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Integration of Artificial Intelligence Technology in Communicative Scenario-Based in Maritime English Learning

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***Abstract*—** The integration of Artificial Intelligence (AI) technology has created new opportunities to enhance language learning, particularly in vocational education contexts such as Maritime English. This study investigated the implementation of AI-assisted communicative scenario-based learning and examined its effectiveness in improving maritime cadets' English-speaking skills. A mixed-method research design was employed involving 50 fourth-semester cadets of the Deck Department (*Teknologi Rekayasa Pengoperasian Kapal*). Quantitative data were collected through pre-test and post-test speaking assessments and questionnaires, while qualitative data were obtained from interviews. AI-supported tools, including Google Speech-to-Text, ChatGPT, Automatic Speech Recognition (ASR) and Langotalk, were integrated into communicative maritime scenarios such as VHF communication, cargo handling communication, and safety drill communication. The findings revealed that cadets demonstrated highly positive perceptions toward AI-assisted learning, with an overall questionnaire mean score of 4.36 (87.2%). Speaking assessment results showed significant improvement across all speaking components, including fluency, pronunciation accuracy, vocabulary mastery, grammar usage, and communication effectiveness. The mean speaking score increased from 68.24 in the pre-test to 82.10 in the post-test. Furthermore, the paired sample t-test indicated a statistically significant difference between pre-test and post-test scores ($t = 14.52$, $p = 0.000 < 0.05$). Interview findings also showed that AI applications enhanced students' confidence, engagement, autonomous learning, and communication practice. The study concludes that AI-assisted communicative scenario-based learning is an effective and innovative approach for improving Maritime English-speaking skills and preparing cadets for professional communication in the maritime industry.

Keywords—artificial intelligence; communicative scenario-based; maritime English

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I. INTRODUCTION

The rapid development of digital technology has significantly transformed educational practices in the twenty-first century, including language learning in higher education. One of the most influential technological innovations is Artificial Intelligence (AI), which has been increasingly integrated into teaching and learning activities across various disciplines. AI technology offers adaptive, interactive, and personalized learning experiences through tools such as speech recognition systems, intelligent tutoring systems, virtual assistants, and conversational chatbots [1]. Furthermore, In English language education, AI provides opportunities for learners to practice communication skills autonomously while receiving immediate feedback regarding pronunciation, grammar, vocabulary, and fluency. The integration of AI in language learning is particularly relevant in vocational and professional education contexts where communication competence is closely connected to workplace demands and operational safety [2].

Meanwhile, in maritime education, English proficiency plays a crucial role in ensuring effective communication among multinational crews and maintaining safety at sea. Maritime English is recognized as a specialized form of English used in navigation, engine operations, emergency communication, cargo handling, and other shipboard activities [3]. According to the International Maritime Organization (IMO), effective communication in English is essential to minimize misunderstandings that may lead to accidents, operational inefficiencies, and safety hazards in international shipping operations [4]. Therefore, maritime cadets are required not only to master general English skills but also to develop communicative competence in authentic maritime situations. These situations closely related with the maritime technical terminology which is also called the technical communication which can be described as a specialized field of professional discourse distinguished by its reliance on domain-specific terminology, procedural precision, and the integration of verbal, written, and instrumental modes of meaning-making [5].

However, many maritime cadets still experience difficulties in speaking English fluently and confidently during classroom communication activities. Traditional teaching methods often emphasize grammar instruction, reading comprehension, and memorization of maritime terminology rather than interactive communication practice [6]. As a result, students may possess theoretical

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knowledge of Maritime English but lack practical speaking ability in real-life maritime contexts. In addition, limited classroom interaction time and the absence of authentic communication scenarios frequently reduce students' opportunities to actively practice speaking. These challenges indicate the need for innovative teaching approaches capable of creating engaging, contextual, and communicative learning environments.

Communicative Scenario-Based Learning has emerged as an effective pedagogical approach in language education because it emphasizes meaningful interaction and contextualized communication practice. This approach allows students to engage in simulated real-world situations where they must use language actively to solve problems, exchange information, and perform professional tasks [7]. In Maritime English learning, communicative scenarios may include bridge communication, emergency response situations, pilotage operations, port communication, distress communication, and interactions among crew members on board ships. Through these simulated activities, cadets can develop speaking fluency, pronunciation accuracy, listening comprehension, and communication confidence in situations closely related to their future professional responsibilities.

