducing reliance on costly physical updates. - Ensures that the Academy remains at the forefront of maritime education by continuously integrating cutting-edge technology.

CASE STUDIES

Simulation Training in Aviation

The aviation industry is known as one of the first industries to adopt simulation-based training, especially for the pilot. Full-flight cockpit simulators are needed as professional pilot training devices in which pilots can be taught to deal with different flight situations including contingency situations.

The aviation industry illustrates the specific regard associating high fidelity in training simulators for high-risk high stakes operations. These simulator hacks are regarded as helping to enhance the readiness and safety of airplane operating personnel. The achievements registered with aviation simulators can be replicated in maritime training regarding enhancing the sophistication and realism of maritime simulators.

Full-Mission Bridge Simulator for Port Development

The Full Mission Bridge Simulator is extensively used in the process of designing and constructing Klaipeda Seaport in Lithuania when it undergoes extension. The simulator is used for navigation safety evaluation and for the training of pilots and other personnel able to navigate the newly or altered port space.
This case study investigates the use of simulators in port expansion to prevent accidents whilst navigating through newly or altered channels. The facility to represent various kinds of vessels, states of weather and various emergencies is found very useful for avoidance of accidents and for maximization of activities in the port.

Using Virtual Reality in Training for Maritime Safety

According to the research by Markopoulos et al. (2019), Marine VR training system is designed to increase the maritime safety with VR technology. The system provides a VR-based development for training scenarios focusing on safety practices of maritime personnel like fire safety and evacuation of personnel on board.

The utilization of VR in maritime training is increasing and allows the development of environments that provide high levels of interaction with trainees. This enables the trainees to practice even in high-risk scenarios and the effect this would have on their performance in actual emergency situations.

Genre for Training Managers - Marine Engineering. Categories Inside – Engine Room Simulators

The Arab Academy for Science, Technology and Maritime Transport puts up an Engine Room Simulator for training purposes for the marine engineers. The trainee can engage themselves in the handling and servicing of ship's engine or engine room facilities and perform the other duties given the change in the weather and other environments.

In this sense, specific training with Engine Room Simulators appears to be essential for learning the practical aspect of a marine engineer from the technical point of view. They enable a practical learning approach in terms of daily operations, repair activities, and crises which help protect and optimize the vessel engineering systems.

The Role of Augmented Reality (AR) in Ships Maintenance Training

Application of augmented reality is implemented in a ship maintenance training center located in Europe. The use of AR headsets in AR training allows the use of real ship components as the interface during trainees' learning of complex maintenance procedures with the help of virtual guidance overlaid on to them.

This spoken information may prove invaluable for novices performing complex tasks and help bridge the gap between theoretical knowledge and practical application of delivering supporting training facets to trainees. This method enhances the efficiency and precision of the performance of the maintenance tasks and considerably decreases the probability of human errors.

Simulation based Training for Offshore Oil and Gas Operations

A special simulator for training personnel for offshore oil and gas operations is developed at the Offshore Simulator Center, Norway. The simulator models the offshore working environment and its inherent hazards with an emphasis on safety, emergency situations, and operational performance.

Special simulations as in offshore oil and gas would be instrumental in personnel preparing for oil and gas operations. Their importance in training cannot be overemphasized, especially on global practices where some risk is involved.

Virtual Simulation as a Tool for Maritime Education Throughout COVID-19 Pandemic

During COVID-19, several maritime training institutions move to cloud-based simulation systems to continue with the training despite the restrictions to physical gatherings. These systems enable the students to carry out simulations from a distance ensuring that they do not miss out on any aspects of their studies.

Spending time training on simulations is possible regardless of the reasons for a disruption of such as a pandemic because of cloud-simulation. Nevertheless, issues such as lower fidelity and presence of internet dependency need to be tackled if this way of training is to be rewarded 'sane instead of prohibitiveority.

Such case studies present the application and efficacy of simulation-based training in various facets of the maritime and other related enterprises and as such raise the level of safety, efficacy, and readiness for a particular environment.

CONCLUSION

In conclusion, the critical analysis of the full-mission simulator at the Arab Academy for Science, Technology, and Maritime Transport ascertains its significance to the training and preparation processes of seafarers regarding future maritime operations. Some of its virtues such as how realistic the situations are and the provision of real time simulations makes the simulator a very central device in maritime learning. However, the analysis also pinpoints internal qualities that represent serious weaknesses such as financial constraints, the requirements for excessive maintenance and the stress and distractions which might overwhelm the trainees.

To mitigate these issues and improve the training programs, the researchers find the combining of (VR) with the full-mission simulator parts as a viable option. VR does not only make training more realistic and engaging as regards train enacting the various scenarios, but also enables provision of economical, adaptable and innovative approaches to improving maritime training. The Academy can harness the complementary advantages of both technologies to augment operational sustainability whilst ensuring effective training preparedness that adequately equips seafarers to meet the actual environmental conditions.

To sum up, although the full-mission simulator will always be part of the maritime staff training strategy, it must be combined with VR technologies to lift that barrier which prevents the Academy from remaining at the very top of maritime education and training. As a result, the Academy will be able to develop innovative, impactful, and long-lasting training solutions, which would be of great importance in today's maritime industry.

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