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Redirecting challenges and benefits on the use of Artificial Intelligence for academic policy formulation in a maritime institution

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Abstract

Aim: This study aimed to determine the perceived benefits and challenges of integrating Artificial Intelligence (AI) in teaching professional maritime courses among maritime instructors in a private higher maritime education institution in the Negros Island Region and to provide a basis for institutional AI governance, academic policy development, and faculty capacity-building initiatives supporting AI adoption.

Methodology: A descriptive-survey research design was employed to collect quantitative data from 56 maritime instructors selected through purposive sampling. Data were gathered using a researcher-made and validated questionnaire. Mean and standard deviation were used to determine the perceived benefits and challenges of AI integration, while the Kruskal-Wallis test was utilized to determine significant differences in perceptions when respondents were grouped according to age and socio-economic status.

Results: Findings revealed that AI integration was perceived as highly beneficial in terms of improved efficiency, enhanced learning experiences, and access and equity. Conversely, faculty training and development, data privacy concerns, plagiarism and academic integrity, digital divide, and computer facilities and resources were perceived as very challenging aspects of AI implementation. Statistical analysis indicated no significant differences in most perceptions when respondents were grouped according to age and socio-economic status, except for improved efficiency, which significantly differed across socio-economic groups.

Conclusion: Maritime instructors recognize the substantial potential of AI to improve instructional delivery, enhance learning experiences, and support digital innovation in maritime education. However, successful AI integration requires addressing challenges related to faculty readiness, data privacy, academic integrity, digital inclusion, and technological infrastructure. The findings provide valuable insights for institutional AI governance, academic policy development, and faculty capacity-building initiatives that promote responsible AI adoption and digital transformation within maritime higher education institutions.

Keywords: *artificial intelligence, maritime education, AI governance, digital transformation, AI integration*

INTRODUCTION

Artificial Intelligence (AI) has emerged as a key driver of digital transformation across governments, industries, and educational institutions worldwide. Recent advances in generative AI, large language models, intelligent automation, and predictive analytics have accelerated the development of data-driven ecosystems that enhance decision-making, innovation, and organizational efficiency. As part of Industry 4.0 and Society 5.0 initiatives, AI technologies are increasingly integrated into smart industries, digital platforms, and knowledge-intensive sectors, creating new opportunities for human–AI collaboration and workforce transformation. Consequently, organizations are placing greater emphasis on AI governance, digital readiness, and responsible technology adoption to ensure that innovation remains transparent, ethical, inclusive, and sustainable (Organisation for Economic Co-operation and Development [OECD], 2024; United Nations Educational, Scientific and Cultural Organization [UNESCO], 2023; World Economic Forum, 2025).

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The maritime sector is likewise experiencing rapid digital transformation through the adoption of autonomous systems, intelligent navigation technologies, predictive maintenance platforms, digital twins, and AI-assisted decision-support systems. These innovations are reshaping maritime operations and increasing demand for professionals who possess both maritime expertise and digital competencies. As a result, Maritime Education and Training (MET) institutions are challenged to develop future-ready graduates capable of operating within increasingly automated and AI-enabled maritime environments. AI-supported educational technologies offer opportunities to enhance simulation-based learning, competency assessment, adaptive instruction, and operational decision-making that align with evolving industry requirements. In the Philippines, maritime education plays a vital role in producing competent seafarers for the global shipping industry. As maritime institutions continue to pursue digital transformation and technology-enhanced learning initiatives, AI presents opportunities to improve instructional effectiveness, faculty productivity, personalized learning, and student engagement (Al Darayseh, 2023; Chan, 2023; Estrellado & Miranda, 2023).

Despite the growing adoption of AI across higher education, limited empirical evidence exists regarding AI readiness, governance mechanisms, and digital transformation strategies within maritime higher education institutions. Existing studies primarily focus on AI acceptance among students and general educators, while relatively few investigate how maritime instructors perceive AI integration and how these perceptions can inform institutional AI governance frameworks, digital transformation roadmaps, and responsible AI implementation strategies. Furthermore, limited research has examined these issues within the Philippine maritime education context, where digital transformation initiatives and AI adoption continue to evolve.

Addressing this gap is important because maritime instructors play a critical role in translating technological innovations into instructional practices, institutional policies, and organizational strategies. Therefore, this study examined the perceived benefits and challenges of integrating AI in teaching professional maritime courses and explored how these findings may contribute to the formulation of academic policy recommendations and faculty development initiatives that support responsible AI adoption, digital transformation, and institutional AI readiness in maritime education. The study contributes to the growing body of knowledge on AI adoption, institutional AI readiness, responsible AI implementation, and digital transformation by providing evidence-based insights that may guide policy development, faculty capacity-building initiatives, and technology governance strategies within maritime higher education institutions.