The integration of Artificial Intelligence technology into communicative scenario-based learning provides additional opportunities to improve the effectiveness of Maritime English instruction. AI-powered applications can simulate interactive conversations, provide real-time pronunciation correction, analyze learners' speaking performance, and adapt learning materials according to students' needs [8]. Speech recognition technology, for example, allows learners to receive immediate feedback on pronunciation and intonation, while conversational AI chatbots can create dynamic communication practice without requiring continuous teacher supervision. Such technologies can increase students' learning motivation and encourage independent learning practices beyond classroom sessions.

Moreover, several previous studies have investigated the application of Artificial Intelligence in English language learning. Research conducted by Wang in 2025 [9] found that AI-supported speaking applications significantly improved students' pronunciation and speaking confidence in English communication activities . Another study by Sa in 2023 [10] demonstrated that conversational chatbots enhanced learners' engagement and interaction during foreign language learning. Furthermore, studies in English for Specific Purposes (ESP) contexts revealed that scenario-based learning effectively increased students' communicative competence because learners practiced language within professional and authentic situations. In maritime education, previous research has mainly focused on simulation-based learning, maritime communication training, and the use of digital learning platforms. Nevertheless, limited studies specifically examine the integration of AI technology in communicative scenario-based Maritime English learning, particularly regarding its effectiveness in improving cadets' speaking skills.

The existing studies indicate a research gap concerning the combination of AI technology and communicative scenario-based approaches in Maritime English instruction. Most previous research has separately discussed AI-assisted language learning or communicative learning methods without exploring how these two elements can be integrated to support speaking development in maritime education [2]. Additionally, few studies investigate the practical implementation of AI tools such as speech recognition systems, conversational chatbots, and adaptive learning platforms in Maritime English classrooms. Therefore, further research is necessary to explore how AI technology can support communicative scenario-based learning activities and improve maritime cadets' speaking performance in authentic maritime communication contexts.

Furthermore, this study is supported by several theoretical perspectives related to language learning, communicative competence, and educational technology. The first theory is Communicative Language Teaching (CLT), which emphasizes meaningful interaction and authentic communication as the primary goals of language learning. According to Đolić (2022) communicative competence includes grammatical competence, sociolinguistic competence, discourse competence, and strategic competence, all of which are essential in professional maritime communication. The second theory is Scenario-Based Learning Theory, which explains that learning becomes more effective when students engage in realistic situations requiring active problem-solving and decision-making [12]. Through scenarios, learners can connect theoretical knowledge with practical application. Another relevant theory is constructivist learning theory proposed by Lev Vygotsky, which highlights the importance of social interaction and collaborative learning in cognitive development [13].

Based on the background above, this study aims to investigate the integration of Artificial Intelligence technology in communicative scenario-based Maritime English learning and examine its effectiveness in improving cadets' English-speaking skills. Specifically, the study seeks to explore how AI technologies are implemented in communicative learning activities, how cadets respond to the use of AI-assisted learning tools, and how the integration of AI influences speaking fluency, pronunciation accuracy, vocabulary mastery, and communication effectiveness in maritime contexts. The findings of this study are expected to contribute to the development of innovative Maritime English teaching strategies and provide insights into the utilization of AI technology in vocational language education.

Therefore, this study is expected to provide practical benefits for maritime educators, institutions, and students. For educators, the findings may serve as references for designing more interactive and technology-supported Maritime English learning activities. For maritime institutions, the research may contribute to curriculum development that aligns with

technological advancements and global maritime communication standards. For cadets, the integration of AI technology may create more engaging learning experiences that enhance their communicative competence and prepare them for professional communication demands in the international maritime industry

II. METHOD

This study employed a mixed-method research design to investigate the integration of Artificial Intelligence (AI) technology in communicative scenario-based Maritime English learning and to examine its effectiveness in improving cadets' English-speaking skills. The mixed-method approach was selected because it allows the researcher to combine quantitative and qualitative data in order to obtain comprehensive findings toward the implementation of AI-assisted learning [14]. Quantitative data were used to measure the improvement of students' speaking performance, while qualitative data were utilized to explore classroom interactions, students' responses, and the practical implementation of AI technology in Maritime English learning activities.

