INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY: APPLIED BUSINESS AND EDUCATION RESEARCH
2025, Vol. 6, No. 6, 2885 – 2898
http://dx.doi.org/10.11594/ijmaber.06.06.20

Research Article

Enhancing Simulation Training Through the Utilization of Transas Engine Room Simulator for Marine Engineering Students at CTU – Carmen

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Article history:
Submission 14 April 2025
Revised 31 May 2025
Accepted 23 June 2025

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ABSTRACT

This study explores the use of the TRANSAS Engine Room Simulator (ERS) to enhance simulation-based training for third-year Marine Engineering students at Cebu Technological University – Carmen Campus. It investigates how simulation technology bridges the gap between theoretical knowledge and practical skills in the maritime industry. The research specifically evaluates the ERS's effectiveness in skill development, considers the influence of students' socio-demographic profiles, and identifies areas for improvement in simulation training. A descriptive-comparative research design with a quantitative approach was used, involving surveys of third-year Marine Engineering students. Data collected included socio-demographic information, technological knowledge of key operations (e.g., generator synchronization, boiler firing sequence), and simulator handling skills. Findings show that the Engine Room Simulator (ERS) significantly improves student engagement, knowledge retention, and operational proficiency. However, gaps were identified in areas such as troubleshooting and data interpretation, suggesting the need for enhanced training modules. The results highlight the importance of integrating advanced simulation technologies into maritime education to support both theoretical learning and hands-on competence. The study recommends tailoring training modules to students' backgrounds, regularly updating simulator content, and incorporating targeted instruction in weaker skill areas. These improvements will help develop a more effective simulation training program, better preparing students for real-world challenges in the maritime industry.

Keywords: *Engine Room Simulator (ERS), simulation-based training, Marine Engineering education, TRANSAS ERS, skill development, technological knowledge*

How to cite:
Apor, M. D., Flores, J. G., & Chin, D. M. (2025). Enhancing Simulation Training Through the Utilization of Transas Engine Room Simulator for Marine Engineering Students at Ctu – Carmen. *International Journal of Multidisciplinary: Applied Business and Education Research*. *6*(6), 2885 – 2898. doi: 10.11594/ijmaber.06.06.20

Introduction

The growing complexity of contemporary marine engineering systems necessitates maritime students to acquire a solid theoretical foundation and practical experience in safe, controlled settings. Engine room simulators are also an essential training tool for marine engineers, as mandated by the STCW (Standards of Training, Certification, and Watchkeeping for Seafarers, as amended) (Shevchenko, 2017). These simulators are now more frequently integrated into maritime education and training programs, offering students valuable hands-on opportunities to develop the skills needed to manage advanced systems effectively in real-world scenarios. According to Ceylan et al., (2022), Engine room simulators that closely replicate real-world conditions and adhere to the standards set by the International Maritime Organization (IMO) are becoming increasingly important. The use of simulators, such as the Transas Engine Room Simulator, plays a pivotal role in bridging the gap between theoretical learning and practical application. As stated by Karahalil et al., (2024), simulation-based learning effectively links theoretical instruction with practical application by immersing trainees in lifelike scenarios within a safe and controlled setting.

The Transas Engine Room Simulator offers a virtual representation of a ship's engine room, allowing students to engage in realistic scenarios without the risks and costs associated with onboard training. It provides a foundational understanding of the operations and functions of machinery and equipment within a specific system onboard, offering hands-on experience in troubleshooting and resolving issues (Alimen and Pador, 2014). These simulators create a dynamic, interactive learning environment that helps students better understand the complexities of marine machinery, operational procedures, and safety protocols. The engine room simulator has significant potential to help seafarers acquire digital and other seafaring-related skills, preparing them to adapt to digitalization and technological progress (Zaini, 2020). This exposure allows them to make decisions, solve problems, and manage crises in a controlled and supervised setting. This experience is particularly valuable for marine engineering students approaching graduation, as they will soon be responsible for maintaining and operating complex machinery systems on ships.