Review of Related Literature and Studies

This section examines relevant literature on Artificial Intelligence (AI) adoption, digital transformation, and responsible AI implementation in educational settings, particularly in higher education and maritime education. It explores the benefits of AI in enhancing learning experiences, improving instructional efficiency, and expanding access to educational resources, as well as the challenges associated with faculty readiness, academic integrity, data privacy, technological infrastructure, and AI governance. The review also examines the growing importance of institutional AI readiness and governance frameworks in supporting sustainable and ethical AI integration.

Artificial Intelligence has emerged as a transformative technology capable of enhancing teaching, learning, and institutional operations. Studies have shown that AI supports personalized learning, adaptive instruction, learning analytics, and data-driven decision-making, enabling more efficient and responsive educational environments (Al Darayseh, 2023; Singh & Hiran, 2022). The increasing adoption of generative AI tools has further expanded opportunities for content creation, assessment support, and learner engagement, positioning AI as a key component of educational innovation and digital transformation (Kasneci et al., 2023). Similarly, Al Darayseh (2023) reported that teachers generally demonstrated favorable attitudes toward AI when they recognized its potential to enhance teaching and learning outcomes.

Despite its potential benefits, AI adoption presents significant technological, ethical, and organizational challenges. Issues related to data privacy, security, transparency, bias, and academic integrity have become increasingly important as AI technologies become more integrated into educational environments (U.S. Department of Education, Office of Educational Technology, 2023). The widespread availability of generative AI tools has also intensified concerns regarding plagiarism, misinformation, and the responsible use of AI-generated content. Faculty readiness remains another critical factor influencing successful AI implementation. Celik et al. (2022) emphasized that educators require adequate digital competencies, training, and institutional support to effectively integrate AI into teaching and learning. These findings suggest that successful AI adoption requires not only technological infrastructure but also governance mechanisms that promote accountability, transparency, and ethical AI use.

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Recent literature highlights the importance of institutional AI readiness in supporting sustainable AI adoption and digital transformation initiatives. AI readiness encompasses technological infrastructure, faculty competencies, governance mechanisms, leadership support, organizational culture, and governance capacity necessary for effective AI implementation (OECD, 2024). Institutions that invest in readiness initiatives are better positioned to integrate AI technologies while managing associated risks and challenges. Digital transformation in education extends beyond technology adoption and involves the strategic integration of digital tools, processes, and governance frameworks that enhance educational quality and organizational performance. UNESCO (2023) emphasized that institutions should develop responsible AI policies, capacity-building programs, and monitoring mechanisms to ensure that AI technologies are used ethically and effectively. The maritime industry is increasingly adopting AI-enabled technologies, including autonomous systems, intelligent navigation platforms, predictive maintenance systems, and data-driven decision-support tools. As a result, Maritime Education and Training (MET) institutions are expected to prepare graduates who can operate within technologically advanced maritime environments (Pedroso et al., 2021). Taeihagh (2021) noted that challenges related to technological readiness and governance must be addressed to maximize the benefits of AI integration within maritime education.

Despite substantial research on AI adoption in education, several important gaps remain. First, most studies focus on students and general educators, with limited attention given to maritime instructors operating within specialized and technology-intensive learning environments. Second, existing research primarily examines educational outcomes and user perceptions while providing limited discussion of institutional AI readiness, AI governance, and digital transformation strategies. Third, limited empirical evidence exists regarding responsible AI implementation within Philippine maritime higher education institutions. Finally, few studies have explored how perceptions of AI benefits and challenges can be translated into AI governance frameworks, readiness models, and institutional strategies that support sustainable digital innovation (World Economic Forum, 2025).

The reviewed literature demonstrates that AI offers significant opportunities to improve learning experiences, instructional efficiency, and educational accessibility while supporting broader digital transformation initiatives (Al Darayseh, 2023; Singh & Hiran, 2022). However, challenges related to faculty readiness, data privacy, academic integrity, technological infrastructure, and responsible AI governance continue to influence successful implementation (Celik et al., 2022; Chan, 2023; UNESCO, 2023). Although previous studies have examined AI adoption in higher education, limited research has focused on maritime education, particularly within the Philippine context. Existing studies rarely explore how maritime instructors' perceptions can inform institutional AI readiness, governance frameworks, and digital transformation strategies.

Theoretical Framework

This study was anchored on the Technology Acceptance Model (TAM) developed by Davis (1989), which explains how individuals accept and use new technologies. The model proposes that technology adoption is primarily influenced by two factors: Perceived Usefulness, which refers to the degree to which an individual believes that a technology will enhance job performance, and Perceived Ease of Use, which refers to the degree to which an individual believes that using the technology will require minimal effort. These two factors influence an individual's attitude toward technology and, ultimately, the intention to adopt and utilize it.