For the research location, the study was conducted at a maritime educational institution involving cadets enrolled in Maritime English subject. The participants consisted of cadets from the deck department or *Teknologi Rekayasa Pengoperasian Kapal (TROK)* in 4th semester who were studying Maritime English as part of their academic curriculum. The sampling technique used in this study was purposive sampling because the participants were selected based on specific criteria relevant to the objectives of the research. The selected participants were cadets who had basic knowledge of Maritime English and actively participated in communicative speaking activities during the learning process. There were 50 (fifty) cadets participated in the study.

The variables examined in this study consisted of independent and dependent variables. The independent variable was the integration of Artificial Intelligence technology in communicative scenario-based Maritime English learning. This variable included the use of AI-supported tools such as speech recognition applications, conversational chatbots, pronunciation assessment systems, and interactive language-learning platforms integrated into communicative maritime scenarios.

The dependent variable was the cadets' English-speaking skills, which included several aspects such as speaking fluency, pronunciation accuracy, vocabulary mastery, grammatical appropriateness, and communication effectiveness in maritime communication contexts such as VHF communication when entering and leaving the port, communication during cargo handling, and communication during the safety drill.

TABLE 1
SPEAKING TEST RUBRIC

Assessment Criteria	Excellent (4)	Good (3)	Fair (2)	Poor (1)
Pronunciation Accuracy	Pronunciation is clear, accurate, and easily understood with minimal errors. Maritime terminology is pronounced correctly.	Minor pronunciation errors occur but do not interfere with understanding.	Several pronunciation errors sometimes affect understanding.	Frequent pronunciation errors seriously hinder communication.
Fluency	Speaks smoothly, confidently, and naturally with very few pauses or hesitations.	Generally fluent with occasional pauses or hesitation.	Speech is often interrupted by pauses and hesitation.	Speech is very slow, fragmented, and difficult to follow.
Vocabulary Mastery	Uses a wide range of Maritime English vocabulary accurately and appropriately.	Uses adequate maritime vocabulary with minor errors.	Limited vocabulary usage; repetitive words occasionally affect communication.	Very limited vocabulary and frequent misuse of terms.
Grammar Accuracy	Uses grammatical structures accurately with very few errors.	Some grammatical errors occur but meaning remains clear.	Frequent grammatical errors sometimes confuse meaning.	Persistent grammatical errors make communication difficult.
Communication Effectiveness	Responds appropriately and effectively in communicative maritime scenarios; demonstrates excellent interaction skills.	Communication is generally effective with occasional misunderstanding.	Communication is sometimes ineffective and requires repetition or clarification.	Unable to maintain effective communication in the scenario.
Interactive Response	Actively engages in conversation, asks/responds appropriately, and maintains interaction naturally.	Participates actively with minor difficulty maintaining interaction.	Limited interaction and occasional inappropriate responses.	Rarely responds appropriately or fails to maintain interaction.
Confidence and Delivery	Speaks confidently with strong voice projection and professional delivery.	Shows moderate confidence with minor nervousness.	Demonstrates limited confidence and noticeable hesitation.	Appears very nervous and lacks confidence throughout the performance.

*Sourc*e: [15]

The research instruments used in this study included speaking tests, questionnaires, and interviews. Speaking tests were conducted to assess the cadets' speaking performance before and after the implementation of AI-assisted learning activities. The speaking assessment rubric focused on fluency, pronunciation, vocabulary usage, grammar, and interactional communication skills was shown in table 1.

The scoring system is used to classify cadets' Maritime English-speaking proficiency based on their overall speaking performance, including pronunciation, fluency, vocabulary, grammar, communication effectiveness, interaction, and confidence. Scores of 24–28 are categorized as Excellent, 18–23 as Good, 12–17 as Fair, and 7–11 as Poor. This classification helps evaluate the effectiveness of AI-assisted communicative scenario-based learning in improving cadets' speaking skills.