Moreover, the study aims to evaluates the effectiveness of the TRANSAS Engine Room Simulator as an effective tool for enhancing the practical training experience of third-year marine engineering students. It will also explore how simulation training improves students' understanding of the interdependence of various systems within the engine room, which is essential for the safe and efficient operation of a vessel. By focusing on integration and assessment of simulation-based methods, the research aims to strengthen students' competence in key areas such as operational control, troubleshooting, and emergency response procedures.

Theoretical and Conceptual Framework

This section presents the different theories applied in conducting this investigation

Constructivist Learning Theory

Constructivist Learning Theory suggests that learning is most effective when it takes place within a context that is meaningful and relevant to the learner. Rather than being passive recipients of information, learners are actively engaged in the construction of knowledge. This approach encourages students to connect new information to their existing knowledge, experiences, and personal understanding, making learning more authentic and lasting. According to Efgivia et al. (2021), knowledge is not something that is simply transmitted from teacher to student; instead, it is actively built by the learner through interaction with their environment and the learning materials. Furthermore, Rullah and Zaini (2023) emphasize that learners form new understandings by drawing upon what they already know. This process involves reorganizing and expanding prior knowledge in light of new experiences. In essence, constructivism views learning as an ongoing, dynamic process in which learners continuously interpret and reinterpret their world, leading to deeper and more meaningful comprehension over time.

The Transas Engine Room Simulator offers a a learning environment that actively supports knowledge construction. In this context, students move beyond simply memorizing facts from textbooks; they actively engage in critical thinking, decision-making, problem-solving, and reflecting on their choices. These skills are essential for developing a deeper and more meaningful understanding of complex concepts. As Prakash Chand (2023) explains, knowledge is not an objective entity separate from the learner, but rather a subjective construction shaped by personal experiences and interpretations of reality. This process of active engagement allows learners to build their understanding step by step, based on real-time feedback from the simulation, fostering a deeper grasp of complex systems that they may not fully comprehend through traditional classroom instruction alone. By using the simulator, students are placed in realistic engine room environments where they can manipulate machinery, monitor performance metrics, troubleshoot issues, and respond to various operational challenges. As Kim et al. (2021) note, simulation technology offers trainees a safe and controlled environment in which they can effectively develop essential navigational skills and gain a deeper understanding of vessel behaviour under varying operational conditions. These experiences help cultivate essential competencies for future marine engineers, who must be prepared to manage the complex and high-pressure conditions encountered in actual engine rooms aboard ships.

Moreover, the Transas Engine Room Simulator not only facilitates experiential learning but also promotes metacognitive development by encouraging learners to reflect on their own thinking processes. This reflective practice is essential in constructivist learning, as it enables students to evaluate their strategies, recognize areas for improvement, and adjust their approaches based on observed outcomes. The learning occurs through the process of actively constructing knowledge in the mind, rather than passively receiving information. As Zajda (2021) emphasizes, knowledge and critical thinking develop through cognitive, cultural, emotional, and social engagement, driven by active participation. The simulator's realistic and immersive environment promotes this engagement, making learning both effective and meaningful. This process not only enhances conceptual understanding but also cultivates essential skills such as situational awareness, technical competence, and decision-making under pressure—all of which are crucial for future marine engineers who must navigate the complexities of onboard systems.

Experiential Learning Theory

Experiential Learning Theory (ELT) emphasizes the importance of learning through direct, active participation rather than passive absorption of information. This approach stands in sharp contrast to traditional educational methods, which often rely heavily on lectures and rote memorization. According to Wang et al. (2021), learners who are actively engaged in their education tend to develop a deeper understanding of concepts and retain knowledge more effectively. ELT provides a compelling framework for understanding how simulation-based training can significantly enhance both student learning and the development of practical skills.

In the context of maritime education, simulation-based training has emerged as an essential pedagogical tool, offering an interactive and immersive environment in which students can develop both cognitive and technical competencies. Maritime education is distinct in that it integrates theoretical instruction with practical, hands-on training—an approach that is crucial for ensuring the safety and efficiency of maritime operations (Abid et al., 2024). The Transas Engine Room Simulator plays a vital role by providing a realistic, immersive environment where students can operate engine systems, troubleshoot problems, and make decisions without the risks associated with real-world settings. This advanced simulation technology effectively bridges the gap between classroom theory and practical application.