The Technology Acceptance Model has been widely applied in studies involving educational technology adoption because it provides a framework for understanding educators' and learners' perceptions toward emerging technologies (Al Darayseh, 2023; Kim & Kim, 2022). In the context of Artificial Intelligence (AI) integration in education, perceived usefulness is reflected in the extent to which educators believe that AI can improve instructional delivery, enhance learning experiences, increase efficiency, and promote access to educational resources. Conversely, perceived ease of use may be influenced by challenges related to faculty training and development, data privacy concerns, academic integrity issues, the digital divide, and the availability of technological resources.

In addition to TAM, this study was informed by the concept of Responsible Artificial Intelligence in Education as emphasized by UNESCO (2023). The framework highlights that successful AI integration extends beyond technological acceptance and requires consideration of ethical principles, transparency, accountability, inclusivity, and data protection. The concept of AI Readiness further supports the study by emphasizing institutional preparedness, technological infrastructure, human resource capability, governance mechanisms, and organizational support required for successful AI implementation.

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Conceptual Framework

The conceptual framework of the study is presented using the Input-Process-Output (IPO) model. The input consists of the perceived benefits of Artificial Intelligence (AI) integration, namely enhanced learning experiences, improved efficiency, and access and equity, as well as the perceived challenges, including faculty training and development, data privacy concerns, academic integrity, digital divide, and computer facilities and resources. These variables represent the factors influencing AI adoption in maritime education.

The process involves the integration of AI in maritime education through the assessment and analysis of maritime instructors' perceptions regarding the benefits and challenges of AI use in teaching professional maritime courses. This stage evaluates institutional readiness, identifies areas requiring support, and determines factors affecting effective AI implementation.

The output of the study is the development of Academic Policy Formulation and Faculty Development Initiatives that support responsible Artificial Intelligence (AI) adoption and digital transformation in maritime education. These initiatives are intended to guide maritime institutions in strengthening institutional AI readiness, promoting responsible AI governance, enhancing faculty competencies, addressing data privacy and academic integrity concerns, and supporting sustainable technology integration.

The framework was developed by the researchers based on the Technology Acceptance Model (Davis, 1989), Responsible Artificial Intelligence in Education (UNESCO, 2023), and institutional AI readiness principles discussed in recent AI governance literature.

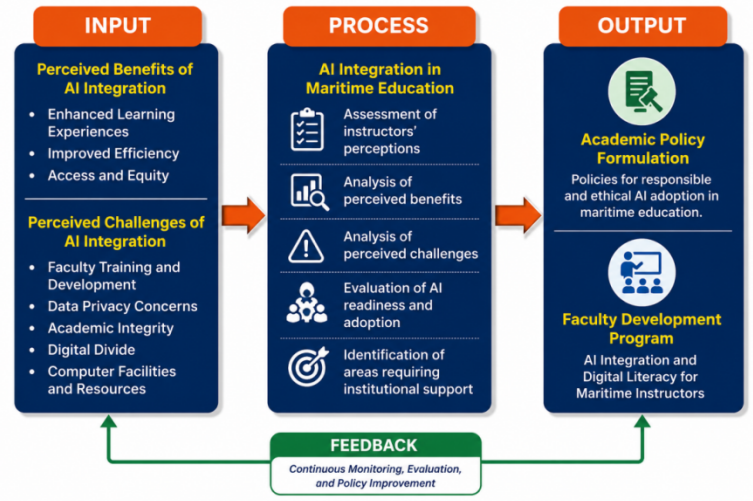

Figure 1
Input–Process–Output (IPO) Model of the study

Statement of the Problem

The rapid advancement of Artificial Intelligence (AI) technologies has accelerated digital transformation across educational institutions worldwide. AI-powered systems are increasingly utilized to support instructional delivery, learning analytics, academic decision-making, and administrative processes. However, successful AI adoption requires not only technological infrastructure but also institutional readiness, responsible AI governance, faculty competence, data privacy protection, and mechanisms that uphold academic integrity.

Within maritime higher education, the integration of AI has become increasingly important due to the growing digitalization of maritime operations, intelligent navigation systems, automation technologies, and data-driven maritime decision-making. As maritime institutions prepare future professionals for technology-driven environments, understanding the opportunities and barriers associated with AI integration has become a critical concern.

Despite growing scholarly attention to AI adoption in higher education, existing studies have largely focused on students and general educational contexts. Limited research has examined maritime instructors' perceptions regarding the benefits and challenges of AI integration, particularly within Philippine maritime higher education

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institutions. Furthermore, limited evidence exists regarding how these perceptions may support institutional AI governance, academic policy development, and faculty development initiatives that promote responsible and effective AI adoption.

Given these technological and institutional challenges, there is a need to investigate maritime instructors' perceptions of AI integration in teaching professional maritime courses. The findings of this study may contribute to AI governance, digital transformation initiatives, faculty capacity building, and policy development that support responsible AI implementation in maritime education.