The speaking assessment rubric used a four-point scale for each assessment criterion, consisting of Excellent (4), Good (3), Fair (2), and Poor (1). The assessment included seven speaking components: pronunciation accuracy, fluency, vocabulary mastery, grammar accuracy, communication effectiveness, interactive response, and confidence and delivery. Since each component had a maximum score of 4 points, the highest possible total score was 28 points (7 × 4 = 28), while the lowest possible score was 7 points (7 × 1 = 7). To convert the speaking scores into a range of 0–100, the following formula was used:

$$\text{Final Score} = \frac{\text{Total Obtained Score}}{28} \times 100$$

For example, if a cadet obtained a total score of 23 from all speaking components, the calculation would be:

$$\text{Final Score} = \frac{23}{28} \times 100 = 82.14$$

Based on this calculation, the cadet's final speaking score would be 82.14 out of 100. This scoring system was used to measure cadets' overall speaking proficiency in Maritime English communication activities.

In addition, the questionnaire was distributed to collect data regarding students' perceptions, motivation, engagement, and attitudes toward the use of Artificial Intelligence (AI) technology in Maritime English learning. The statements were shown in table 2.

The questionnaire consisted of several statements using a Likert scale ranging from strongly agree to strongly disagree. The items were designed to examine how AI-assisted learning influenced students' interest, confidence, participation, communication practice, and overall learning experiences during communicative scenario-based Maritime English activities. This questionnaire consists of ten statements with the five-point Likert scale consisting of 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, and 5 = Strongly Agree to measure the students' level of agreement with each statement.

TABLE 2
QUESTIONNAIRE STATEMENTS

No	Statements	1	2	3	4	5
1	AI technology helps me improve my Maritime English-speaking skills					
2	AI-assisted learning activities make Maritime English lessons more interesting					
3	AI applications help me practice pronunciation more accurately.					
4	I feel more confident speaking English when using AI-supported learning tools.					
5	AI technology motivates me to participate actively in Maritime English learning activities.					
6	AI-assisted communicative scenarios help me understand real maritime communication situations.					
7	AI technology provides useful feedback for improving my speaking performance.					
8	I am more engaged in classroom activities when AI technology is integrated into learning.					
9	AI-based learning helps me communicate more effectively in Maritime English.					
10	I believe AI technology should continue to be used in Maritime English learning.					

Meanwhile, semi-structured interviews were also conducted with selected participants and lecturers to gather deeper information about the effectiveness, advantages, and challenges of integrating AI into communicative learning activities. The semi-structured interviews were conducted with selected students and lecturers to obtain deeper information regarding the integration of Artificial Intelligence (AI) technology in communicative Maritime English learning. The interview questions focused on how AI technology helps improve communicative learning activities, the advantages of using AI-assisted applications in speaking practice, and the challenges encountered during the implementation process. In addition, the interviews explored the influence of AI on students' motivation, confidence, and participation in Maritime English communication practice. The participants were also asked to share their opinions about the effectiveness of AI integration in preparing cadets for real maritime communication situations, such as VHF communication, cargo handling, and safety drills.

The data collection process was conducted in several stages. First, a pre-test was administered to measure cadets' initial speaking abilities. Then, AI-assisted communicative scenario-based learning activities were implemented through maritime communication simulations such as bridge communication, emergency response, port operations, and shipboard interaction. During the treatment, classroom observations were conducted to examine students' participation and engagement. After the treatment, a post-test, questionnaires, and interviews were administered to collect quantitative and qualitative data regarding students' speaking improvement and perceptions toward AI integration.

The quantitative data from speaking tests and questionnaires were analyzed using descriptive statistics and a paired sample t-test to measure significant improvement between pre-test and post-test scores.

Meanwhile, qualitative data from observations, interviews, and documentation were analyzed using thematic analysis to identify themes related to motivation, engagement, confidence, and perceptions of AI technology.

Meanwhile, the qualitative data collected from the interviews were analyzed using thematic analysis. The researcher categorized and interpreted the data based on recurring themes related to students' engagement, communication confidence, learning motivation, interaction patterns, and perceptions of AI technology in Maritime English learning. The qualitative findings were used to support and strengthen the quantitative results obtained from the speaking tests and questionnaires.

Overall, the research method employed in this study was expected to provide comprehensive data regarding the effectiveness of integrating Artificial Intelligence technology into communicative scenario-based Maritime English learning. Through the combination of quantitative and qualitative approaches, the study aimed to generate meaningful insights into how AI-supported learning can improve cadets' speaking skills and support innovative language learning practices in maritime education.