Furthermore, the psychological engagement in simulation-based training is positively correlated with improved learning outcomes, Zhang et al. (2021). Simulation tools offer students an interactive platform to engage with complex engine room systems in a controlled, risk-free setting. Abeysiriwardhane et al.

(2021) highlight that experiential learning supports both knowledge acquisition and skills development, emphasizing the learner's active role in shaping their educational journey through direct engagement and reflection. This immersive experience not only enhances conceptual understanding but also strengthens technical proficiency by allowing students to interact directly with engine room equipment.

Theoretical Framework

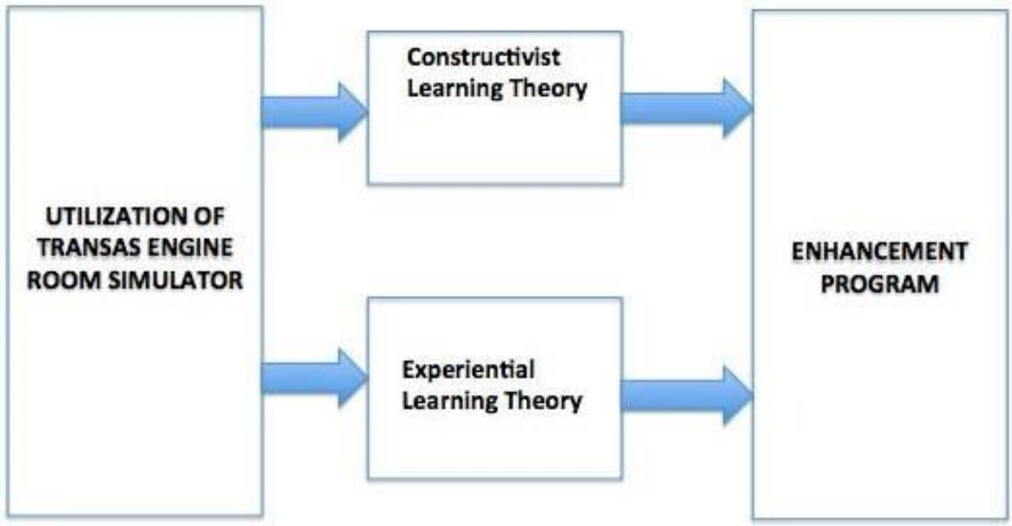

Figure 1. The theoretical framework of Utilization of Transas Engine Room Simulator

Research Objectives

The main purpose of this study is to determine the effectiveness of Engine Room Simulator on the skill development of Marine Engineering students at Cebu Technological University - Carmen Campus, College of Maritime Sciences.

Specifically, it seeks to answer the following specific inquiries:

1. What is the demographic profile of the respondents in terms of :
   a. Age
   b. Civil Status
   c. Technical training
   d. Socio-economic Status
2. Determine to what extent is the technological knowledge can be obtained from the respondents, as follows:
   a. Synchronization of generator
   b. Firing sequence of Boiler System
3. Determine to what extent the assessment of the engine simulator can be acquired by the respondents in terms of:
   a. capability and skills
   b. operating system
4. Based on the results of the study, what enhancement program can help assess whether simulation learning significantly influences the skill development of marine engineering students

Methods

Design

The descriptive-comparative research method was used in this study with a quantitative approach to examine the relationship between the use of an engine room simulator and the skill development of Marine Engineering students at Cebu Technological University-Carmen Campus, College of Maritime Sciences. The study aimed to explore the existing conditions, practices, and trends related to the use of simulation technology in maritime education. A survey questionnaire, tailored to address the specific needs of the research, was distributed to the students and validated for content accuracy. Data collected from the survey were analyzed to identify any significant relationships and differences between the use of engine room simulators and students' skill development, contributing to a comprehensive understanding of the impact of simulation on maritime training.