Research Objectives

General Objective

This study aimed to determine the perceived benefits and challenges of Artificial Intelligence (AI) integration in teaching professional maritime courses among maritime instructors in a private higher maritime education institution in the Negros Island Region and to provide a basis for academic policy formulation and faculty development initiatives that support responsible AI adoption and digital transformation.

Specific Objectives

Specifically, this study sought:

1. To determine the perceived benefits of AI integration in teaching professional maritime courses in terms of:
   a. enhanced learning experiences;
   b. improved efficiency; and
   c. access and equity.
2. To determine the perceived challenges of AI integration in teaching professional maritime courses in terms of:
   a. computer facilities and resources;
   b. data privacy concerns;
   c. plagiarism and academic integrity;
   d. digital divide; and
   e. faculty training and development.
3. To determine whether significant differences exist in the perceived benefits of AI integration when maritime instructors are grouped according to:
   a. age; and
   b. socio-economic status.
4. To determine whether significant differences exist in the perceived challenges of AI integration when maritime instructors are grouped according to:
   a. age; and
   b. socio-economic status.
5. To formulate academic policy recommendations and faculty development initiatives that support responsible AI adoption, digital transformation, and institutional AI readiness in maritime education.

Research Questions

1. What are the perceived benefits of AI integration in teaching professional maritime courses in terms of:
   a. enhanced learning experiences;
   b. improved efficiency; and
   c. access and equity?
2. What are the perceived challenges of AI integration in teaching professional maritime courses in terms of:
   a. computer facilities and resources;
   b. data privacy concerns;
   c. plagiarism and academic integrity;
   d. digital divide; and
   e. faculty training and development?
3. Is there a significant difference in the perceived benefits of AI integration when maritime instructors are grouped according to:

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a. age; and
b. socio-economic status?

4. Is there a significant difference in the perceived challenges of AI integration when maritime instructors are grouped according to:
   a. age; and
   b. socio-economic status?
5. What academic policy recommendations and faculty development initiatives may be proposed to support responsible AI adoption and digital transformation in maritime education?

Hypotheses

H01: There is no significant difference in the perceived benefits of AI integration in teaching professional maritime courses when maritime instructors are grouped according to age.
H02: There is no significant difference in the perceived benefits of AI integration in teaching professional maritime courses when maritime instructors are grouped according to socio-economic status.
H03: There is no significant difference in the perceived challenges of AI integration in teaching professional maritime courses when maritime instructors are grouped according to age.
H04: There is no significant difference in the perceived challenges of AI integration in teaching professional maritime courses when maritime instructors are grouped according to socio-economic status.

METHODS

Research Design

This study employed a quantitative descriptive-survey research design focusing on Artificial Intelligence (AI) adoption, institutional AI readiness, and digital transformation in maritime education. The descriptive-survey approach was deemed appropriate because it enabled the researchers to systematically collect, analyze, and interpret maritime instructors' perceptions regarding the benefits and challenges of AI integration in teaching professional maritime courses without manipulating any variables.

Specifically, the study examined key factors influencing AI adoption, including enhanced learning experiences, improved efficiency, access and equity, faculty readiness, data privacy concerns, academic integrity, digital divide, and technological infrastructure.

Furthermore, the descriptive-survey design allowed the researchers to determine whether significant differences existed in the perceived benefits and challenges of AI integration when respondents were grouped according to age classification and socio-economic status. The findings may contribute to AI governance, digital transformation initiatives, faculty capacity building, and policy development that support responsible AI implementation in maritime education.

Population and Sampling

The study population consisted of 56 maritime instructors teaching professional maritime courses in a private higher maritime education institution in the Negros Island Region. A purposive sampling technique was employed to select participants who possessed relevant experience and knowledge regarding the use and integration of Artificial Intelligence (AI) in maritime education. To qualify for participation, respondents were required to be currently employed as maritime instructors and actively engaged in teaching professional maritime subjects during the conduct of the study.

The primary data source of the study was the survey responses obtained from the participating maritime instructors within the institution's digital learning environment. The data focused on the perceived benefits of AI integration, including enhanced learning experiences, improved efficiency, and access and equity, as well as the perceived challenges related to computer facilities and resources, data privacy concerns, academic integrity, digital divide, and faculty training and development. These data served as the basis for assessing AI adoption, institutional AI readiness, and opportunities for digital transformation in maritime education.

Instrument

Data were collected using a researcher-made questionnaire developed based on existing literature related to Artificial Intelligence integration in education. The instrument consisted of two major parts: perceived benefits of AI

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integration, including enhanced learning experiences, improved efficiency, and access and equity; and perceived challenges of AI integration, including, computer facilities and resources, data privacy concerns, plagiarism and academic integrity, digital divide, and faculty training and development.