III. Results and Discussion

This study investigated the integration of Artificial Intelligence (AI) technology in communicative scenario-based Maritime English learning and examined its effectiveness in improving cadets' English-speaking skills. The findings of the study were obtained through speaking tests, questionnaires, and interviews during the implementation of AI-assisted learning activities. The results are presented according to the research objectives and research questions formulated in the study.

The implementation of AI technology in Maritime English learning was conducted through several communicative learning scenarios related to maritime operations. The learning activities including VHF communication when entering and leaving the port, communication during cargo handling, and communication during the safety drill. During these activities, cadets utilized AI-supported applications such as speech recognition software called Google Speech-to-Text, conversational chatbots such as ChatGPT, pronunciation correction systems using Automatic Speech Recognition (ASR), and interactive language-learning platform like Langotalk.

These activities were the examples of the implementation of communicative scenario-based maritime English learning by the cadets in the classroom.

1. VHF Communication When Entering and Leaving the Port

Scenario Description

This communicative scenario focused on radio communication between the ship's officer and the port authority during arrival and departure procedures. Cadets practice using VHF communication, Standard Marine Communication Phrases (SMCP), and appropriate maritime expressions to ensure safe navigation and port coordination. This communicative scenario focused on VHF radio communication between the ship's officer and the port authority during arrival and departure procedures, in which cadets practice using Standard Marine Communication Phrases (SMCP) and appropriate maritime expressions through dialogues such as requesting port entry permission, receiving navigation instructions, and coordinating safe port operations.

Example Dialogue:

Port Control (Student 1): Vessel approaching Surabaya Port, identify yourself, please.
Bridge Officer (Student 2): This is MV Ocean Star. We are requesting permission to enter the port.
Port Control (Student 1):MV Ocean Star, proceed to Anchorage Area B and wait for pilot instructions.
Bridge Officer (Student 2): Roger, proceeding to Anchorage Area B. Standing by on Channel 16.

2. Communication During Cargo Handling

Scenario Description

This scenario trained cadets to communicate effectively during loading and unloading operations on board. The activity emphasized safety procedures, cargo instructions, teamwork, and operational communication between deck officers, crane operators, and port workers. The learning objectives of this activity were to develop cadets' communication skills during cargo operations, improve their use of Maritime English vocabulary related to cargo handling, and enhance interaction and teamwork communication on board.

Example Dialogue:

Chief Officer (Student 3): Prepare the crane for container loading operation.
Deck Crew (Student 4): Crane is ready, Chief Officer.
Chief Officer (Student 3): Check the cargo lashings carefully before loading.
Deck Crew (Student 4): Understood. Cargo lashings are being inspected now.

3. Communication During Safety Drill

Scenario Description

This communicative scenario focused on emergency and safety drill communication on board. Cadets practiced giving instructions, responding to emergencies, and coordinating with crew members during fire drills, abandon ship drills, or emergency response situations. The learning objectives of this activity was to improve cadets' emergency communication skills, practice giving clear and effective safety instructions, and develop confidence in responding to emergency situations in English.

Example Dialogue:

Captain (Student 5): Attention all crew members, this is a fire drill.
Safety Officer (Student 6): Fire reported in the engine room. Emergency team, proceed immediately.
Deck Cadet (Student 7): Emergency team proceeding to the engine room, Sir.
Captain (Student 5): All crew members must wear life jackets and report to the muster station.

So, those were the examples of Artificial Intelligence (AI) integration in the learning activities which could be integrated through speech recognition applications, conversational chatbots, pronunciation correction tools, and interactive speaking platforms. AI-assisted learning provides real-time feedback on pronunciation, fluency,

grammar, and communication effectiveness, allowing cadets to practice Maritime English more actively and independently in simulated maritime situations.

After the implementation of artificial intelligence, the questionnaire which was distributed to 50 cadets participating in AI-assisted communicative scenario-based Maritime English learning was also analyzed using descriptive statistics, including mean scores and percentages. This questionnaire result was shown in table 3.

