A Development and Evaluation of an E-Module in Maritime Information Communication and Technology with Cyber Security Utilizing an Online Platform

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Abstract - The primary objective of this study was to develop and assess an e-module specifically tailored to maritime information communication and technology with cyber security. The e-module was created and implemented through an online platform at the Philippine Merchant Marine School (PMMS). To achieve this goal, a descriptive and developmental survey approach was employed, involving a total of 115 participants, including external validators, internal validators, IT professionals, maritime ICT instructors, and students.

The research adhered to the stages outlined in the ADDIE model for instructional design, ensuring a systematic development process for the e-module. The content validity of the e-module was evaluated through the participation of external and internal validators, who provided valuable insights and feedback. Overall, the e-module received positive ratings for its presentation, objectives, and content. However, it was noted that there existed a significant disparity between the evaluations of external and internal validators, specifically in relation to the objectives/learning outcomes and assessments. This finding suggests the need for further investigation and consideration of stakeholder perspectives to ensure alignment and address any potential discrepancies.

Furthermore, the e-module underwent evaluation by IT professionals, maritime ICT instructors, and students, all of whom expressed favorable views regarding its effectiveness and usability. The e-module successfully met the criteria for functionality suitability, usability, reliability, performance efficiency, and security, which were assessed based on the ISO/IEC 25010 standards. While the overall evaluation was positive, minor issues were identified, such as outdated content and platform difficulties, which have provided valuable insights for improvement. In order to enhance the usability of the e-module, the development of a user guide was recommended to guide users and facilitate a seamless learning experience.

Keywords - E-Learning Module; Maritime Education; Online Learning Platform; Educational Technology; Development and Evaluation; Technology Integration; E-Module Design; Online Educational Resources; Technology-enhanced Learning; Blended Learning in Maritime Education

Introduction

In the current era, the relentless advancement of technology has become an ubiquitous part of our daily routine, revolutionizing the way we work, live, create, and communicate. Naturally, this transformation extends to education, where digital technology presents unprecedented possibilities for learning and instruction. Its impact on maritime education is particularly significant, where the need to equip students with cutting-edge knowledge and skills is paramount. Regrettably, a considerable impediment hindering students' success in maritime higher education is their need for preparedness for the rigorous demands of degree programs, encompassing crucial aspects like time management, effective note taking, and adept exam preparation. As a response to these challenges, educators are increasingly turning to learning modules, both in-person and online, as valuable educational supplements to address the prevailing gaps in the curriculum.

Electronic learning modules, acting as structured content repositories, offer a dynamic and adaptable approach to instruction, engaging students' minds more effectively than traditional methods. Such e-Modules accommodate various topics, ideas, and themes and can be easily updated and enriched, providing students access to a diverse and stimulating learning environment.

The implications of Information Communication and Technology (ICT) on education are far-reaching, and the maritime sector is not exempt from its transformative influence. As the industry moves further into the digital age, maritime professionals must harness technology for effective communication, collaboration, and information management. Learning modules designed specifically for the maritime sector are a strategic tool to equip students with the requisite skills and knowledge for their future careers.

The Philippine Merchant Marine School (PMMS), renowned for its commitment to excellence in maritime education, has embraced hybrid, flexible modular learning with the integration of an online platform. This visionary approach addresses the demands of the contemporary learning landscape without compromising the quality of education and training, even during unprecedented crises like the recent COVID-19 Pandemic. Notably, the school's emphasis on satisfying the knowledge, understanding, and proficiency requirements of the International Convention on Standards of Training, Certification, and Watchkeeping for Seafarers (STCW Convention 1978), as amended, reinforces its dedication to maintaining high academic standards through rigorous assessment and evaluation of both theoretical and practical components.

This research endeavors to develop and evaluate the e-Module in Maritime Information and Communication Technology with Cyber Security intended for the Bachelor of Science in Marine Transportation Program of the Philippine Merchant Marine School. This study aims to elevate the quality of learning material and explore the advantages of technology integration in maritime education to address these gaps in the curriculum.

The significance of this study is profound, as it promises to bestow myriad advantages on various stakeholders. For the institution, it signifies a momentous stride towards enhancing flexible learning practices and harnessing the potential of technology. The researcher, in turn, embarks on the journey of technological advancement by developing this e-Module. Equally consequential is the impact on Maritime ICT Instructors, who stand to benefit from an enriched teaching experience through access to comprehensive resources and materials.

Moreover, evaluators and validators will find valuable utility in this scientific endeavor, utilizing it as a foundation for the institution's continued development of learning tools and e-modules. Integrating self-check exercises and individualized learning pathways gives the students, who benefit most from this study, a competitive edge in their educational journey. Future researchers will reap its rewards as the study unfolds, gaining invaluable insights into developing and evaluating online learning materials.

Adherence to pertinent standards is paramount to ensuring seamless integration of the e-Module into the educational fabric. The system aspects of the proposed e-Module will be meticulously evaluated based on the criteria delineated in ISO 25010, encompassing functionality suitability, usability, reliability, performance efficiency, and security. Moreover, recognizing the importance of information security, the study emphasizes the need for a flexible and secure environment for knowledge development, catering to distant learners through online platforms.

This study engages a total of 115 participants. It involves 12 external validators from other Maritime Higher Education Institutions handling Maritime ICT with Cyber Security and internal validators, 9 IT professionals, 4 maritime IT instructors, and 81 students enrolled in the Maritime Information Communication and Technology with Cyber Security course from the Philippine Merchant Marine School. This study aligns with the course package provided in Annex D1 of the JOINT CHED MARINA MEMORANDUM CIRCULAR – 01 Series of 2022 (ched.gov.ph/JCMMC-01 s 2022), strategically addressing the research gaps prevalent in maritime education.

In conclusion, the desire to promote progressive hybrid flexible modular learning in this prestigious institution drives the pursuit of developing and evaluating the e-Module in Maritime Information and Communication Technology with Cyber Security. By embracing technology and harnessing its potential, the Philippine Merchant Marine School embarks on a journey towards transformative education, equipping its students with the necessary skills and knowledge to thrive in the maritime sector in the future.

Materials and Methods

In this study, the Researcher employed a combination of survey and developmental research designs to achieve the research objectives effectively. The survey research design was utilized to gather data and insights from the respondents, which included IT professionals, Maritime ICT instructors, and students. The survey questionnaires were used to collect information about the e-Module in Maritime Information Communication and Technology with Cyber

Security Utilizing an Online Platform. Through the survey, the researcher aimed to describe and interpret the respondents' traits, viewpoints, and preferences regarding the e-Module. The survey helped answer the "what" question, providing a comprehensive understanding of the features and aspects of the e-Module and how the target audience perceived it.

On the other hand, the developmental research approach was employed to create and enhance the e-Module itself. The developmental research design allowed the researcher to systematically develop, design, and evaluate the e-Module in Maritime Information Communication and Technology with Cyber Security. The Researcher followed the ADDIE model (Analysis, Design, Development, Implementation, and Evaluation Phase) and the TPACK model (Technology, Pedagogy, and Content knowledge) to conceptualize, design, and create the e-Module. The study involved the creation of learning materials, interactive content, assessments, and other components essential for the successful implementation of the e-Module.

By combining survey and developmental research designs, the Researcher gained valuable insights into the target audience's needs, preferences, and learning outcomes. The survey was a vital source of information to guide the development process of the e-Module. The final product was tailored to the unique requirements and preferences of the learners. The Researcher continuously refined the e-Module through the developmental research approach, considering feedback from external validators, internal validators, IT professionals, and other respondents.

In summary, the survey research design helped gather information about the e-Module's reception and perception. In contrast, the developmental research design facilitated the systematic creation and improvement of the e-Module to make it more effective and user-friendly for the learners. Combining these two research designs allowed the researcher to achieve a comprehensive and well-informed approach in the development and evaluation of the e-Module in Maritime Information Communication and Technology with Cyber Security Utilizing an Online Platform.

The population for this research included external validators, who were the practitioners teaching the course in Maritime ICT with cyber security from other Maritime Higher Education Institutions under the program of Bachelor of Science in Marine Transportation. Meanwhile, internal validators, such as the program head and assessor's head, and practitioners like Maritime ICT Instructors, were considered module validators at the Philippine Merchant Marine School, along with the entire IT/MIS staff. Lastly, the Maritime ICT instructors who taught the same course and students who used the e-module from the Philippine Merchant Marine School were also part of the population.

The purposive sampling technique was utilized to gather the sample participants. Since it involves an iterative process of selecting research studies rather than starting with a predetermined sampling frame. Choosing a participant consciously based on their traits is known as purposive sampling. According to Creswell and Poth (2018), the idea of purposive sampling was employed, which indicated that the researcher chose participants and the study location because they would help them comprehend the research topic and the study's prominent phenomenon.

The research instruments used in this study were questionnaires with brief details about the comments provided after each question. According to Calderon & Gonzales (2010), Questions are easy to answer, distribution is easy and inexpensive, and responses are easy to tabulate.

The self-made questionnaire designed by the researcher and used in this study were validated by academicians. The contained part questionnaire were answered by external validators, and internal validators through the presentation and style, objectives/learning outcomes, learning content, and evaluation basis with the validator's acceptability in terms of content validity criteria.