The questionnaire underwent content and face validation by a panel of five experts consisting of a research content specialist, a statistician, a grammarian, and two Information Technology practitioners. Content validation using Lawshe's Content Validity Ratio (CVR) yielded a score of 1.00, while face validation resulted in an overall rating of 4.91, interpreted as *Very Good*. A pilot test involving 30 maritime instructors from another maritime institution was conducted to determine reliability. Using Cronbach's Alpha, the instrument obtained a reliability coefficient of 0.951, indicating excellent reliability and confirming its suitability for data collection.

Data Collection

Data collection was conducted during the second semester of Academic Year 2023–2024. Prior to the administration of the survey, permission to conduct the study was secured from the institution's administration. The validated questionnaire was then distributed to qualified maritime instructors who were actively teaching professional maritime courses during the conduct of the study. These instructors were selected because they regularly utilized digital technologies and educational platforms in their teaching and were part of an academic environment where Artificial Intelligence (AI) tools and generative AI applications were becoming increasingly accessible and relevant to instructional practice.

The purpose of the study, including its focus on the perceived benefits and challenges of AI integration in maritime education, was explained to the respondents. Instructions regarding the completion of the questionnaire were likewise provided to ensure consistency in responses. The survey was administered using a pen-and-paper format, allowing respondents to manually complete the questionnaire. Respondents were given sufficient time to accomplish the instrument before retrieval. Upon collection, the completed questionnaires were checked for completeness, organized, encoded into a digital database, and prepared for statistical analysis.

Treatment of Data

The data collected from the respondents were tabulated, encoded, and analyzed using IBM Statistical Package for the Social Sciences (SPSS) Statistics Version 25. Descriptive statistics, including frequency counts, percentages, means, and standard deviations, were utilized to summarize the respondents' perceptions regarding the benefits and challenges of AI integration in maritime education.

Inferential statistical analysis was performed using the Kruskal-Wallis H Test to determine significant differences in respondents' perceptions when grouped according to age classification and socio-economic status. The Kruskal-Wallis H Test was selected because it is a non-parametric statistical test appropriate for comparing three or more independent groups when the assumptions of normality and homogeneity of variance may not be satisfied. Given the study's relatively small sample size and the ordinal nature of Likert-scale responses, the use of a non-parametric test provided a more robust and appropriate method for examining group differences. All statistical analyses were interpreted using a 0.05 level of significance.

Ethical Considerations

The researchers secured permission from the concerned institutional authorities prior to the conduct of the study. Participation in the study was voluntary, and respondents were informed of the purpose, procedures, and expected outcomes of the research before data collection commenced. Informed consent was obtained from all participants, and they were assured that their participation or non-participation would not result in any form of advantage or disadvantage.

To protect respondents' privacy, anonymity and confidentiality were strictly maintained throughout the study. No personally identifiable information was collected, and all responses were treated with utmost confidentiality. The data gathered were used solely for academic and research purposes and were stored securely to prevent unauthorized access. The researchers ensured that the study adhered to accepted ethical standards in educational research and respected the rights, dignity, and welfare of all participants.

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Responsible AI and Digital Governance Ethics

The study recognizes the importance of responsible Artificial Intelligence (AI) practices in educational environments. In addition to adhering to established research ethics principles, the researchers considered key aspects of responsible AI adoption, including transparency, accountability, privacy protection, fairness, and ethical use of AI technologies. Given the increasing integration of AI and generative AI applications in education, attention was given to issues related to data governance, academic integrity, and the responsible use of digital technologies.

Furthermore, the interpretation of findings and the development of the proposed Academic Policy Formulation and Faculty Development Initiatives were guided by the principles of responsible AI and digital governance. These principles emphasize the need for institutional policies and practices that promote ethical AI implementation, safeguard stakeholder data, ensure transparency in AI-assisted processes, and support the responsible use of emerging technologies in teaching and learning. By incorporating these considerations, the study contributes to the promotion of trustworthy and sustainable AI adoption within maritime education institutions.

RESULTS AND DISCUSSION

This section presents the findings of the study through the systematic presentation, analysis, and interpretation of data gathered from maritime instructors regarding the perceived benefits and challenges of integrating Artificial Intelligence (AI) in teaching professional maritime courses. The results are organized according to the research objectives and are discussed in relation to relevant literature and existing studies on AI adoption, institutional AI readiness, and digital transformation in education.

Table 1

Overall Means and SDs of the Perceived Benefit of Integrating AI in Teaching Professional Maritime Courses

Items	Overall Mean	SD	Description
Improved Efficiency	3.59	.40	Highly Beneficial
Access and Equity	3.47	.46	Highly Beneficial
Enhanced Learning Experiences	3.46	.46	Highly Beneficial

*Note

Scale	*Description*
3.26 – 4.00	Highly Beneficial
2.51 – 3.25	Beneficial
1.76 – 2.50	Less Beneficial
1.00 – 1.75	Not Beneficial

Table 1 presents the perceived benefits of integrating Artificial Intelligence (AI) in teaching professional maritime courses. Results revealed that all indicators were rated as Highly Beneficial, indicating a positive perception of AI integration among maritime instructors. Among the indicators, Improved Efficiency obtained the highest mean (M = 3.59, SD = 0.40), followed by Access and Equity (M = 3.47, SD = 0.46) and Enhanced Learning Experiences (M = 3.46, SD = 0.46). These findings suggest that respondents view AI primarily as a tool that enhances instructional productivity, streamlines routine academic tasks, and improves access to educational resources.