Respondents

The respondents of this study were 133 third-year marine students of Cebu Technological University located in Carmen, Cebu. The basis for the selection of the study was based on the Inclusion-Exclusion Criteria set:

The following are the inclusion parameters considered in this research:

1. Must be a bonafide students of third-year marine students of Cebu Technological
2. University-Carmen, Cebu Campus.
3. Must be a third –year marine students of Cebu Technological University
4. Must be of legal age
5. 4.Must be willing to participate
6. Must have provide voluntary consent.

Those who do not fall within the bounds of the inclusion criteria are deemed excluded from the conduct of this research. Simple random sampling was used by the researcher in the study.

Environment

The research study was conducted at Cebu Technological University - Carmen Campus (CTU), which serves as the primary setting for the research. Cebu Technological University - Carmen Campus was situated within the municipality of Carmen, which spanned an area of 84.78 square kilometers (approximately 32.73 square miles), representing 1.71% of the total land area of Cebu province. The relatively small size of the municipality, both in terms of land area and population, contributed to its accessibility, making it a practical choice for the researcher to gather data. The population and geographical characteristics of Carmen also provide context for understanding the local dynamics and the broader scope of the study.

Data Gathering Procedure

The primary researcher sought and obtained the approval of the Dean of the Graduate School of Engineering to conduct the study. After receiving endorsement for the research proposal, the proponents prepared a formal letter of permission, which was subsequently approved by Cebu Technological University – Carmen Campus. This authorization enabled the researchers to proceed with the data collection phase within the campus. To ensure the appropriateness and effectiveness of the instrument, the researcher conducted a content validity test. This involved soliciting feedback from field experts to assess the relevance, clarity, and comprehensiveness of the items. The results of the validity testing were then used to refine the tool before its full implementation.

Data gathering was carried out with the support and assistance of faculty members from the university to ensure smooth coordination and effective monitoring throughout the study. The researchers utilized a self-constructed research instrument specifically designed to address the inquiries and objectives set forth in the study. Following the data collection phase, the researchers proceeded with organizing and tabulating the data. A qualified statistician was engaged to assist in the statistical treatment and analysis to ensure the accuracy, reliability, and validity of the quantitative results. Various tables and graphs were generated and presented to clearly illustrate findings and provide visual support in addressing the study's specific sub-problems.

Data Analysis

The study utilized the following statistical treatments to analyze the gathered data: Simple frequency and percentage were employed to interpret the demographic profile of the respondents, which included information such as age, gender, year level, and other relevant characteristics. These descriptive statistics provided a clear overview of the composition of the participants involved in the research.

Furthermore, the weighted mean and standard deviation were used to assess and quantify the extent of the effectiveness of the Engine Room Simulator (ERS) in enhancing the skill development of marine engineering students at Cebu Technological University – Carmen Campus, College of Maritime Sciences. The weighted mean allowed the researchers to determine the general perception and level of agreement among respondents regarding the impact of the ERS, while the standard deviation provided insights into the variability or consistency of their responses. These statistical tools ensured a comprehensive and objective evaluation of the ERS as a learning tool in maritime education.

Scoring Procedure

Table 1. Study's Scoring Procedure and Interpretation

Scale	Range	Descriptive Equivalent	Interpretation Equivalent
5	(4.21- 5.0)	Strongly Agree	The Engine Room Simulator (ERS) demonstrates a high level of effectiveness in developing students' skills.
4	(3.41-4.20)	Agree	Engine Room Simulator (ERS) in enhancing the skill development is effective
3	(2.61-340)	Average	The Engine Room Simulator (ERS) has a neutral effect on skill development.
2	(1.81- 2.60)	Disagree	The Engine Room Simulator (ERS) is considered ineffective in facilitating skill development.
1	(1.0- 1.80)	Strongly Disagree	The Engine Room Simulator (ERS) does not effectively enhance skill development.