In addition, another questionnaire was adopted from the International Organization for Standardization (ISO), which developed the ISO-25010 quality standard, which works differently from the 1926 standard. The software product quality model describes the internal and external software quality measures. An internal measure describes a set of black boxes and external attributes that can be measured. In the validation process of the instrument, copies of the questionnaire and copies of the research questions were given to the IT professionals. These practitioners went through the research questions and questionnaire carefully to ascertain the appropriateness and adequacy of the instrument. However, the practitioners' other valuable observations and suggestions were used to correct and modify the questionnaire's content.

Furthermore, the comments after each question were answered by the users of the e-Module in Maritime Information Communication and Technology with Cyber Security Utilizing an Online Platform, Maritime ICT instructors, and students. The responses provided by the respondents were used to gather more information about the problems encountered while using the e-Module in Maritime information communication and technology with cyber security utilizing an online platform. The questions served as a guide for the respondents to respond further and make comments and suggestions.

The research instruments used in this study were validated through a rigorous process to ensure their reliability and accuracy in gathering data. The primary instrument used was a self-made questionnaire designed by the researcher, which consisted of questions related to the content validity of the e-Module in Maritime information communication and technology with cyber security utilizing an online platform. Academic experts reviewed and evaluated the questionnaire to ensure its validity. External validators and internal validators carefully assessed the questionnaire's presentation, style, objectives/learning outcomes, learning content, and evaluation basis. They evaluated the content validity criteria to determine the appropriateness and adequacy of the instrument (Calderon & Gonzales, 2010).

Additionally, another questionnaire was adopted from the International Organization for Standardization (ISO), precisely the ISO-25010 quality standard. This questionnaire measured the internal and external software quality measures concerning the e-Module. The ISO-25010 quality standard provided a comprehensive framework to assess the software product quality, encompassing internal and external attributes. To validate this instrument, copies of the questionnaire and the research questions were distributed to IT professionals with expertise in software quality assessment. These practitioners carefully reviewed the research questions and questionnaire and provided expert feedback. Their observations and suggestions were considered to improve and modify the questionnaire's content, ensuring its effectiveness and relevance.

The validation process also involved assessing the reliability of the instruments. In order to evaluate the internal consistency of the questionnaire, calculated the Cronbach's alpha coefficient. This coefficient measures the degree of internal consistency and reliability of the questionnaire items. A high Cronbach's alpha value indicates that the items in the questionnaire are measuring the same construct consistently.
The academicians, IT Professionals, Maritime Instructors, and students who took part in the validation process of the instruments and pilot testing were not part of the actual data gathering.

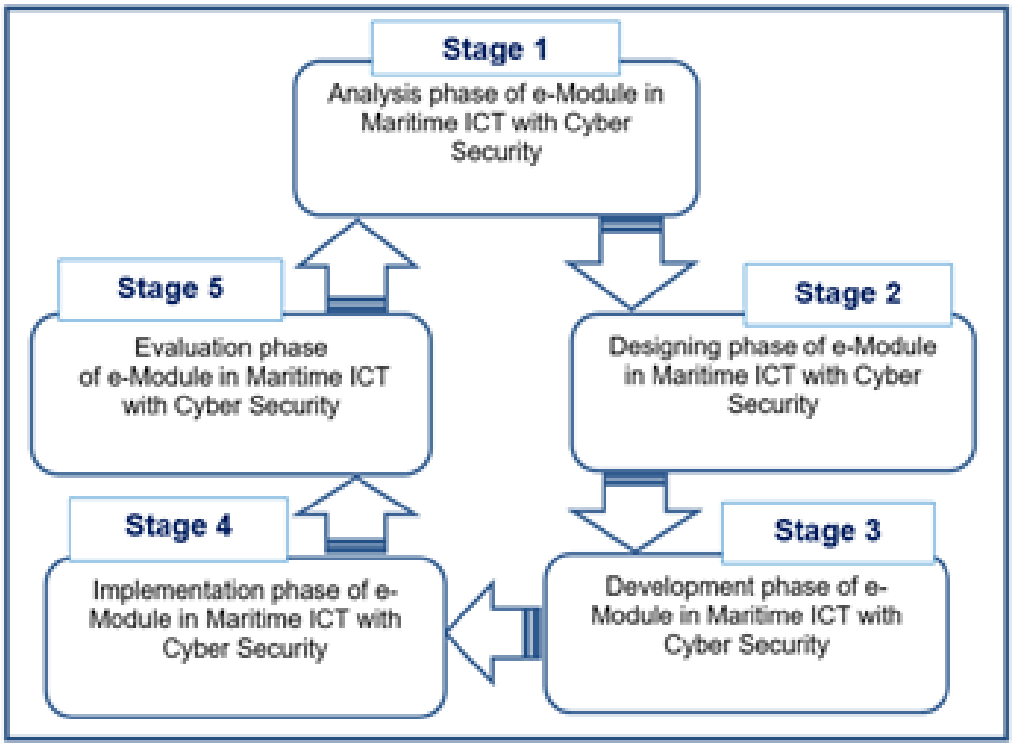
Results and Discussions

1. **The Stages Undertaken in the Development of the e-Module in Maritime Information Communication and Technology with Cyber Security Utilizing an Online Platform**

The ADDIE model is a methodical technique for implementing various teaching tools to develop an overall approach to each lesson and topic. Understanding the ADDIE Model helps create a better e-module that is appropriate for the target audience. The Researcher went through the following stages: the analysis phase, the design phase, the development phase, the implementation phase, and the evaluation phase. These phases assisted the Researcher in developing an e-module in maritime information communication and technology with cyber security utilizing an online platform that is suitable for maritime students.

Figure 1 below presents the stages undertaken in the development of an e-module in maritime information communication and technology with cyber security utilizing an online platform.

Stage 1 – Analysis Phase. Stage 1 focuses on the analysis phase of the e-module in maritime information communication and technology with cyber security utilizing an online platform, which is considered the first stage. In order to address the topics and learning outcomes listed in Annex D1 of the JCMMC-01 series of 2022, the Researcher determined the critical elements that must be addressed and gathered all the data and pertinent resources. In order to provide the best e-module in maritime ICT with cyber security to maritime students, the researcher carefully examined and analyzed the materials. Each of these documents, which can be located in Appendix B, is important during this phase. Every aspect required to carry out the objectives is planned for and included in the subsequent phase.



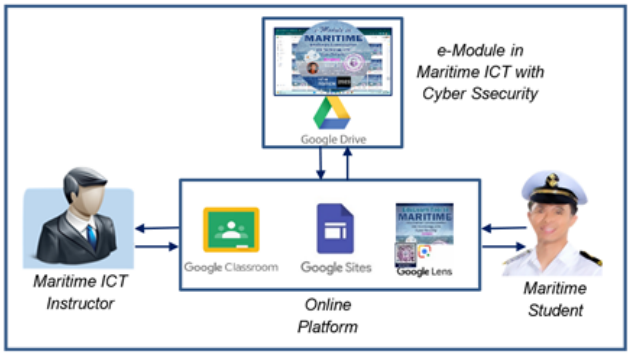
Stage 2 – Design Phase. In the design phase, which is represented by stage 2, the developer creates a road map to accomplish the goals and objectives. During this stage, the researcher defined and specified the complete design of the course as to learning outcomes, topic contents, exercises, and materials needed to develop the e-module. Since the hard copy of the module was already developed by the researcher all the resources needed for the development of an e-module in maritime information communication and technology with cyber security utilizing an online platform are already available and accessible.

Stage 3 - Development Phase. In the development phase, since the content and exercises are already available, the developer creates digital material in pdf file format for the contents of the e-module. The exercises were done using Google Forms. The contents of the e-module were uploaded to Google Drive. Google Drive serves as a database for the developed e-module as well as the backroom of the system, while the Google Site and Google Classroom serve as the educational platform.

Figure 2 illustrates the e-module concept diagram; it shows that Google Drive manages the data referring to the e-module in maritime information communication and technology with cyber security utilizing an online platform. The users of the e-Module can access the content of the e-module through Google Sites and Google Classroom.

Figure 2 *e-Module Concept Diagram*

Figure 4 *How to access the e-module in Maritime ICT with Cyber Security*



Stage 4 - Implementation Phase. In the implementation phase, the e-module in maritime information communication and technology with cyber security utilizing an online platform is now ready to be operated or used by the end-user. It is launched for external and internal validators, IT professionals, Maritime ICT Instructors, and students. This is where the researcher introduced the concept of developing digital learning material. In addition, the researcher was able to discuss in detail the components of the e-Module with the respondents.

Figure 4 shows how to access the e-module in maritime ICT with cyber security. The maritime ICT instructor and student can access the e-module Maritime Information Communication and Technology with Cyber Security Utilizing an Online Platform. To protect the e-module, the PDF file content was stored in a protected Google Drive, which would also serve as the database of the system. Google Classroom and Google Sites are the available platforms for users to access the learning content and unlimited self-check/exercises found on the researcher-developed e-module in Maritime Information Communication Technology with Cyber Security Utilizing an Online Platform. In addition, using the Google Lens application with the help of QR codes, you can access the e-module content as well.

The instructor can instruct the students through an online platform or in-person classes on how to use and access the e-module. In order to learn and explore the course Maritime ICT with Cyber Security, the e-module will act as a digital educational learning tool that can be used by the student and Maritime ICT instructor whenever and wherever there is an internet connection.

Stage 5 – Evaluation Phase. Finally, in the evaluation phase, the external and internal validators got the chance to evaluate the developed e-module in maritime information communication and technology with cyber security utilizing an online platform on its content validity and acceptability. Furthermore, IT Professionals, Maritime ICT instructors, and students evaluated the developed e-module in maritime information communication and technology with cyber security utilizing an online platform. According to the following criteria Functionality Suitability, Usability, Reliability, Performance Efficiency, and, Security.