The findings support the Technology Acceptance Model (TAM), which posits that technologies are more likely to be accepted when users perceive them as useful in improving job performance (Davis, 1989). The high rating for improved efficiency indicates that instructors recognize the ability of AI tools to automate repetitive tasks, assist in content development, and provide timely feedback. Similar findings were reported by Al Darayseh (2023), who found that educators demonstrated positive attitudes toward AI when they perceived it as useful and beneficial to teaching. Likewise, Singh and Hiran (2022) noted that AI enhances efficiency in educational processes through data-driven decision-making and instructional support. The high ratings for access and equity and enhanced learning experiences further suggest that maritime instructors acknowledge AI's potential to provide personalized learning opportunities and improve student engagement, consistent with the findings of UNESCO (2023). The results indicate a growing readiness among maritime educators to engage in AI-enabled teaching practices and human-AI collaboration within digital learning environments.

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Table 2

Overall Means and SDs of the Perceived Challenges of Integrating AI in Teaching Professional Maritime Courses

Items	Overall Mean	SD	Description
Faculty Training and Development	3.70	.38	Very Challenging
Data Privacy Concerns	3.63	.38	Very Challenging
Plagiarism and Academic Integrity	3.61	.41	Very Challenging
Digital Divide	3.55	.39	Very Challenging
Computer Facility and Resources	3.48	.52	Very Challenging

*Note

Scale	*Description*
3.26 – 4.00	Very Challenging
2.51 – 3.25	Challenging
1.76 – 2.50	Less Challenging
1.00 – 1.75	Not Challenging

Table 2 presents the perceived challenges associated with AI integration. All indicators were rated as Very Challenging, with Faculty Training and Development receiving the highest mean (M = 3.70, SD = 0.38), followed by Data Privacy Concerns (M = 3.63, SD = 0.38), Plagiarism and Academic Integrity (M = 3.61, SD = 0.41), Digital Divide (M = 3.55, SD = 0.39), and Computer Facilities and Resources (M = 3.48, SD = 0.52). These findings indicate that while instructors recognize the benefits of AI, they are equally aware of the barriers that may hinder its successful implementation.

The prominence of faculty training and development as the greatest challenge highlights the need for continuous professional development programs to improve educators' competence in using AI technologies. This finding is consistent with Celik et al. (2022), who emphasized that teachers require specialized knowledge and skills to effectively integrate AI into educational practice. Concerns regarding data privacy and academic integrity also reflect growing global discussions on the ethical implications of AI use in education. UNESCO (2023) stressed that educational institutions must establish safeguards to protect learner data and ensure the responsible use of AI technologies. Similarly, Chan (2023) emphasized the importance of institutional policies that address plagiarism, transparency, and ethical AI use. The findings suggest that successful AI integration in maritime education requires not only technological infrastructure but also comprehensive governance frameworks and faculty support systems.

Table 3

Significant Difference in the Perceived Benefits of Integrating AI in Teaching Professional Maritime Courses of Respondents When Grouped and Compared According to Age

	Chi-Square	df	Sig.
Enhanced Learning Experiences	1.038	2	.595
Improved Efficiency	1.169	2	.557
Access and Equity	1.632	2	.442

$p > .05$, if significant, $*p < .05$

Table 3 shows the results of the Kruskal-Wallis test examining differences in the perceived benefits of AI integration according to age. The results revealed no significant differences in enhanced learning experiences (p = .595), improved efficiency (p = .557), and access and equity (p = .442), as all p-values exceeded the 0.05 level of significance. These findings indicate that maritime instructors, regardless of age, share similar perceptions regarding the benefits of AI integration.

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The absence of significant differences suggests that the perceived usefulness of AI transcends generational differences among educators. Regardless of age, instructors recognize the value of AI in improving teaching efficiency, enhancing learning experiences, and promoting access to educational resources. This finding supports previous studies indicating that age is not a strong predictor of technology acceptance when users perceive clear educational benefits (Mannheim et al., 2023). The results further indicate that maritime institutions may focus on institution-wide AI adoption and readiness strategies rather than developing age-specific interventions.