TABLE 3
QUESTIONNAIRE RESULT

No	Questionnaire Indicators	Mean Score	Percentage	Interpretation
1	AI helps improve Maritime English-speaking skills	4.43	88.6%	Very Positive
2	AI-assisted learning makes lessons more interesting	4.37	87.4%	Very Positive
3	AI applications improve pronunciation accuracy	4.30	86.0%	Very Positive
4	AI increases students' confidence in speaking	4.20	84.0%	Positive
5	AI motivates students to participate actively	4.33	86.6%	Very Positive
6	AI scenarios help understanding maritime communication	4.47	89.4%	Very Positive
7	AI provides useful speaking feedback	4.40	88.0%	Very Positive
8	AI integration increases classroom engagement	4.27	85.4%	Positive
9	AI-based learning improves communication effectiveness	4.36	87.2%	Very Positive
10	AI technology should continue to be used	4.50	90.0%	Very Positive

The statistical results indicated that the cadets showed highly positive perceptions toward the implementation of AI technology in communicative scenario-based Maritime English learning. The overall mean score of 4.36 (87.2%) demonstrated that most students agreed that AI-supported applications such as Google Speech-to-Text, ChatGPT, ASR systems, and Langotalk effectively supported their speaking practice in maritime communication scenarios. The highest score (4.50) was obtained for the statement regarding the continued use of AI technology in Maritime English learning, indicating strong acceptance of AI integration among the cadets. Meanwhile, the lowest mean score (4.20) was related to students' confidence in speaking, although it still fell within the positive category. Overall, the findings suggested that AI-assisted communicative learning activities improved students' motivation, engagement, pronunciation, communication effectiveness, and understanding of real maritime communication situations.

Meanwhile, the interview data from students further supported the questionnaire findings regarding the effectiveness of AI integration in Maritime English learning. Most participants explained that AI-assisted communicative learning activities created a more active and engaging learning environment. According to the students, AI technology helped them practice speaking more independently and frequently outside the classroom. They also stated that Google Speech-to-Text and ASR-based pronunciation correction systems were useful for improving pronunciation accuracy during VHF communication exercises. They explained that immediate feedback helped them recognize pronunciation mistakes and improve communication clarity. Some cadets also mentioned that ChatGPT allowed them to simulate conversations with virtual port officers and crew members, which increased their confidence in real communication practice. In cargo handling communication activities, students reported that AI-assisted simulations helped them understand operational vocabulary and communication procedures more effectively. During safety drill scenarios, cadets felt that AI-supported speaking practice improved their ability to respond clearly and confidently in emergency situations. Overall, students agreed that the implementation of AI technology in communicative scenario-based Maritime English learning was effective in improving speaking skills, communication confidence, pronunciation accuracy, and engagement in maritime communication practice.

Next, the effectiveness of AI integration in improving cadets' speaking skills was measured through pre-test and post-test speaking assessments. The speaking tests evaluated several components, including fluency, pronunciation, vocabulary mastery, grammar usage, and communication effectiveness which were conducted in three communicative maritime scenarios, namely VHF Communication When Entering and Leaving the Port, Communication During Cargo Handling, and Communication During Safety Drill. The speaking tests were designed to simulate authentic maritime communication situations that cadets are likely to encounter during their future professional duties on board ships.

In the VHF Communication When Entering and Leaving the Port scenario, cadets were required to perform a simulated radio communication between a vessel and Port Control. Acting as the Officer of the Watch on board a ship approaching or departing a port, cadets were instructed to report their vessel's position, destination berth, and request permission to enter or leave the port. The assessment focused on their fluency, pronunciation, use of maritime vocabulary, grammatical accuracy, and overall communication effectiveness in delivering information through standard maritime communication procedures.

In the Communication During Cargo Handling scenario, cadets participated in a role-play activity involving communication between a Chief Officer and a Deck Crew member during cargo loading operations. The task required cadets to give and respond to instructions related to cargo loading procedures, container positioning, cargo securing, and inspection activities. Their performance was evaluated based on their ability to provide clear instructions and responses, accuracy in using maritime terminology, pronunciation and intelligibility, speaking fluency, and communication effectiveness.

The Communication During Safety Drill scenario simulated emergency situations commonly encountered

on board ships. Cadets assumed the roles of officers and crew members during a fire drill or abandon ship drill. They were required to give emergency instructions, respond to status reports, and communicate safety-related information using appropriate maritime language. The assessment emphasized the clarity of instructions, fluency and confidence in speaking, pronunciation, use of safety-related maritime vocabulary, and effectiveness in communicating during emergency situations.