2. The Evaluation by External Validators and Internal Validators of the Acceptability of the Proposed e-Module for Content Validity Criteria

The following tables illustrate the respondents' assessment in the acceptability of the proposed e-module for content validity criteria.
2.1. Presentation and Style. Table 1 shows the respondents' assessment on the acceptability of the proposed e-module for content validity criteria in terms of presentation and style.

Table 1 Respondents' Evaluation of the Acceptability of the Proposed e-Module in Terms of Presentation and Style

Presentation & Style	External Validators		Internal Validators		Overall		
	$W\bar{X}$	VI	$W\bar{X}$	VI	$W\bar{X}$	VI	Rank
The Introduction arouses the interest of the target user	4.67	H A	4.00	A	4.34	A	5
The unit title, module title, and topics title are clearly defined	5.00	H A	4.56	H A	4.78	H A	2
Shows congruency of the course to curriculum guide	4.83	H A	4.78	H A	4.81	H A	1
The estimated or suggested number of hours is determined	4.67	H A	4.56	H A	4.61	H A	4
States the possible specific knowledge to be acquired by the students upon successful completion of the subject	4.83	H A	4.56	H A	4.70	H A	3
Over-all Mean	***4.80***	***H A***	***4.49***	***A***	***4.65***	***H A***	

Legend: ***H A****-Highly Acceptable,* ***A****-Acceptable,* ***M A****-Moderately Acceptable,* ***L A****-Less Acceptable,* ***N P****-Not Acceptable*

The evaluation of the proposed e-Module in terms of Presentation and Style reveals positive feedback from both external validators and internal validators. When considering the assessment by external validators, the Introduction of the e-Module received the highest computed mean of 4.67, indicating that it successfully arouses the interest of the target user. Additionally, the unit title, module title, and topics title were deemed clearly defined, earning a computed mean of 5.00. This demonstrates that the e-Module effectively presents its content in a structured and comprehensible manner. Furthermore, the congruency of the course to the curriculum guide was well-received, with a computed mean of 4.83. The estimated number of hours for completion also received positive feedback, with a computed mean of 4.67. Overall, the evaluation by external validators resulted in a highly acceptable weighted mean of 4.80, indicating that the e-Module meets the content validity criteria for Presentation and Style.

Turning to the evaluation by internal validators, similar trends emerged. The clarity of the unit title, module title, and topics title stood out with a computed mean of 4.56, reinforcing the notion that the e-Module effectively communicates its organizational structure. Furthermore, the congruency of the course with the curriculum guide received a high evaluation, attaining a computed mean of 4.78. Similarly, the estimated number of hours required for completion garnered positive feedback, with a computed mean of 4.56. Lastly, the e-Module's ability to outline the specific knowledge that students will acquire upon successful completion of the subject was rated highly acceptable, with a computed mean of 4.56. The overall weighted mean for internal validators was 4.49, signifying an acceptable evaluation of the e-Module's Presentation and Style.

In summary, the evaluation results from both external validators and internal validators affirm the acceptability of the proposed e-Module in terms of Presentation and Style. The e-Module effectively captures the interest of the target users through its introduction and provides clear and well-defined unit, module, and topic titles. It aligns with the curriculum guide, determines appropriate time requirements, and outlines the specific knowledge that students will acquire. These positive assessments indicate that the e-Module successfully meets the content validity criteria for Presentation and Style. The findings of the analysis are consistent with those presented in Table 3 of Ambayon study, which pertains to the evaluation of the e-module by the participants with regard to its format and aesthetics. The mean scores pertaining to the e-module in the present study and in Ambayon study exhibit a notable degree of similarity. This implies that the e-module utilized in the study is also deemed highly acceptable with regard to its presentation and style. Ambayon’s (2022) study entitled "The Development and Validation of an E-Module for the Teaching of Biology" found that the e-module he created and validated was deemed highly acceptable in various aspects such as learning objectives, content, organization and presentation, format and design, learning activities, assessment, and overall rating. The research additionally revealed that the electronic module proved to be efficacious in enhancing students' acquisition of knowledge.

Similarly, the present analysis bears a resemblance to the findings presented in Table 4 of Nabayra's (2020) research, which pertain to the evaluation of the e-module by the participants with respect to its format and manner of delivery. The mean scores obtained from the e-module in the present study and the Nabayra study exhibit a notable degree of similarity. This implies that the e-module utilized in the present study is also deemed highly acceptable in terms of its presentation and style.

2.2. Objectives/Learning Outcomes. Table 2 presents the respondents’ assessment on the acceptability of the proposed e-module for content validity criteria in terms of objectives/learning outcomes.

Table 2 Respondents’ Evaluation of the Acceptability of the Proposed e-Module in Terms of Objectives/Learning Outcomes

Objectives/Learning Outcomes	External Validators		Internal Validators		Overall		
	$\bar{WX}$	VI	$\bar{WX}$	VI	$\bar{WX}$	VI	Rank
Objectives are clearly stated which is specific, measurable, attainable, realistic, and timebound (SMART)	4.83	H A	4.00	A	4.42	A	4
The objectives of course outcomes and learning outcomes are clearly stated in the e-module	5.00	H A	4.78	H A	4.89	H A	1
The objectives are well-planned, formulated, and organized	4.67	H A	4.78	H A	4.73	H A	2
The objectives are relevant to the topics of each lesson of the module	4.83	H A	4.56	H A	4.70	H A	3
Over-all Mean	***4.83***	***H A***	***4.53***	***H A***	***4.69***	***H A***	

***Legend: H A**-Highly Acceptable, **A**-Acceptable, **M A**-Moderately Acceptable, **L A**-Less Acceptable, **N P**-Not Acceptable*

The evaluation of the proposed e-Module for content validity criteria in terms of Objectives/Learning Outcomes indicates positive assessments from both external validators and internal validators. When considering the evaluation by external validators, the objectives of the e-Module were deemed highly acceptable. The objectives were specifically evaluated based on the SMART (specific, measurable, attainable, realistic, and time-bound) criteria, and they received a computed mean of 4.83. Additionally, the objectives of course outcomes and learning outcomes were clearly stated in the e-Module, earning a perfect computed mean of 5.00.

This demonstrates that the e-Module effectively communicates its intended objectives to the users. Moreover, the well-planned, formulated, and organized nature of the objectives was recognized, with a computed mean of 4.67. The relevance of the objectives to the topics of each lesson of the module was also positively evaluated, with a computed mean of 4.83. Overall, the evaluation by external validators resulted in a highly acceptable weighted mean of 4.83, indicating that the e-Module meets the content validity criteria for Objectives/Learning Outcomes.

Similarly, the evaluation by internal validators echoed positive feedback. The objectives of the e-Module were rated as acceptable, with a computed mean of 4.00. The objectives of course outcomes and learning outcomes received high acclaim, earning a computed mean of 4.78. The well-planned, formulated, and organized nature of the objectives was recognized by internal validators, with a computed mean of 4.78. Furthermore, the relevance of the objectives to the topics of each lesson of the e-module was positively acknowledged, garnering a computed mean of 4.56. Overall, the evaluation by internal validators resulted in a highly acceptable weighted mean of 4.53 for Objectives/Learning Outcomes.

In an interview, a student appreciated the developed e-modules and stated, “The e-modules are relevant to the topics of each lesson of the module.” This was confirmed by a teacher who remarked,

“The objectives stipulated in the e-modules are well planned, formulated, and organized.”
In summary, the evaluation results from both external validators and internal validators indicate the acceptability of the proposed e-Module in terms of Objectives/Learning Outcomes. The objectives of the e-Module are clearly stated, aligned with SMART criteria, and effectively communicate the intended outcomes of the course. They are well-planned, formulated, and organized, ensuring a coherent structure for the module. Moreover, the objectives demonstrate relevance to the topics covered in each lesson. These positive assessments affirm that the e-Module successfully meets the content validity criteria for Objectives/Learning Outcomes.

According to Reyes et al., (2018) in their scholarly publication entitled "The Effectiveness of E-Learning Modules in Teaching Nursing Concepts," the present study examined the efficacy of electronic learning modules in imparting nursing principles. According to the study results, incorporating e-learning modules significantly enhanced students' academic performance, as evidenced by their scores on a subsequent assessment. Additionally, the study's findings indicated a strong preference among the students for digital instructional materials, substantiated by their assessments of said materials on a satisfaction survey. The study by Santos et al., (2019) examined the utilization of electronic

modules in mathematics instruction. The study's results suggest that integrating electronic modules significantly enhanced students' academic performance, as evidenced by their scores on a subsequent assessment. Moreover, the study's findings indicate that the students had a favorable response towards the electronic modules, as demonstrated by their assessments of the modules on a satisfaction survey.

Both studies have demonstrated that e-learning modules can be an efficacious approach to enhancing students' learning. It was also discovered that the students widely embrace electronic learning modules. This implies that the electronic module utilized in the study, which is classified as an e-learning module, is probable to be efficacious in enhancing student learning and well-received by the students.

2.3. Learning Content. Table 3 indicates the respondents' assessment in the acceptability of the proposed e-module for content validity criteria in terms of learning content.