Table 4

Significant Difference in the Perceived Benefits of Integrating AI in Teaching Professional Maritime Courses of Respondents When Grouped and Compared According to Socio-Economic Status

	Chi-Square	df	Sig.
Enhanced Learning Experiences	.227	2	.893
Improved Efficiency	6.565	2	.038
Access and Equity	.423	2	.809

$p > .05$, if significant, $*p < .05$

Table 4 presents the differences in perceived benefits according to socio-economic status. The findings revealed no significant differences in enhanced learning experiences (p = .893) and access and equity (p = .809). However, a significant difference was found in Improved Efficiency (p = .038), indicating that perceptions regarding AI's efficiency vary across socio-economic groups.

The significant result for improved efficiency suggests that instructors from different socio-economic backgrounds may have varying levels of access to technology, training opportunities, and digital resources that influence their experiences with AI. Individuals with greater access to technological resources may be more likely to perceive AI as an efficient tool for instructional tasks. This finding aligns with studies highlighting the influence of digital access and technological readiness on technology adoption and utilization (Chan, 2023). Nevertheless, the absence of differences in enhanced learning experiences and access and equity indicates a shared recognition of AI's educational value regardless of socio-economic background. The results also underscore the importance of digital inclusion initiatives and equitable access strategies as essential components of institutional AI readiness and digital transformation efforts.

Table 5

Significant Difference in the Perceived Challenges of Integrating AI in Teaching Professional Maritime Courses of Respondents When Grouped and Compared According to Age

	Chi-Square	df	Sig.
Computer Facility and Resources	.838	2	.658
Data Privacy Concerns	.662	2	.718
Digital Divide	.139	2	.933
Plagiarism and Academic Integrity	3.627	2	.163
Faculty Training and Development	.427	2	.808

$p > .05$, if significant, $*p < .05$

Table 5 shows that no significant differences were found in any of the challenge indicators when respondents were grouped according to age. All p-values exceeded the 0.05 level of significance, indicating that maritime instructors consistently perceived faculty training and development, data privacy concerns, plagiarism and academic integrity, digital divide, and computer facilities and resources as major challenges regardless of age.

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The findings suggest that concerns regarding AI implementation are shared across different age groups. Challenges related to infrastructure, ethical use, and faculty preparedness appears to be an institutional rather than age-specific concern. Similar observations were reported by UNESCO (2023), which identified these challenges as common barriers to AI adoption across educational sectors. This consistency highlights the need for institution-wide AI governance frameworks and readiness initiatives that address organizational challenges affecting the entire academic community.

Table 6

Significant Difference in the Perceived Challenges of Integrating AI in Teaching Professional Maritime Courses of Respondents When Grouped and Compared According to Socio-Economic Status

	Chi-Square	df	Sig.
Computer Facility and Resources	1.864	2	.394
Data Privacy Concerns	3.005	2	.223
Digital Divide	.565	2	.754
Plagiarism and Academic Integrity	3.585	2	.167
Faculty Training and Development	1.614	2	.446

$p > .05$, if significant, $*p < .05$

Table 6 indicates that no significant differences were found in any of the challenge indicators when respondents were grouped according to socio-economic status. The p-values for computer facilities and resources, data privacy concerns, digital divide, plagiarism and academic integrity, and faculty training and development were all greater than 0.05, indicating similar perceptions across socio-economic groups.

These findings imply that the challenges associated with AI integration are widely recognized regardless of socio-economic background. Concerns related to infrastructure, data privacy, academic integrity, and professional development appear to affect maritime educators uniformly. This result reinforces the need for comprehensive institutional strategies that address these challenges holistically. UNESCO (2023) emphasized that successful AI integration requires investments in digital infrastructure, educator capacity building, and equitable access to technology, while Chan (2023) highlighted the importance of institutional policies that promote ethical AI use, transparency, and academic integrity. Collectively, these findings support the development of institutional AI readiness frameworks and responsible AI governance models that can guide sustainable digital transformation in maritime higher education.

Proposed Academic Policy Formulation and Faculty Development Program

Table 7

Proposed Academic Policy Formulation

Objectives	Development Plan and Strategies	Institutional Integration	Monitoring and Evaluation	Resources and Support
• Develop institutional policies that address equitable access to technology, data privacy, and academic integrity, and in AI integration. • Promote inclusive	1. Conduct stakeholder consultations, including maritime educators, administrators, and IT specialists. 2. Review existing frameworks such as STCW conventions and AI-related policies in education. 3. Draft and implement policies addressing key issues such	• Incorporate AI-related policies into the Quality Management System. • Integrate policy awareness into maritime education programs; ensuring students	• Adoption of an institutional AI policy by AY 2024-2025. • Reduction in reported data privacy incidents. • Increased faculty satisfaction in	• Legal and IT expertise for policy drafting. • Budget allocation for bridging digital divide challenges. • Training sessions to

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AI-driven learning environments by bridging the digital divide.	4. Periodically review and update policies based on technological advancements and feedback.	and staff understand ethical AI use.	policy-related surveys.	educate stakeholders on new policies.