All speaking performances were assessed using a standardized speaking rubric consisting of five components: fluency, pronunciation, vocabulary mastery, grammar usage, and communication effectiveness. Each component was scored on a scale ranging from 1 to 10. The pre-test and post-test scores were then compared to determine the extent to which the integration of AI technology contributed to the improvement of cadets' Maritime English-speaking skills across the three communicative scenarios. The comparison of the two tests was described in table 4.

TABLE 4
THE COMPARISON BETWEEN PRE-TEST AND POST-TEST SPEAKING SCORES.

Speaking Components	Pre-Test Mean Score	Post-Test Mean Score	Improvement
Fluency	68.4	82.1	+13.7
Pronunciation Accuracy	65.7	81.3	+15.6
Vocabulary Mastery	70.2	83.4	+13.2
Grammar Usage	69.1	79.5	+10.4
Communication Effectiveness	67.8	84.2	+16.4

The results indicated significant improvement in all speaking components after the implementation of AI-assisted communicative scenario-based learning. The highest improvement was observed in communication effectiveness and pronunciation accuracy. Cadets became more capable of delivering messages clearly, responding appropriately in communication exchanges, and maintaining interactive conversations in maritime situations.

The statistical analysis using a paired sample t-test showed that the post-test scores were significantly higher than the pre-test scores with a significance level below 0.05. This finding indicates that the integration of AI technology had a positive and statistically significant effect on cadets' English-speaking performance. It was presented in table 5.

TABLE 5
PAIRED SAMPLE T-TEST RESULT OF PRE-TEST AND POST-TEST SPEAKING SCORES

Variables	Mean Score	Standard Deviation	t-value	df	Sig. (2-tailed)	Interpretation
Pre-Test	68.24	5.87				
Post-Test	82.10	4.96	14.52	49	0.000	Significant Improvement

The paired sample t-test analysis showed a significant difference between the pre-test and post-test speaking scores of the cadets after the implementation of AI-assisted communicative scenario-based Maritime English learning. The mean score increased from 68.24 in the pre-test to 82.10 in the post-test. The statistical result revealed a t-value of 14.52 with a significance value (Sig. 2-tailed) of 0.000, which was lower than the significance level of 0.05. Therefore, the null hypothesis was rejected, indicating that the integration of AI technology had a positive and statistically significant effect on cadets' Maritime English speaking skills. The findings demonstrated that AI-supported learning activities effectively improved students' fluency, pronunciation, vocabulary mastery, grammar usage, and communication effectiveness in maritime communication scenarios.

The findings of this study demonstrated that the integration of Artificial Intelligence (AI) technology in communicative scenario-based Maritime English learning positively contributed to the improvement of cadets' speaking skills. The implementation of AI-assisted learning activities through maritime communication scenarios, such as VHF communication, cargo handling communication, and safety drill communication, created meaningful opportunities for cadets to practice English in realistic and professional contexts. This finding supports the principles of communicative language learning, which emphasize authentic interaction and contextual communication practice to improve language proficiency.

The questionnaire results revealed that the cadets showed highly positive perceptions toward the use of AI technology in Maritime English learning, with an overall mean score of 4.36 (87.2%). Most students agreed that AI-supported applications, including Google Speech-to-Text, ChatGPT, ASR systems, and Langotalk, helped improve their speaking skills, pronunciation accuracy, motivation, and communication effectiveness. The highest questionnaire result was related to the continued use of AI technology in Maritime English learning, indicating that students strongly accepted AI integration as an innovative learning approach. These findings suggest that AI technology can increase students' engagement and create more interactive learning environments in maritime education.

The interview findings also supported the quantitative data. Students explained that AI-assisted applications enabled them to practice speaking more independently and confidently. Real-time pronunciation correction and conversational feedback provided by speech recognition systems and chatbots helped cadets recognize communication errors and improve speaking clarity. This finding is consistent with previous studies stating that AI-assisted learning technologies can provide immediate feedback and adaptive communication practice, which are important factors in improving speaking proficiency and learner autonomy.