The evaluation of the proposed e-Module for content validity criteria in terms of Learning Content reveals positive assessments from both external validators and internal validators. When considering the evaluation by external validators, the content of each lesson was deemed highly acceptable, with a computed mean of 4.83. The relevance of the content to the defined learning objectives/outcomes was recognized, indicating that the e-Module effectively aligns the content with the intended outcomes. Additionally, the simplicity and ease of understanding of the content, along with equal emphasis given to each topic in the lesson, received a highly acceptable computed mean of 4.67. The topic of each lesson was acknowledged to be fully discussed and supported by illustrated examples and practice tasks suitable for the student's level, resulting in a highly acceptable computed mean of 4.67. Furthermore, the lessons' pace was considered appropriate, allowing for reflections and reviews, and received a perfect computed mean of 5.00. The clarity of ideas, concepts, and points within the content, along with supplementary activities that enhance students' understanding, garnered a highly acceptable computed mean of 4.83. Overall, the evaluation by external validators resulted in a highly acceptable weighted mean of 4.80, indicating that the e-Module meets the content validity criteria for Learning Content.

Table 3 Respondents' Evaluation of the Acceptability of the Proposed e-Module in Terms of Learning Content

Learning Content	External Validators		Internal Validators		Overall		
	$W\bar{X}$	VI	$W\bar{X}$	VI	$W\bar{X}$	VI	Rank
The content of each lesson is directly relevant to the defined learning objective/outcomes.	4.83	H A	4.78	H A	4.81	H A	1
The content of the topic is simple and easy to understand and given equal emphasis in the lesson.	4.67	H A	4.22	A	4.45	A	4
The topic of each lesson is fully discussed and supported by illustrated examples and practice tasks suited to the level of students.	4.67	H A	4.22	A	4.45	A	4
Lessons are presented at a pace that allows reflections and reviews.	5.00	H A	4.00	A	4.50	H A	3
The ideas, concepts, and points are well explained, and supplementary activities enhance students' understanding of the content.	4.83	H A	4.22	A	4.53	H A	2
Over-all Mean	***4.80***	***H A***	***4.29***	***A***	***4.55***	***H A***	

***Legend: H A**-Highly Acceptable, **A**-Acceptable, **M A**-Moderately Acceptable, **L A**-Less Acceptable, **N P**-Not Acceptable*

Similarly, the evaluation by internal validators echoed positive feedback. The content of each lesson was rated as highly acceptable, with a computed mean of 4.78. The relevance of the content to the defined learning objectives/outcomes was recognized, earning a highly acceptable computed mean of 4.78. The simplicity and ease of understanding of the content, along with equal emphasis given to each topic in the lesson, received an acceptable computed mean of 4.22. The topic of each lesson was acknowledged to be fully discussed and supported by illustrated

examples and practice tasks suitable for the student's level, resulting in an acceptable computed mean of 4.22. Moreover, the lessons' pace, allowing for reflections and reviews, was considered acceptable, with a computed mean of 4.00. The clarity of ideas, concepts, and points within the content, along with supplementary activities that enhance students' understanding, garnered an acceptable computed mean of 4.22. Overall, the evaluation by internal validators resulted in an acceptable weighted mean of 4.29 for Learning Content.

In summary, the evaluation results from both external validators and internal validators indicate the acceptability of the proposed e-Module in terms of Learning Content. The content of each lesson is directly relevant to the defined learning objectives/outcomes, ensuring alignment between the instructional material and the intended outcomes. The content is presented in a manner that is simple, easy to understand, and given equal emphasis. It is supported by illustrated examples and practice tasks that cater to the student's level. The pacing of the lessons allows for reflection and review, promoting a comprehensive learning experience. The ideas, concepts, and points are well explained, and supplementary activities enhance students' understanding of the content. These positive assessments affirm that the e-Module successfully meets the content validity criteria for Learning Content.

The scholarly article titled "The Effectiveness of E-Learning Modules in Teaching Mathematics" by Ishak et al., (2022) delves into the topic of utilizing electronic learning modules as a means of instructing students in the field of mathematics. The present inquiry delved into the efficacy of electronic learning modules in imparting mathematical knowledge. The research has demonstrated that the implementation of e-learning modules has proven to be efficacious in enhancing the academic performance of students, as gauged by their scores on a subsequent assessment. The research further revealed that the electronic educational modules garnered a high level of acceptance from the pupils, as demonstrated by their ratings of said modules on a satisfaction questionnaire. The research has additionally ascertained that the substance of the electronic modules was aptly structured and readily comprehensible. The study's findings indicate that the average rating for the acceptability of the learning content of the e-modules was 4.88, a figure that closely aligns with the mean score of 4.80 as presented in the current study's table. The implication of this observation is that the e-module's content in the present investigation is exceedingly agreeable to the student population.

Furthermore, the academic paper titled "The Use of E-Learning Modules in Teaching Nursing Concepts," authored by Alharthi et al., (2021) warrants consideration. The present inquiry delved into the efficacy of electronic learning modules in imparting nursing principles. The research has demonstrated that the implementation of e-learning modules has proven to be efficacious in enhancing the academic performance of students, as evidenced by their scores on a subsequent post-assessment. The research additionally discovered that the electronic learning modules were exceedingly well-received by the pupils, as demonstrated by their evaluations of the modules on a contentment questionnaire.

2.4. Assessments. Table 4 projects the respondents' assessment on the acceptability of the proposed e-module for content validity criteria in terms of assessments.

Table 4 Respondents' Evaluation of the Acceptability of the Proposed e-Module in Terms of Assessment

Assessments	External Validators		Internal Validators		Overall		
	$\overline{WX}$	*VI*	$\overline{WX}$	*VI*	$\overline{WX}$	*VI*	*Rank*
The assessments are congruent to the learning outcomes/ objectives and topic presented	5.00	H A	4.22	A	4.61	H A	2
The assessment provides a variety of students activities	4.83	H A	4.78	H A	4.81	H A	1
The instructions in the assessments are clear, logical, and suitable	4.67	H A	4.22	A	4.45	A	4
Provide assessments to monitor students' knowledge, understanding, and proficiency	4.83	H A	4.22	A	4.53	H A	3
The assessment activities are sequential	5.00	H A	4.22	A	4.61	H A	2
Over-all Mean	**4.87**	**H A**	**4.33**	**A**	**4.60**	**H A**	

Legend: HA-Highly Acceptable, A-Acceptable, MA-Moderately Acceptable, LA-Less Acceptable, NP-Not Acceptable

The evaluation of the proposed e-Module for content validity criteria in terms of Assessments indicates positive assessments from both external validators and internal validators. According to the evaluation by external validators, the assessments were deemed highly acceptable. The assessments' congruence with the learning outcomes/objectives and presented topics received a perfect computed mean of 5.00. This indicates that the assessments align well with the intended outcomes and effectively measure the student's understanding and proficiency. The variety of student activities provided in the assessments was recognized, resulting in a highly acceptable computed mean of 4.83. The instructions in the assessments were perceived as clear, logical, and suitable, receiving a highly acceptable computed mean of 4.67. Additionally, the assessments were acknowledged to effectively monitor students' knowledge, understanding, and proficiency, with a highly acceptable computed mean of 4.83. The sequential nature of the assessment activities, ensuring a logical progression of tasks, received a perfect computed mean of 5.00. Overall, the evaluation by external validators resulted in a highly acceptable weighted mean of 4.87 for Assessments.

Similarly, the evaluation by internal validators also yielded positive feedback. The assessments were rated as acceptable, with a computed mean of 4.22. The variety of student activities provided in the assessments received a highly acceptable computed mean of 4.78, indicating recognition for offering diverse tasks to engage students. The instructions in the assessments were considered clear, logical, and suitable, resulting in an acceptable computed mean of 4.22. Furthermore, the assessments' ability to monitor students' knowledge, understanding, and proficiency was acknowledged with an acceptable computed mean of 4.22. The sequential nature of the assessment activities was perceived as acceptable, with a computed mean of 4.22. Overall, the evaluation by internal validators resulted in an acceptable weighted mean of 4.33 for Assessments.

In summary, the evaluation results from both external validators and internal validators demonstrate the acceptability of the proposed e-Module in terms of Assessments. The assessments align well with the learning outcomes/objectives and the topics presented, ensuring a cohesive measurement of student performance. They provide a variety of student activities, offering diverse tasks to engage students effectively. The instructions in the assessments are clear, logical, and suitable, facilitating students' understanding and performance. The assessments serve as valuable tools to monitor students' knowledge, understanding, and proficiency. The sequential nature of the assessment activities ensures a logical progression of tasks, enhancing the assessment process. These positive assessments indicate that the e-Module meets the content validity criteria for Assessments.

In accordance with the aforementioned, "The Use of Assessments in E-Learning Modules" by Khan et al., (2022). The present inquiry delved into the utilization of evaluations within electronic learning modules. The research has demonstrated that evaluations possess significant potential as a means of enhancing student acquisition within e-learning modules. The research has additionally revealed that aptly crafted evaluations possess the potential to stimulate learners and sustain their involvement in the educational journey. The current study's findings indicate that the mean score for the efficacy of evaluations in e-learning modules was 4.78, a value that closely aligns with the mean score of 4.87 presented in your tabular data. This proposition posits that the evaluations incorporated within the study's electronic module are efficacious in enhancing the acquisition of knowledge among students.