Table 8

Proposed Faculty Development Program

Objectives	Development Plan and Strategies	Institutional Integration	Monitoring and Evaluation	Resources and Support
• Improve institutional AI readiness and digital literacy. • Provide specialized training focusing on how to capably utilize AI tools in maritime education. • Foster faculty confidence and innovation in AI-driven teaching methods. • Address challenges related to academic integrity, data privacy, and equitable resource access through targeted workshops and resources.	1. Conduct AI readiness assessments and digital skills evaluations among faculty members. 2. Identify training needs through a faculty survey. 3. Develop a modular training program focusing on AI tools, data security, and innovative teaching strategies. 4. Conduct workshops, webinars, and hands-on training sessions. 5. Create a mentorship and support network for ongoing skill development.	• Incorporate AI readiness indicators into institutional quality assurance and strategic planning initiatives. • Embed AI-related modules into faculty professional development courses. • Offer elective training programs tailored to various levels of AI proficiency.	• Annual AI readiness assessment results and digital literacy improvement metrics. • Percentage of faculty completing AI training programs. • Improved faculty confidence ratings in post-training surveys. • Increased use of AI tools in maritime course delivery.	• Assessment tools, institutional databases, and analytics software. • AI software and hardware for practical training sessions. • Expert trainers and resource persons for workshops. • Dedicated funding for faculty development initiatives.

Based on the findings of the study, the proposed Academic Policy Formulation and Faculty Development Initiatives serve as a strategic institutional guide for strengthening Artificial Intelligence (AI) governance, institutional AI readiness, faculty competency development, and responsible AI implementation in maritime higher education. The proposed initiatives address both the perceived benefits and challenges of AI integration by focusing on critical areas such as institutional governance, digital readiness, faculty capability enhancement, data privacy and security, academic integrity, technological infrastructure, and equitable access to digital resources.

Anchored on the principles of responsible AI governance, the proposed initiatives promote transparency, accountability, fairness, privacy protection, inclusivity, and human oversight in the adoption and use of AI technologies (Chan, 2023; UNESCO, 2023). Furthermore, they support broader digital transformation efforts by encouraging the development of institutional policies, governance mechanisms, and capacity-building programs that facilitate the ethical, effective, and sustainable integration of AI into teaching and learning. Ultimately, these initiatives provide maritime higher education institutions with a practical framework for fostering innovation, enhancing educational quality, improving institutional effectiveness, and preparing educators and learners for increasingly technology-driven maritime environments.

Conclusion

The findings revealed that maritime instructors generally perceived Artificial Intelligence (AI) integration in teaching professional maritime courses as highly beneficial, particularly in improving instructional efficiency,

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enhancing learning experiences, and promoting equitable access to educational resources. These results indicate that AI technologies possess significant potential to support digital transformation initiatives and improve educational processes within maritime higher education institutions.

The study also identified substantial implementation challenges, particularly in faculty training and development, data privacy, academic integrity, digital inclusion, and technological infrastructure. These findings highlight the importance of strengthening institutional AI readiness through investments in technology resources, educator capacity building, and responsible AI governance mechanisms.

The absence of significant differences across most demographic groupings suggests that perceptions regarding AI adoption are generally shared among maritime educators. However, the significant variation observed in perceived efficiency across socio-economic groups indicates that technological access and digital readiness may influence the extent to which educators experience AI-related benefits.

Overall, the study contributes to the growing body of knowledge on Artificial Intelligence adoption, digital transformation in education, and institutional AI governance. The findings provide evidence that may support the development of AI governance frameworks, faculty development initiatives, and technology integration strategies that promote responsible, ethical, and sustainable AI implementation within maritime higher education institutions.

Recommendations

Based on the findings of the study, maritime higher education institutions may establish institutional policies that promote the responsible, ethical, transparent, and effective use of Artificial Intelligence in teaching, learning, assessment, research, and academic decision-making. Such policies may provide guidance on academic integrity, data privacy, responsible AI utilization, and institutional AI governance.

Faculty development initiatives may be strengthened through continuous professional development programs, workshops, seminars, and hands-on training activities designed to improve instructors' digital literacy, AI competencies, and capacity to integrate AI technologies into maritime education effectively.

Institutions may invest in technological infrastructure by enhancing internet connectivity, upgrading computer facilities, expanding access to AI-enabled educational technologies, and supporting digital transformation initiatives that improve institutional AI readiness and technology adoption.

Guidelines governing AI-generated content, academic integrity, and responsible AI use may be developed and regularly reviewed to ensure that technological innovation is balanced with ethical considerations, transparency, accountability, and educational quality.

Future researchers may expand the scope of investigation by including students, administrators, and faculty members from other disciplines. Additional studies may examine institutional AI readiness, AI governance frameworks, digital transformation maturity, technology acceptance behaviors, and the long-term impact of AI adoption on educational effectiveness and workforce preparedness.

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