Ethical Considerations

Ethical principles were strictly observed throughout the study, especially during data collection. The researcher ensured social responsibility, non-discrimination, objectivity, and participant welfare. Informed consent was obtained after fully informing participants about the study's purpose, benefits, and their rights, including the option to withdraw at any time. The research upheld human rights by treating respondents with respect, maintaining confidentiality, and safeguarding their autonomy. No harmful interventions were introduced; data were collected using surveys and interviews administered fairly to all participants. The study was reviewed and approved by the University of Visayas Institutional Review Board, ensuring ethical compliance. Risks were minimal, limited to time commitment and confidentiality concerns, with benefits including increased participant awareness of the relationship between engine room simulators and skill development.

Results and Discussion

Table 2. Profile of the Respondents

	Frequency	Percent
Age		
20	55	41.4
21	61	45.9
22	8	6.0
23	7	5.3
24	1	0.8
26	1	0.8
Sex		
Male	133	100.0
Civil status		
Single	132	99.2
Married	1	0.8
Separated	0	0.0
Widowed	0	0.0

Table 2 shows the demographic profile of the respondents. The Marine Engineering students are predominantly young, male, and unmarried. Most participants are 21 years old, accounting for 45.9% (61 respondents), while those who are 20 years old make up 41.4% (55 respondents). The age categories of 24 and 26 had the least representation, with just 0.8% (1 individual) each. All participants are male, with 99.2% (132 participants) being single, only 0.8% (1 participant) categorized as married, and no participants being separated or widowed. This demographic profile indicates a uniform population trait among Marine Engineering students, which may influence the efficiency of the Transas Engine Room Simulator. Younger students tend to adjust to and engage with technology-enhanced training programs, as highlighted by Zhou et al. (2023), who observed the significant preference of younger groups for interactive educational settings.

Moreover, the consistency in civil status also suggests limited external family responsibilities, potentially allowing students to concentrate more on their education. Mendez et al. (2022) emphasized the significance of demographic elements such as age and marital status in developing and achieving effective simulation-based learning, stressing the importance of aligning training methods with the traits of the learners. Additionally, Tan et al. (2023) highlighted the role of demographics in influencing participation and time management in simulation training programs.

Table 3. Technological knowledge on Generator Synchronization

Synchronization Generator	Mean	Std. Deviation	Interpretation
The respondents have a thorough understanding of generator synchronization in power systems.	4.3	0.63	Strongly agree
The respondents are familiar with the various methods used for synchronizing generators in power systems.	4.35	0.62	Strongly agree
The respondents feel confident in their ability to explain the importance of generator synchronization for stable power supply	4.12	0.64	Agree
The respondents have practical experience in implementing generator synchronization techniques in simulated or real-world scenarios.	4.17	0.69	Agree
The respondents understand the implications of improper generator synchronization on equipment performance and grid stability.	4.25	0.62	Strongly agree
The respondents are capable of troubleshooting synchronization issues and making adjustments as needed.	4.08	0.7	Agree
The respondents believe that proper training in generator synchronization is essential for their future careers in the field of electrical engineering.	4.64	0.57	Strongly agree
The respondents perceive generator synchronization as a critical aspect of maintaining reliable electrical systems in various industries.	4.47	0.6	Strongly agree
The respondents are eager to expand their knowledge and skills in advanced generator synchronization techniques	4.5	0.6	Strongly agree
The respondents recognize the role of emerging technologies in improving the efficiency and accuracy of generator synchronization processes	4.51	0.61	Strongly agree
Overall mean	4.34		Strongly Agree

Legend:

Range	
4.21-5.00	Strongly Agree
3.41-4.20	Agree
2.61- 3.40	Average
1.81-2.60	Disagree
1.00-1.80	Strongly Disagree

Table 3 above indicates the Technological Knowledge on Generator Synchronization, emphasizes the views and skills of the respondents concerning generator synchronization. The highest average score of 4.64 corresponds to the statement, the respondents feel that adequate training in generator synchronization is vital for their future careers in electrical engineering, reflecting significant consensus on the necessity of this training for their professional growth. On the other hand, the lowest mean of 4.08 reflects respondents' general agreement that they are capable of troubleshooting synchronization issues, though it suggests a slight gap in confidence compared to other areas.