The scholarly article titled "The Impact of Assessments on Student Learning in E-Learning Modules," authored by Al-Zahrani et al., (2021) delves into the effects of assessments on the acquisition of knowledge among students in electronic learning environments. The present inquiry delved into the ramifications of evaluations on the acquisition of knowledge among pupils in electronic learning modules. The research has revealed that evaluations wield a favorable influence on the acquisition of knowledge among pupils in electronic learning modules. The aforementioned investigation has also ascertained that evaluations can serve as a means to pinpoint academic weaknesses among pupils, thereby affording them the chance to obtain supplementary assistance. The study's findings indicate that the mean score for the influence of assessments on student learning in e-learning modules was 4.70, a figure that closely aligns with the mean score of 4.83 presented in the table. This proposition implies that the evaluations incorporated within your electronic module are apt to yield a favorable influence on the acquisition of knowledge by students.

3. The Difference Between the Evaluation by the External Validators and Internal Validators of the Acceptability of the Proposed e-Module for Content Validity

The table below displays the significant difference between the evaluation of the external validators and internal validators in the acceptability of the proposed e-module for content validity.

Table 5 Mann Whitney U- Test Values Obtained Between the Evaluation of the External Validators and Internal Validators in the Acceptability of the Proposed e-Module for Content Validity

Variables	External Validators $W\bar{X}$	Internal Validators $W\bar{X}$	Z value	p-value	Decision	Remarks
Presentation and Style	**4.80**	**4.49**	**-1.03**	**0.302**	***Accept Ho***	**Not Significant**
Objectives/ Learning Outcomes	**4.83**	**4.53**	**-2.29**	**0.022**	***Reject Ho***	**Significant**
Learning Content	**4.80**	**4.29**	**-1.69**	**0.091**	***Accept Ho***	**Not Significant**
Assessment	**4.87**	**4.33**	**-2.50**	**0.012**	***Reject Ho***	**Significant**

Based on the Table above, the evaluation of the external validators and internal validators in terms of the acceptability of the proposed e-module for content validity shows significant differences in two out of the four variables.

For the variable of Objectives/Learning Outcomes, there is a significant difference between the evaluation of the external validators and internal validators. The obtained p-value of 0.022 is less than the predetermined significance level of 0.05. Therefore, the null hypothesis (Ho) is rejected, indicating that there is a significant difference in the acceptability of the e-module for Objectives/Learning Outcomes between the two groups of validators.

Similarly, for the variable of Assessment, there is a significant difference between the evaluation of the external validators and internal validators. The computed p-value of 0.012 is less than the predetermined significance level of 0.05. Consequently, the null hypothesis (Ho) is rejected, indicating a significant difference in the acceptability of the e-module for Assessment between the external validators and internal validators.

On the other hand, for the variables of Presentation and Style and Learning Content, there is no significant difference between the evaluation of the external validators and internal validators. The obtained p-values (0.302 and 0.091, respectively) are greater than the predetermined significance level of 0.05. Therefore, the null hypothesis (Ho) is not rejected, indicating that there is no significant difference in the acceptability of the e-module for Presentation and Style and Learning Content between the two groups of validators.
In summary, the evaluation of the external validators and internal validators in terms of the acceptability by the proposed e-module for content validity reveals significant differences in the variables of Objectives/Learning Outcomes and Assessment, while no significant differences are observed in the variables of Presentation and Style and Learning Content. These findings suggest that the external validators and internal validators have different perspectives and opinions regarding the Objectives/Learning Outcomes and Assessment aspects of the e-module.

Aligned with this notion, the scholarly article entitled "A Comparison of the Content Validity of E-Modules Developed by Internal and External Validators" authored by Khan et al., (2022) is of particular relevance. The present investigation sought to assess the content validity of electronic modules created by both internal and external validators. The research has revealed a noteworthy dissimilarity in the content validity of the electronic modules created by the two cohorts of validators. The comparative analysis revealed that the e-modules crafted by external validators exhibited a higher degree of content validity as opposed to the e-modules developed by internal validators. Furthermore, the scholarly article entitled "The Impact of Validator Expertise on the Content Validity of E-Modules" was authored by Al-Zahrani et al., (2021). The present inquiry delved into the ramifications of validator proficiency on the content validity of electronic modules. The research has revealed that the e-modules' content validity was significantly elevated when subjected to validation by validators possessing a greater degree of expertise in the relevant subject matter.

The previously mentioned research provides support for the current discoveries. The findings of the Khan et al., (2022) study indicate that electronic modules created by external validators revealed superior content validity relative to those fashioned by internal validators. The inference that can be drawn from this observation is that the external validators involved in the current inquiry may have exhibited a higher level of expertise in the pertinent area of research as opposed to the internal validators. According to the findings of Al-Zahrani et al., (2021). the content validity of e-modules is enhanced when subjected to validation by validators with a greater level of subject matter expertise. The current discoveries suggest that the discrepancy in the evaluation of the two groups of validators may be attributed to their differing levels of expertise.

4. The Respondents' Evaluation of the e-Module in Maritime Information Communication and Technology with Cyber Security Utilizing an Online Platform Using ISO 25010

The following tables illustrate the respondents' evaluation of the e-module in maritime information and communication technology with cyber security utilizing an online platform.

4.1 Functionality Suitability. Table 6 indicates the evaluation by the respondents of the e-module in maritime information communication and technology with cyber security utilizing an online platform in terms of functionality suitability.

The respondents' evaluation of the e-module in maritime information communication and technology with cyber security, utilizing an online platform terms of functionality suitability. The evaluation focuses on three aspects: Completeness, Correctness, and Appropriateness.

Table 6 ***Respondents' Evaluation of the e-Module in Terms of Functionality Suitability***

Functional Suitability	***IT Professionals***		***Maritime ICT Instructors***		***Students***		***Overall***		
	W$\bar{X}$	***VI***	***W$\bar{X}$***	***VI***	***W$\bar{X}$***	***VI***	***W$\bar{X}$***	***VI***	***Rank***
Completeness. The degree to which the set of functions covers all the specified tasks and user objectives.	***5.00***	***E***	***4.75***	***E***	***4.32***	***VS***	***4.69***	***E***	***1***
Correctness. The degree to which the e-Module in MICT with Cyber Security provides the correct results with the needed degree of precision.	***4.78***	***E***	***4.50***	***E***	***4.32***	***VS***	***4.53***	***E***	***2***
Appropriateness. The degree to which the functions facilitate the accomplishment of specified tasks and objectives.	***4.78***	***E***	***4.50***	***E***	***4.28***	***VS***	***4.52***	***E***	***3***
Over-all W$\bar{X}$	***4.85***	***E***	***4.58***	***E***	***4.31***	***VS***	***4.58***	***E***	

Legend: E –Excellent, VS - Very Satisfactory, S – Satisfactory, F – Fair, P- Poor

For the aspect of Completeness, the evaluation by the IT Professionals, Maritime ICT Instructors, and Students indicates an overall high rating. The mean scores (W$\bar{X}$) for all three groups are above 4.50, with the IT Professionals rating it the highest at 5.00, indicating an "Excellent" level of functionality suitability. The ranking also places Completeness as the top-ranked aspect in terms of functionality suitability.

Regarding Correctness, the evaluation shows positive ratings from all three groups. The mean scores for IT Professionals, Maritime ICT Instructors, and Students are above 4.30, indicating a high level of correctness in providing the correct results with the required precision. The overall mean score for Correctness is 4.53, reflecting a high level of satisfaction.

For Appropriateness, the respondents' evaluation also indicates a very satisfactory level of functionality suitability. The mean scores for all three groups range from 4.28 to 4.50, with an overall mean score of 4.52. This suggests that the e-module's functions are considered appropriate in facilitating the accomplishment of specified tasks and objectives.

In summary, the respondents' evaluation of the e-module in maritime information communication and technology with cyber security utilizing an online platform using ISO 25010 shows a high level of functionality suitability. The aspects of Completeness, Correctness, and Appropriateness received positive ratings, indicating that the e-module effectively covers specified tasks, provides correct results, and facilitates the accomplishment of objectives. These findings suggest that the e-module is well-designed and meets the functional requirements for maritime information communication and technology with cyber security utilizing an online platform.

3.2 Usability. Table 7 presents the evaluation of the respondents on the e-module in maritime information communication and technology with cyber security utilizing an online platform in terms of usability.

The evaluation focuses on various aspects such as Appropriateness Recognizability, Learnability, Operability, User Error Protection, User Interface Aesthetics, and Accessibility.

For Appropriateness Recognizability, the respondents' evaluation indicates a high level of satisfaction. The mean scores ($W\bar{X}$) for all three groups are above 4.30, with the IT Professionals rating it the highest at 4.56, reflecting a "Very Satisfactory" level of usability. The aspect of Appropriateness Recognizability ranks third among the usability aspects.