Furthermore, the results of the speaking assessments showed significant improvement in all speaking components after the implementation of AI-assisted communicative scenario-based learning. The greatest improvement occurred in communication effectiveness and pronunciation accuracy. This finding indicates that communicative maritime simulations supported by AI technology successfully trained cadets

to deliver messages clearly, respond appropriately, and maintain interactive communication in maritime situations. The improvement in pronunciation accuracy may be influenced by the use of speech recognition and ASR systems, which continuously provided corrective feedback during speaking practice.

The paired sample t-test analysis further confirmed the effectiveness of AI integration in Maritime English learning. The significant difference between pre-test and post-test scores, with a significance value of 0.000 lower than 0.05, indicated that AI-assisted learning had a statistically significant positive effect on cadets' speaking performance. The increase in the mean score from 68.24 to 82.10 demonstrated substantial improvement in fluency, vocabulary mastery, grammar usage, pronunciation, and communication effectiveness. These findings support previous research emphasizing that AI technologies can enhance language learning outcomes by providing interactive, personalized, and continuous speaking practice opportunities.

In addition, the communicative scenario-based approach played an important role in helping cadets connect language learning with real maritime operations. Through simulations of port communication, cargo handling, and safety drills, students were able to practice maritime terminology, Standard Marine Communication Phrases (SMCP), and professional communication procedures in realistic situations. Such contextual learning activities helped students better understand maritime communication demands and prepare for future professional responsibilities in the global maritime industry.

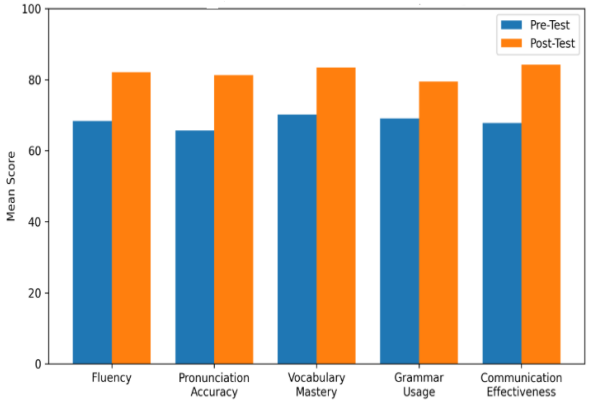

Figure 1. Comparison of pre-test and post-test Speaking Scores

Despite the positive findings, several challenges were also identified during the implementation process. Some students experienced technical difficulties, unstable internet connections, and limited familiarity with AI applications. These limitations indicate that adequate technological infrastructure and user training are necessary to maximize the effectiveness of AI-assisted learning in maritime education. Nevertheless, the overall findings demonstrated that the integration of AI technology in communicative scenario-based Maritime English learning can serve as an innovative and effective approach to improving cadets' English-speaking skills, engagement, confidence, and professional communication competence

IV. Conclusion

This study concluded that the integration of Artificial Intelligence (AI) technology in communicative scenario-based Maritime English learning effectively improved cadets' English-speaking skills. Through learning activities such as VHF communication, cargo handling communication, and safety drill communication, cadets were able to practice Maritime English in realistic maritime situations. AI-supported applications such as Google Speech-to-Text, ChatGPT, Automatic Speech Recognition (ASR) and Langotalk helped improve students' pronunciation, fluency, vocabulary mastery, communication effectiveness, confidence, and engagement during learning activities.

The questionnaire, interview, and speaking test results showed positive perceptions and significant improvement in cadets' speaking performance after the implementation of AI-assisted learning. The paired sample t-test result with a significance value of 0.000 indicated that AI integration had a statistically significant positive effect on Maritime English-speaking skills. Therefore, AI-assisted communicative scenario-based learning can be considered an innovative and effective approach to support Maritime English education and prepare cadets for professional communication in the maritime industry.

The paired sample t-test analysis further confirmed the effectiveness of AI integration in Maritime English learning. The significant difference between pre-test and post-test scores, with a significance value of 0.000 lower than 0.05, indicated that AI-assisted learning had a statistically significant positive effect on cadets' speaking performance. The increase in the mean score from 68.24 to 82.10 demonstrated substantial improvement in fluency, vocabulary mastery, grammar usage, pronunciation, and communication effectiveness. These findings support previous research emphasizing that AI technologies can enhance language learning outcomes by providing interactive, personalized, and continuous speaking practice opportunities.

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