Furthermore, the overall mean result is 4.34, which denotes a "strongly agree" rating specific to the assessment of generator synchronization. It reflects a robust comprehension and valuation of generator synchronization, including theoretical concepts, real-world applications, and its importance for power systems. These results suggest that although students have a strong understanding of generator synchronization, there is potential for improvement in practical troubleshooting abilities, which can be enhanced through better hands-on training and simulations. According to Choi et al. (2023), integrating experiential learning strategies into the curriculum can significantly boost students' confidence and technical abilities. Additionally, Singh et al. (2022) highlight the importance of integrating emerging technologies to improve synchronization processes, which suggests that curriculum updates should include the latest technological tools and methods. Lee et al. (2022) further emphasize that well-structured training programs and simulation-based learning are essential in preparing students for real-world challenges, reinforcing the need for targeted simulation initiatives within the curriculum.

Table 4. Firing Sequence of Boiler System

Firing Sequence of Boiler System	Mean	Std. Deviation	Interpretation
The respondents demonstrate a clear understanding of the clear understanding of the sequential steps involved in the firing sequence of boiler systems.	4.11	0.68	Agree
The respondents possess practical experience in implementing the correct firing sequence for boiler systems in industrial settings.	4.11	0.69	Agree
The respondents feel confident in their ability to explain the significance of following a specific firing sequence for boiler systems.	4.03	0.7	Agree
The respondents are proficient in identifying and implementing the appropriate firing sequence for different types of boiler systems.	4.02	0.73	Agree
The respondents understand the potential consequences of deviating from the prescribed firing sequence and prioritize adherence to correct protocols.	4.22	0.74	Strongly agree

Firing Sequence of Boiler System	Mean	Std. Deviation	Interpretation
The respondents believe that knowledge of the firing sequence is essential for ensuring safety, efficiency, and longevity in boiler operations.	4.53	0.53	Strongly agree
The respondents perceive the firing sequence as a fundamental aspect of their training in mechanical engineering and boiler technology.	4.29	0.68	Strongly agree
The respondents are eager to deepen their understanding of advanced techniques for optimizing the firing sequence in boiler systems.	4.47	0.63	Strongly agree
The respondents recognize the importance of continuous improvement in their knowledge and skills related to boiler firing sequence for enhanced performance.	4.51	0.64	Strongly agree
The respondent's value ongoing professional development opportunities that enhance their proficiency in managing boiler systems and their firing sequences effectively	4.45	0.63	Strongly agree
Overall mean	4.27		Strongly Agree

Legend:

Range	
4.21-5.00	Strongly Agree
3.41-4.20	Agree
2.61- 3.40	Average
1.81-2.60	Disagree
1.00-1.80	Strongly Disagree

The table 4 highlights the perspectives and comprehension of the participants regarding the firing order of boiler systems. The highest mean score is 4.53, which corresponds to the statement, "The respondents believe that knowledge of the firing sequence is essential for ensuring safety, efficiency, and longevity in boiler operations." This indicates that respondents strongly agree with the critical importance of understanding the firing sequence for ensuring the safety and long-term performance of the boiler systems. The lowest mean score is 4.02, associated with the statement, "The respondents are proficient in identifying and implementing the appropriate firing sequence for different types of boiler systems." This suggests that while respondents generally agree with their proficiency in this area, it is slightly less emphasized than other aspects, such as safety or ongoing improvement.

Also, the overall mean score of 4.27 falls within the "strongly agree" range. The study implies that the respondents have a strong understanding of and confidence in their knowledge and practices related to boiler firing sequences. This suggests that they are well-trained, highly aware of the importance of following correct procedures, and committed to continuous improvement in this area. The results indicate that although students have a solid theoretical foundation and understand the importance of firing sequences, there is an opportunity to improve their practical skills through simulation or hands-on training. Addressing these gaps will improve students' preparedness for industry demands by linking theoretical knowledge with hands-on application. Singh et al. (2022) emphasize the significance of incorporating advanced simulation tools in engineering education to improve students' hands-on skills and comprehension of complex systems like boiler operations. Lee et al. (2023) highlight the importance of well-structured training programs for upholding safety and ef-

ficiency standards in mechanical systems. Similarly, Choi and Park (2022) advocate for continuous professional development and hands-on training to enhance technical abilities and effectiveness
.