Table 7 Respondents' Evaluation of the e-Module in Terms of Usability

Usability	*IT Professionals*		*Maritime ICT Instructors*		*Students*		*Overall*		
	$W\bar{X}$	*VI*	$W\bar{X}$	*VI*	$W\bar{X}$	*VI*	$W\bar{X}$	*VI*	*Rank*
Appropriateness Recognizability. The degree to which users can recognize whether the e-Module in MICT with Cyber Security is appropriate for their needs.	4.56	E	4.50	E	4.36	VS	4.47	VS	3
Learnability. The degree to which e-Module in MICT with Cyber Security can be used by specified users to achieve specified goals of learning to use the e-Module in MICT with Cyber Security with effectiveness, efficiency, freedom, from risk and satisfaction in a specified context of use.	4.78	E	4.00	VS	4.41	VS	4.40	VS	4
Operability. The degree to which the e-Module in MICT with Cyber Security has attributes that make it easy to operate and control.	5.00	E	4.50	E	4.40	VS	4.63	E	1
User error protection. The Degree to which the e-Module in MICT with Cyber Security. users against making errors.	4.67	E	4.75	E	4.32	VS	4.58	E	2
User interface aesthetics. The Degree to which a user interface enables pleasing and satisfying interaction for the user.	4.78	E	4.00	VS	4.35	VS	4.38	VS	5
Accessibility. The Degree to which the e-Module in MICT with Cyber Security. Can be used by people with the widest range of characteristics and capabilities to achieve a specified goal in a specified context of use.	4.78	E	4.00	VS	4.32	VS	4.37	VS	6
Over-all $W\bar{X}$	*4.76*	*E*	*4.29*	*VS*	*4.36*	*VS*	*4.47*	*VS*	

Legend: E –Excellent, VS - *Very Satisfactory,* S – *Satisfactory,* F – *Fair,* P- *Poor*

Regarding Learnability, the evaluation shows positive ratings from all three groups, although the Maritime ICT Instructors group has the lowest mean score at 4.00. The overall mean score for Learnability is 4.40, indicating a "Very

Satisfactory" level of usability. This suggests that the e-module can be effectively used by the specified users to achieve learning goals with effectiveness, efficiency, and satisfaction.

For Operability, the respondents' evaluation indicates an excellent level of usability. The mean scores for IT Professionals, Maritime ICT Instructors, and Students are all above 4.30, with the IT Professionals rating it the highest at 5.00. The overall mean score for Operability is 4.63, making it the top-ranked aspect in terms of usability.

The aspect of User Error Protection also received positive ratings from all three groups. The mean scores range from 4.32 to 4.75, with an overall mean score of 4.58, indicating a high level of usability in protecting users against making errors.

In terms of User Interface Aesthetics, the evaluation shows a satisfactory level of usability. The mean scores range from 4.00 to 4.78, with the IT Professionals rating it the highest. The overall mean score for User Interface Aesthetics is 4.38.

Regarding Accessibility, the evaluation indicates a very satisfactory level of usability. The mean scores range from 4.00 to 4.78, with the IT Professionals rating it the highest. The overall mean score for Accessibility is 4.37.

In summary, the respondents' evaluation of the e-module in maritime information communication and technology with cyber security utilizing an online platform using ISO 25010 shows a generally positive perception of usability. The aspects of Operability and User Error Protection received the highest ratings, indicating that the e-module is easy to operate, control, and provides protection against user errors. The aspects of Appropriateness Recognizability, Learnability, User Interface Aesthetics, and Accessibility also received very satisfactory ratings, suggesting that the e-module is suitable for users' needs, can be effectively learned, provides pleasing interaction, and can be used by a wide range of users. These findings indicate that the e-module demonstrates good usability for maritime information communication and technology with cyber security utilizing an online platform.

3.3 Reliability. Table 8 presents the evaluation by the respondents of the e-module in maritime information communication and technology with cyber security utilizing an online platform in terms of reliability.
The respondents' evaluation of the e-module in maritime information communication and technology with cyber security utilizing an online platform in terms of reliability. The evaluation focuses on four aspects: Maturity, Availability, Fault Tolerance, and Recoverability.

Table 8 Respondents' Evaluation of the e-Module in Terms of Reliability

Reliability	***IT Professionals***		***Maritime ICT Instructors***		***Students***		***Overall***		
	$\bar{WX}$	***VI***	$\bar{WX}$	***VI***	$\bar{WX}$	***VI***	$\bar{WX}$	***VI***	***Rank***
Maturity. The Degree to which the e-Module in MICT with Cyber Security meets the needs for reliability under normal operation	4.78	E	4.00	VS	4.41	VS	4.40	VS	3
Availability. The Degree to which the e-Module in MICT with Cyber Security is operational and accessible when required for use.	4.78	E	3.75	VS	4.36	VS	4.30	VS	4
Fault Tolerance. The Degree to which the e-Module in MICT with Cyber Security operates as intended despite the presence of hardware or software faults.	4.67	E	4.75	E	4.17	VS	4.53	E	1
Recoverability. The degree to which, in the event of an interruption or a failure, the e-Module in MICT with Cyber Security can recover the data directly affected and re-establish the desired state of the system.	4.78	E	4.25	VS	4.30	VS	4.44	VS	2
Over-all $\bar{WX}$	*4.75*	*E*	*4.19*	*VS*	*4.31*	*VS*	*4.42*	*VS*	

Legend: E –Excellent, VS - *Very Satisfactory,* S – *Satisfactory,* F – *Fair,* P- *Poor*

For Maturity, the respondents' evaluation indicates a high level of reliability. The mean scores ($W\bar{X}$) for all three groups are above 4.25, with the IT Professionals rating it the highest at 4.78, reflecting an "Excellent" level of reliability. The aspect of Maturity ranks third among the reliability aspects.

Regarding Availability, the evaluation shows positive ratings from all three groups, although the students group has the lowest mean score at 4.36. The overall mean score for Availability is 4.30, indicating a "Very Satisfactory" level of reliability. This suggests that the e-module is operational and accessible when required for use.

For Fault Tolerance, the respondents' evaluation indicates an excellent level of reliability. The mean scores for IT Professionals, Maritime ICT Instructors, and Students are all above 4.00, with the IT Professionals rating it the highest at 4.67. The overall mean score for Fault Tolerance is 4.53, making it the top-ranked aspect in terms of reliability. This indicates that the e-module can operate as intended despite the presence of hardware or software faults.

The aspect of Recoverability also received positive ratings from all three groups. The mean scores range from 4.25 to 4.78, with an overall mean score of 4.44, indicating a high level of reliability in recovering data and re-establishing the desired state of the system in the event of an interruption or failure.

In summary, the respondents' evaluation of the e-module in maritime information communication and technology with cyber security utilizing an online platform using ISO 25010 shows a generally positive perception of reliability. The aspects of Fault Tolerance and Recoverability received the highest ratings, indicating that the e-module can operate as intended despite faults and can recover from interruptions or failures effectively. The aspects of Maturity and Availability also received satisfactory ratings, suggesting that the e-module meets the needs for reliability under normal operation and is operational and accessible when required. These findings indicate that the e-module demonstrates good reliability for maritime information communication and technology with cyber security utilizing an online platform.

3.4 Performance Efficiency. Table 9 describes the evaluation by the respondents of the e-module in maritime information communication and technology with cyber security utilizing an online platform in terms of performance efficiency.

Table 9 Respondents' Evaluation of the e-Module in Terms of Performance Efficiency

Performance Efficiency	IT Professionals		Maritime ICT Instructors		Students		Overall		
	$W\bar{X}$	VI	$W\bar{X}$	VI	$W\bar{X}$	VI	$W\bar{X}$	VI	Rank
Time behavior. The degree to which the response and processing times and throughput rates of the e-Module in M. MICT with Cyber Security, when performing its functions, meet requirements.	**4.78**	**E**	**4.00**	**VS**	**4.40**	**VS**	**4.39**	**VS**	**3**
Resource utilization. The degree to which the amounts and types of resources used by the e-Module in MICT with Cyber Security, when performing its functions, meet requirements.	**5.00**	**E**	**4.75**	**E**	**4.35**	**VS**	**4.70**	**E**	**1**
Capacity. The degree to which the maximum limits of the e-Module in MICT with Cyber Security parameters meet requirements.	**4.78**	**E**	**4.25**	**VS**	**4.41**	**VS**	**4.48**	**VS**	**2**
Over-all $W\bar{X}$	***4.85***	***E***	***4.33***	***VS***	***4.38***	***VS***	***4. 52***	***E***	

Legend: E –Excellent,* VS - *Very Satisfactory,* S – *Satisfactory,* F – *Fair,* P- *Poor

The evaluation by the respondents of the e-module in maritime information communication and technology with cyber security utilizing an online platform in terms of performance efficiency. The evaluation focuses on three aspects: Time behavior, Resource utilization, and Capacity.

For Time behavior, the respondents' evaluation indicates a high level of performance efficiency. The mean scores ($W\bar{X}$) for all three groups are above 4.30, with the IT Professionals rating it the highest at 4.78, reflecting an "Excellent" level of performance efficiency. The overall mean score for Time behavior is 4.39, suggesting that the e-module meets the requirements for response and processing times and throughput rates.

Regarding Resource utilization, the evaluation shows positive ratings from all three groups, with mean scores ranging from 4.35 to 5.00. The IT Professionals group gives it the highest rating of 5.00, indicating an "Excellent" level of resource utilization. The overall mean score for Resource utilization is 4.70, making it the top-ranked aspect in terms of performance efficiency. This suggests that the e-module effectively uses the required amounts and types of resources.

For Capacity, the respondents' evaluation indicates satisfactory ratings for the e-module. The mean scores range from 4.25 to 4.78, with an overall mean score of 4.48, reflecting a "Very Satisfactory" level of performance efficiency. This indicates that the e-module meets the requirements for the maximum limits of parameters.

In summary, the respondents' evaluation of the e-module in maritime information communication and technology with cyber security utilizing an online platform using ISO 25010 shows a positive perception of performance efficiency. The aspects of Resource utilization and Time behavior received high ratings, indicating that the e-module effectively utilizes resources and meets the requirements for response and processing times. The aspect of Capacity also received a satisfactory rating, suggesting that the e-module meets the requirements for maximum limits of parameters. These findings indicate that the e-module demonstrates good performance efficiency for maritime information communication and technology with cyber security utilizing an online platform.

3.5 Security. Table 10 indicates the evaluation by the respondents of the e-module in maritime information communication and technology with cyber security utilizing an online platform in terms of security.

Table 10 Respondents' Evaluation of the e-Module in Terms of Security

Security	IT Professionals		Maritime ICT Instructors		Students		Overall		
	$W\bar{X}$	*VI*	*$W\bar{X}$*	*VI*	*$W\bar{X}$*	*VI*	*$W\bar{X}$*	*VI*	*Rank*
Confidentiality. The degree to which the e-Module in M.I.C.T. with Cyber Security ensures that data are accessible only to those authorized to have access.	5.00	E	4.75	E	4.33	VS	4.69	E	1
Integrity. The degree to which the e-Module in M.I.C.T. with Cyber Security prevents unauthorized access to, or modification of, computer programs or data.	4.78	E	4.25	VS	4.33	VS	4.45	VS	3
Non-repudiation. The degree to which actions or events can be proven to have taken place so that the events or actions cannot be repudiated later.	4.44	VS	4.00	V4S	4.27	VS	4.24	VS	4
Accountability. The degree to which the actions of an entity can be traced uniquely to the entity.	4.78	E	4.50	E	4.44	VS	4.57	E	2
Authenticity. The degree to which the identity of a subject or resource can be proved to be the one claimed.	4.78	E	3.50	VS	4.42	VS	4.23	VS	5
Over-all $W\bar{X}$	*4.76*	*E*	*4.20*	*VS*	*4.36*	*VS*	*4.44*	*VS*	

Legend: E –Excellent, VS - *Very Satisfactory,* S – *Satisfactory,* F – *Fair,* P- *Poor*

For Confidentiality, the respondents' evaluation indicates an excellent level of security. The mean scores ($W\bar{X}$) for all three groups are above 4.30, with the IT Professionals rating it the highest at 5.00. The overall mean score for Confidentiality is 4.69, suggesting that the e-module effectively ensures that data are accessible only to authorized individuals.

Regarding Integrity, the evaluation shows positive ratings from all three groups, with mean scores ranging from 4.25 to 4.78. The IT Professionals group gives it the highest rating of 4.78, indicating an "Excellent" level of integrity. The overall mean score for Integrity is 4.45, reflecting a "Very Satisfactory" level of security. This suggests that the e-module effectively prevents unauthorized access to or modification of computer programs or data.

For non-repudiation, the respondents' evaluation indicates a very satisfactory rating for the e-module. The mean scores range from 4.00 to 4.44, with an overall mean score of 4.24. This reflects a "Very Satisfactory" level of security, indicating that the e-module provides a reasonable degree of proof for actions or events that have taken place.
In terms of Accountability, the respondents' evaluation indicates a high level of security. The mean scores range from 4.44 to 4.78, with an overall mean score of 4.57, reflecting an "Excellent" level of accountability. This suggests that the e-module enables tracing of actions to specific entities.

Regarding Authenticity, the evaluation shows mixed ratings. The mean scores range from 3.50 to 4.78, with an overall mean score of 4.23, indicating a "Very Satisfactory" level of security. This suggests that the e-module provides a reasonable degree of proof for the claimed identity of a subject or resource.

In summary, the respondents' evaluation of the e-module in maritime information communication and technology with cyber security utilizing an online platform using ISO 25010 shows a positive perception of security. The aspects of Confidentiality, Accountability, and Integrity received high ratings, indicating that the e-module effectively ensures data confidentiality, enables tracing of actions, and prevents unauthorized access or modification. The aspects of Non-repudiation and Authenticity received satisfactory ratings, suggesting reasonable levels of proof for actions or events and claimed identities. These findings indicate that the e-module demonstrates good security in the context of e-module in maritime information communication and technology with cyber security utilizing an online platform.

These implications provide valuable insights into the effectiveness of the developed e-module in Maritime Information Communication and Technology with Cyber Security Utilizing an Online Platform, delivered through, and offer opportunities for improvement and enhancement.

The research indicates that a significant proportion of IT professionals, Maritime ICT Instructors, and students found the e-module effective in delivering Maritime ICT concepts and Cyber Security principles. This suggests that the e-module can serve as an efficient and valuable learning tool for enhancing knowledge and skills in the maritime domain.

The assessment by external and internal validators provides valuable feedback on the content validity of the e-module. The positive evaluation of clear objectives, learning outcomes, and relevant content indicates that the e-module aligns well with the curriculum guide and course objectives. However, the suggestions for improvements highlight the need to continuously review and update the content to ensure accuracy and relevance.

The usability evaluation of the e-module demonstrates overall satisfaction among respondents with the user interface. The high mean scores for operability and user error protection indicate that the e-module is easy to navigate and operate. This emphasizes the importance of designing user-friendly interfaces to enhance the overall learning experience.

The positive assessment of the reliability and performance efficiency of the e-module by IT professionals, Maritime ICT Instructors, and students is crucial in ensuring that the learning platform operates smoothly and efficiently. Addressing any potential hardware or software faults and optimizing resource usage can lead to a seamless learning experience.

The evaluation of security aspects is essential in ensuring the protection of sensitive data and restricting access to authorized users. The positive assessment of data accessibility and traceability implies that the e-module's security measures are effective in safeguarding information.

The identified problems encountered by respondents, such as inaccurate content and usability issues, provide specific areas for improvement. Addressing these challenges can lead to a more effective and satisfactory learning experience for users.

The research highlights the importance of continuous development and training for maritime professionals and instructors to stay updated with the latest advancements in Maritime ICT and Cyber Security. The e-module can be used as a valuable resource for ongoing professional development.
The positive evaluation by Maritime ICT Instructors and students emphasizes the potential of e-modules to offer inclusive education opportunities, reaching a wider audience and accommodating diverse learning preferences.

The findings of this study can contribute to policy and curriculum development in maritime education and training. The incorporation of e-learning modules and Cyber Security topics in the curriculum can prepare future maritime professionals to tackle evolving challenges in the digital era.

The research opens avenues for future studies on e-learning effectiveness, content development, and user experience in the maritime domain. Collaborative efforts between academia, industry, and policymakers can lead to more comprehensive and innovative e-learning solutions.

5. The Difference Between the Evaluation by the IT Professionals, Maritime ICT Instructors, and Students of the System Aspects on the Variables Above

The analysis of differences between the evaluation by IT Professionals, Maritime ICT Instructors, and Students on the system aspects of the e-module in maritime information communication and technology with cyber security utilizing an online platform.

Table 11 Kruskal Wallis H Test Values Obtained Between the Evaluation of IT Professionals, Maritime ICT Instructors, and Students in the System Aspects of e-Module in Maritime Information Communication and Technology with Cyber Security Utilizing an Online Platform

Variables	IT Professionals	Maritime ICT Instructors	Students	X^2 value	p-value	Decision	Remarks
	$W\bar{X}$	$W\bar{X}$	$W\bar{X}$				
Functionality Suitability	4.85	4.58	4.31	6.038	0.049	*Reject Ho*	Significant
Usability	4.76	4.29	4.36	3.254	0.197	*Accept Ho*	Not significant
Reliability	4.75	4.19	4.31	4.389	0.111	*Accept Ho*	Not significant
Performance Efficiency	4.85	4.33	4.38	4.936	0.085	*Accept Ho*	Not significant
Security	4.76	4.20	4.36	4.527	0.104	*Accept Ho*	Not significant

For the aspect of Functionality Suitability, there is a significant difference among the groups. The X2 value is 6.038, and the p-value is 0.049. Since the p-value is less than the significance level of 0.05, the null hypothesis (Ho) is rejected, indicating a significant difference in the evaluation of Functionality Suitability among the groups. This means that IT Professionals have a notably higher evaluation of functionality suitability compared to Maritime ICT Instructors and Students.

For the aspects of Usability (p = 0.197), Reliability (p = 0.111), Performance Efficiency (p = 0.085), and Security (p = 0.104), there are no significant differences among the groups. The p-values for these aspects are all above the significance level of 0.05, indicating that the null hypothesis (Ho) is not rejected. Therefore, there are no significant differences in the evaluation of these aspects among IT Professionals, Maritime ICT Instructors, and Students.

In summary, based on the analysis, there is a significant difference in the evaluation of Functionality Suitability among the groups. However, there are no significant differences in the evaluation of Usability, Reliability, Performance

Efficiency, and Security. This suggests that the perceptions of IT Professionals, Maritime ICT Instructors, and Students are relatively consistent in terms of Usability, Reliability, Performance Efficiency, and Security aspects of the e-module. Alrabai and Alasmari (2019) revealed that the comprehension of cyber security concepts among maritime students in Saudi Arabia was largely satisfactory, albeit with some scope for enhancement in certain domains. The implication here is that the provision of diverse learning avenues, such as e-learning platforms, is of utmost significance in equipping students with the necessary skills to effectively tackle contemporary cyber security challenges.

According to the data presented in the table, it can be inferred that the e-module exhibited a notably high level of performance efficiency. The findings indicate that the electronic module demonstrated effectiveness regarding its response and processing durations, throughput frequencies, and utilization of resources. Consistent with this notion, Al-Qatawneh et al., (2021) conducted a study which revealed that the efficacy of e-learning modules can be significantly influenced by performance efficiency. This implies that the e-module created by the present study has the potential to enhance student learning, if it is efficient. Additionally, Al-Zahrani et al., (2021) conducted a study which revealed that various factors, including content quality, user interface, and technical infrastructure, can impact performance efficiency. The implication of this finding is that the efficacy of the e-module produced by the present investigation could be contingent upon the provision of superior content, an interface that is easy to navigate, and a dependable technical framework.