Table 5. Capability and skills assessment of the engine stimulator

Capability and Skills	Mean	Std. Deviation	Interpretation
The respondents believe that the engine stimulator effectively assesses their practical skills in operating marine engines	4.68	0.57	Strongly agree
The respondents feel adequately challenged by the tasks presented on the Engine Stimulator, enhancing their capabilities over time	4.5	0.6	Strongly agree
The engine stimulator provides a realistic simulation of engine operations, allowing respondents to develop valuable hands-on skills	4.48	0.63	Strongly agree
The respondents feel that their proficiency in engine troubleshooting and maintenance has improved through regular use of the Engine Stimulator	4.42	0.67	Strongly agree
The Engine Stimulator effectively evaluates the respondents' ability to interpret engine performance data and make informed decisions	4.36	0.62	Strongly agree
The respondents perceive the Engine Stimulator as a valuable tool for honing their technical skills in engine control and optimization	4.44	0.64	Strongly agree
The Engine Stimulator offers diverse scenarios that test the respondents' adaptability and problem-solving abilities in engine-related tasks	4.46	0.68	Strongly agree
The respondents feel confident in their ability to apply theoretical knowledge to practical situations after using the Engine Stimulator.	4.44	0.69	Strongly agree
The Engine Stimulator enhances the respondents' understanding of complex engine systems and their interdependencies	4.43	0.69	Strongly agree
The respondents consider the Engine Stimulator an indispensable resource for preparing them for real-world challenges in marine engineering	4.44	0.58	Strongly agree
Overall mean	4.46		Strongly Agree

Legend:

Range	
4.21-5.00	Strongly Agree
3.41-4.20	Agree
2.61- 3.40	Average
1.81-2.60	Disagree
1.00-1.80	Strongly Disagree

Table 5 above evaluates the perspective of respondents regarding the Engine Stimulator's effectiveness in enhancing their hands-on skills and capabilities in handling marine engines. The respondents believe that the Engine Stimulator effectively assesses their practical abilities in handling marine engines received the highest average rating of 4.68. This indicates a strong consensus regarding the equipment's capacity to provide practical and skillsoriented learning opportunities. The statement that received the lowest average score of 4.36, it effectively evaluates the respondent's ability to comprehend engine performance information and make informed decisions. While still demonstrating robust support, this highlights a somewhat reduced perception of its efficacy in improving data interpretation and decision-making abilities compared to other skills.

Furthermore, the overall mean is 4.46 which denotes a "strongly agree" rating specific to assessment on capability and skills. Among the ten positive attributes, all are rated as strongly agree. Highest mean is 4.68 which denotes a rating of strongly agree on the attribute of the respondents believe that the Engine Stimulator effectively assesses their practical skills in operating marine engines. These findings indicate that the Engine Stimulator is an incredibly valuable instrument for skill development, offering realistic scenarios, challenging tasks, and opportunities for hands-on learning. However, the results indicates that potential paths for improvement, such as enhancing the simulator's ability to boost participants' skills in data analysis and decision-making. Choi et al. (2022) emphasize the importance of immersive simulation tools in improving hands-on learning and decision-making abilities in engineering education.