6. The Problems Encountered by the Respondents in the Use of the e-Module

The successful implementation of e-module in Maritime Information and Communication Technology with Cyber Security, through the utilization of online platforms, has undoubtedly brought about significant advancements in the education of maritime students. Nevertheless, it is crucial to acknowledge that these transformative technologies are not without their share of challenges. In this section, we delve into the specific problems faced by the respondents while utilizing the e-module in Maritime ICT with Cyber Security on an online platform.

Table 12 presents the problems encountered by the IT Professionals, Maritime ICT Instructors, and Students while using the e-Module in Maritime ICT with Cyber Security through an online platform. The table includes the interview questions, the corresponding answers provided by each group of respondents, and their respective frequencies and percentages.

For the first question, which asks whether the e-Module is effective, all IT professionals responded positively, indicating a 100% agreement on its effectiveness. Among Maritime ICT Instructors, 75% agreed that it is effective, while 25% disagreed. Among students, the majority, 93%, found the e-Module effective, while 7% disagreed.

The second question inquired about the problems encountered while using the e-Module. IT professionals reported no significant problems, with 89% stating that they encountered none.

However, 11% mentioned other issues. Maritime ICT Instructors encountered problems related to the slow system loading (25%) and the lack of exercises/assessments in the e-module content (50%). Similarly, among students, 62% stated that they had no problems, while 16% reported issues with the slow system loading and the lack of exercises/assessments. An additional 6% mentioned other problems.
The third question asked about the frequency of encountering problems in the e-Module. All IT professionals stated that they never encountered problems, while 75% of Maritime ICT Instructors reported the same. Among students, 79% mentioned never encountering problems, 11% encountered problems always, and 10% mentioned encountering problems at other times.

Table 12 Problems Faced by the Respondents while Using the e-Module in Maritime ICT with Cyber Security Utilizing an Online Platform

Item No	Interview Questions	Answers	IT Professionals		Maritime ICT Instructor		Students	
			f	%	f	%	f	%
1	Is the e-Module in Maritime Information Communication Technology with Cyber Security Utilizing an Online Platform Effective?	Yes	9	100%	3	75%	75	93%
		No	0	0%	1	25%	6	7%
Total			**9**	**100%**	**4**	**100%**	**81**	**100%**
2	What are the problems you encountered while using the e-Module in Maritime Information Communication Technology with Cyber Security Utilizing an Online Platform?	System loading slow	0	0%	1	25%	13	16%
		Lack of Exercises /Assessments in the e-module Content	0	0%	2	50%	13	16%
		None	8	89%	1	25%	50	62%
		Others	1	11%	0	0%	5	6%
Total			**9**	**100%**	**4**	**100%**	**81**	**100%**
3	How many times do you encounter problems in the e-Module in Maritime Information Communication Technology with Cyber Security Utilizing an Online Platform?	Never	9	100%	3	75%	64	79%
		Always	0	0%	0	0%	9	11%
		Others	0	0%	1	25%	8	10%
Total			**9**	**100%**	**4**	**100%**	**81**	**100%**
4	Which part of the e-Module in Maritime Information Communication Technology with Cyber Security Utilizing an Online Platform would you like to recommend a subject for improvement?	Content of the Module	2	22%	1	25%	30	37%
		Online Platform	1	11%	2	50%	31	38%
		None	6	67%	1	25%	20	25%
Total			**9**	**100%**	**4**	**100%**	**81**	**100%**

Legend: f - *frequency*, **%** - *Percentage*

The fourth question aimed to identify the areas of the e-Module that respondents would like to recommend for improvement. Among IT professionals, 22% recommended improving the content of the module, while 11% mentioned the online platform. The majority, 67%, did not specify any part for improvement. Among Maritime ICT Instructors, 25% recommended improving the content of the module, 50% mentioned the online platform, and 25% did not specify any part for improvement. Among students, 37% recommended improving the content of the module, 38% mentioned the online platform, and 25% did not specify any part for improvement.

According to the data presented in the table, a significant proportion of the IT professionals who participated in the survey did not experience any difficulties when utilizing the e-module. Nonetheless, a minority of participants reported encountering certain issues, such as erroneous inputs and incomplete exercises/evaluations. The study participants put forth the notion that enhancing the quality of the module's content and the online platform could be beneficial. Aligned with this notion, Al-Qatawneh et al., (2021) conducted a study that revealed that technical difficulties were the most

frequently encountered issues faced by users of e-learning modules. The current table's results align with the user's statement, indicating that a minority of participants experienced difficulties related to erroneous data inputs and incomplete exercises/evaluations. Al-Qatawneh et al., (2022) conducted a study that identified the primary factors that influence the efficacy of e-learning modules. The study revealed that the quality of the content, user interface, and technical infrastructure were the most significant determinants of effectiveness. The current study's results align with the aforementioned statement, as participants who provided feedback on enhancing the e-module identified both the substance and the digital interface as areas for improvement.

In summary, the majority of IT professionals, Maritime ICT Instructors, and students found the e-Module in Maritime ICT with Cyber Security utilizing an online platform to be effective. However, some issues were encountered, such as slow system loading and the lack of exercises/assessments in the content. Overall, the majority of respondents did not encounter problems, and most were satisfied with the e-Module's content and online platform.

7. A User's Guide for the e-Module in Maritime Information Communication and Technology with Cyber Security Utilizing an Online Platform

The researcher-made user's guide serves as a comprehensive and detailed resource that encapsulates the entirety of the content within the e-module, focusing on maritime information communication and technology with cyber security utilizing an online platform. This guide is meticulously designed to provide users with a step-by-step roadmap for effectively utilizing and accessing the online platform.

About EduLearn Tool

EduLearn-Tool is an e-module that was developed to steer teaching in ICT (Maritime Information Communication and Technology with Cyber Security) for maritime students in a simple form to facilitate the learning process and enable them to picture out the subject matter. The sequence of topics was based on Annex D-1 of the Joint CHED-Marina Memorandum Circular, 01 Series of 2022. (JCMMC-01 s. 2022).

This course introduces the fundamentals of ICT technologies and systems. It includes topics on the introduction to computer systems, computer hardware, and storage devices; basic computer hardware and software services with troubleshooting; software productivity tools; data communication and computer networks; cyber security; and emerging technologies in the fourth industrial revolution. The students in this course are going to be immersed in interactive discussions as well as various activities. Lastly, at the end of the course, the students are expected to be able to effectively use computer devices and applications to help them manage cyber security.

The content of the EduLearn-Tool was done in PDF file format and attached to the Google site and the classwork tab of Google Classroom. Additionally, the EduLearn-Tool can be accessed using Google Lens or an equivalent application; make sure that the application is installed on the mobile phone before scanning the QR codes found on the user's guide. Scan the QR code available in every learning outcome to access the content of the EduLearn-Tool. The Self-check/Exercise can be accessed through Google Forms, and it will be found at the end of every learning content of the e-Module. You have an unlimited chance to take the Self-check/Exercise given in every learning outcome to ensure that the required outcomes are acquired.

Conclusion

Based on the findings of the study, the following conclusions are drawn:
The e-module developmental phases, as outlined in this study has provided a comprehensive framework for developing an e-module for maritime information communication and technology focusing on cybersecurity. The sequential stages, which include analysis, design, development, implementation, and evaluation, have been thoroughly outlined and explained. This framework serves as a valuable guide for creating effective and secure e-modules in the maritime industry, ensuring the integration of cybersecurity measures throughout the development process.

In the evaluation of acceptability, the-module has received favorable acceptance ratings from external and internal validators, indicating its adherence to curricular criteria and effectiveness in delivering concise information and suitable evaluations. The positive reception of the educational tool can be attributed to various factors, including its presentation, style, objectives/learning outcomes, and content. These elements collectively contribute to its success as an educational tool within the specific environment it is designed for.

In terms content validity, a notable disparity exists between the assessments of external and internal validators concerning the objectives/learning outcomes and assessments of the e-module.

In the assessment of system aspects, The evaluation of the e-module by IT professionals, Maritime ICT instructors, and students, based on the ISO/IEC 25010 criteria, has yielded positive ratings across multiple dimensions, including functionality suitability, usability, reliability, performance efficiency, and security. These favorable assessments collectively affirm that the e-module effectively fulfills its intended functions and successfully meets the diverse needs of its user base.

The realm of users consistency, the evaluation of the e-module's system aspects by IT professionals, Maritime ICT instructors, and students have revealed a remarkable consistency in their assessments. They have a shared perception of the e-module's effectiveness and usability among these distinct user groups.

The study has uncovered several challenges faced by users of the e-module. IT professionals expressed concerns about outdated content and encountered difficulties with the online platform, while Maritime ICT instructors and students also reported minor issues.

The study recommends developing a user guide to enhance the overall user experience. This guide will prioritize incorporating user-friendly features and recommend using platforms such as Google Sites, Google Classroom, and Google Lens application (or equivalent alternatives) to improve content accessibility. Furthermore, self-assessment exercises are suggested to empower users to verify and consolidate their knowledge, ultimately contributing to a more effective and engaging learning experience with the e-module.

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