Table 6. Operating System of the Engine Stimulator

Operating System	Mean	Std. Deviation	Interpretation
The respondents find the operating system of the Engine Stimulator intuitive and user-friendly	4.42	0.64	Strongly agree
The Engine Stimulator's operating system allows for easy navigation and access to various functionalities	4.47	0.61	Strongly agree
The respondents feel comfortable using the controls and interfaces of the Engine Stimulator's operating system	4.45	0.63	Strongly agree
The Engine Stimulator's operating system provides comprehensive guidance and instructions for performing tasks	4.48	0.64	Strongly agree
The respondents believe that the operating system of the Engine Stimulator enhances their learning experience	4.54	0.58	Strongly agree
The operating system of the Engine Stimulator enables seamless integration with other training resources and materials	4.51	0.57	Strongly agree
The Engine Stimulator's operating system facilitates efficient setup and configuration for different training scenarios	4.52	0.61	Strongly agree
The respondents appreciate the responsiveness and reliability of the Engine Stimulator's operating system	4.48	0.66	Strongly agree
The respondents feel that the operating system of the Engine Stimulator adequately simulates real-world conditions and challenges	4.47	0.65	Strongly agree
The Engine Stimulator's operating system empowers the respondents to explore and experiment with engine configurations and parameters confidently	4.65	0.55	Strongly agree
Overall mean	4.50		Strongly Agree

Legend:

Range	
4.21-5.00	Strongly Agree
3.41-4.20	Agree
2.61- 3.40	Average
1.81-2.60	Disagree
1.00-1.80	Strongly Disagree

Table 6 above shows the highlights the effectiveness of the operating system used in the Transas Engine Room Simulator. The item with the highest mean of (4.65), reflects a strong consensus among the respondents on the simulator's capacity to encourage extensive exploration. This capability fosters a deeper understanding of engine configurations and operational parameters, which is vital for the professional development of Marine Engineering students. The item with the lowest mean, the respondents find the operating system of the engine stimulator intuitive and user-friendly (4.42), also received a strong agreement rating. This indicates that while the system is generally user-friendly, minor challenges in familiarizing with its interface might exist for some students.

Moreover, the overall resulting mean is 4.50 which denotes a “strongly agree” rating specific to assessment on operating system. This imply that the simulator's operating system significantly enhances the training process by providing an intuitive design, seamless integration with training resources, and realistic simulation capabilities. It supports students in developing essential operational skills and confidence, making it an invaluable tool for simulation-based training programs. Additionally Kim et al. (2022) highlighted the critical role of user-friendly interfaces in improving student engagement and comprehension in simulation tools. According to the study of Zaini (2020), training is beneficial, as it offers a realistic platform and hands-on experience to effectively prepare skilled operators for working in a highly automated environment.

Conclusions

The study provides a clear overview of Marine Engineering students’ demographics and their perceptions of simulation-based training using the Transas Engine Room Simulator. Respondents, mostly young, male, and single, are well-suited for technology-enhanced learning due to their adaptability and focused academic engagement. Students demonstrated strong theoretical knowledge across technical areas, especially in generator synchronization and boiler firing sequences, though slight gaps in troubleshooting and practical application were noted. The Engine Stimulator was highly rated for developing practical skills in engine operation, while the operating system was praised for its intuitive design and realistic simulations. Despite the overall strong performance, areas such as data interpretation and proficiency with varied systems suggest a need for more advanced, hands-on simulations. This hands-on experience reinforces theoretical learning and helps students troubleshoot real-time system responses . However, to maximize ERS effectiveness, training modules need continuous updates to improve fidelity, incorporate the latest technological advancements, and reflect emerging maritime trends. The findings affirm the simulator’s effectiveness while underscoring the value of continuous curriculum enhancement and integration of emerging technologies, in line with current educational best practices in marine engineering.

Recommendations

Based on the results of the study, the following recommendations are given.

1. Conduct skill gap assessments quarterly to identify specific weaknesses in areas.
2. Develop and integrate scenario-based modules using the Engine Room Simulator (ERS).
3. Make a pre-training surveys and skill-level screening to assess learners’ technical backgrounds and socioeconomic conditions at program intake to customize learning paths.

4. Organize optional pre-simulation workshops covering basic systems and controls for those with limited exposure.
5. Establish continuous learning assessments in simulations to measure on-going learner progress and adapt training accordingly.
6. Regularly consult maritime industry partners to align simulator capabilities and training content with current operational practices.

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