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Enhancing Maritime ESP Reading Comprehension through Kahoot-Based Gamification: A Mixed-Methods Study among Maritime Cadets in Indonesia

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ABSTRACT

The integration of digital technology into English for Specific Purposes (ESP) instruction has become increasingly important in vocational and professional education. In maritime education, the ability to comprehend technical texts and master specialized vocabulary is essential for effective communication and operational safety. However, many maritime cadets continue to experience difficulties in reading comprehension due to limited vocabulary mastery, low learning motivation, and the predominance of conventional teacher-centered instructional approaches. This study investigated the effectiveness of Kahoot-based gamification in improving maritime cadets' reading comprehension and technical vocabulary mastery in ESP classes. Employing a mixed-methods sequential explanatory design, the study involved 23 third-semester cadets from the Nautical Study Program at North Sulawesi Maritime Polytechnic. Quantitative data were collected through pre-tests, post-tests, and questionnaires, while qualitative data were obtained through classroom observations and semi-structured interviews. Statistical analysis revealed significant improvements in reading comprehension and maritime vocabulary mastery across three intervention sessions, with all paired-sample t-tests yielding significance levels below .001. Questionnaire results indicated highly positive perceptions regarding the ease of use, usefulness, and motivational impact of Kahoot. Qualitative findings further demonstrated increased engagement, reduced language anxiety, enhanced metacognitive awareness, and stronger peer collaboration. The findings suggest that Kahoot-based gamification provides an effective pedagogical approach for improving ESP reading instruction

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in maritime education. The study contributes to the growing literature on gamification in vocational ESP contexts and offers practical implications for technology-enhanced maritime language instruction.
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1. Introduction

The rapid globalization of maritime industries has significantly increased the importance of English as the primary language of international communication at sea. Maritime professionals are required to communicate effectively using English in various operational situations, including navigation, cargo handling, emergency procedures, safety management, and ship-to-ship communication. Consequently, maritime educational institutions must ensure that cadets acquire sufficient English language competence to perform successfully in international maritime environments (Asmali, 2018; Boeru, 2023; Gabedava & Hu, 2025). Within this context, English for Specific Purposes (ESP) has become a fundamental component of maritime education because it focuses on language instruction tailored to learners' professional and occupational needs (Hutchinson & Waters, 1987).

ESP differs from General English in that its curriculum, teaching methods, and learning materials are designed according to specific professional requirements (Daiu & Mihali, 2025; Durović & Dlabač, 2025; Skalicky, 2020). In maritime education, ESP emphasizes the acquisition of Maritime English, including technical vocabulary, communication procedures, operational terminology, and Standard Marine Communication Phrases (SMCP) established by the International Maritime Organization (IMO). Maritime cadets must understand a wide range of authentic documents such as navigational manuals, weather reports, cargo instructions, safety regulations, emergency procedures, and international maritime conventions. Therefore, reading comprehension plays a central role in Maritime ESP because professional competence depends heavily on the ability to understand technical written information accurately and efficiently (Al-Jarf, 2022; Catts, 2021; Zamanian & Heydari, 2012).

Despite the importance of Maritime English, many maritime students continue to experience difficulties in reading technical texts. Previous studies have indicated a substantial gap between expected competencies and actual student performance in ESP contexts. Conventional teaching methods, insufficient use of authentic materials, and limited student engagement have been identified as major factors contributing to low achievement in Maritime English learning. Traditional teacher-centered instruction often emphasizes passive knowledge transmission rather than active participation and meaningful interaction with learning materials. Consequently, students frequently struggle to connect classroom learning with real-world maritime communication needs. The challenges become even more pronounced when considering the complexity of maritime texts. Technical documents contain specialized terminology, formal grammatical structures, and procedural information that require both linguistic and professional knowledge. Maritime cadets must comprehend instructions accurately because misunderstanding technical information can result in communication failures,

operational errors, and safety risks. Maritime accident investigations have repeatedly highlighted communication breakdowns as contributing factors to serious incidents, demonstrating that language competence is not merely an academic requirement but also a critical safety issue.

In addition to linguistic challenges, motivational factors significantly influence learning outcomes (Ghajarieh et al., 2025). Reading activities are frequently perceived by students as monotonous and cognitively demanding, particularly when texts contain unfamiliar technical vocabulary. Low motivation can reduce students' willingness to engage deeply with texts, thereby limiting opportunities for vocabulary acquisition and comprehension development. Consequently, educators increasingly seek innovative instructional approaches capable of enhancing student engagement while maintaining academic rigor.

Recent advances in educational technology have introduced new possibilities for language learning. Among these innovations, gamification has emerged as a promising strategy for increasing motivation, participation, and learning effectiveness (Hamari et al., 2014). Gamification refers to the application of game design elements in non-game contexts to promote engagement and desired behaviors (Deterding et al., 2011). Common gamification elements include points, badges, leaderboards, challenges, and immediate feedback mechanisms. These elements are designed to make learning activities more interactive, enjoyable, and motivating without compromising educational objectives.

One of the most widely adopted gamification platforms in education is Kahoot. Kahoot is a game-based learning system that enables teachers to create interactive quizzes and assessments using multimedia elements, real-time scoring, and competitive features (Alawadhi & Abu-ayyash, 2021; Anggraini et al., 2023; Atherton, 2018; Domínguez et al., 2013; Ghawail & Yahia, 2022). Through its user-friendly interface, immediate feedback system, and dynamic learning environment, Kahoot has demonstrated positive effects on student motivation, participation, and academic performance across various educational contexts (Mawarni et al., 2025; Navarro-castillo et al., 2025).

Although the effectiveness of Kahoot has been widely documented in general language learning, relatively few studies have examined its application within highly specialized ESP environments, particularly maritime education. Existing research has primarily focused on general English classrooms, business English, economics, or healthcare-related ESP programs. Consequently, there remains a significant gap in understanding how gamification influences reading comprehension and technical vocabulary acquisition in Maritime ESP contexts. The present study addresses this gap by investigating the implementation of Kahoot-based gamification in Maritime English reading classes at North Sulawesi Maritime Polytechnic. Specifically, the study examines whether Kahoot can improve cadets' reading comprehension and mastery of maritime vocabulary, explores students' perceptions of the platform, and investigates the motivational effects of gamified learning experiences.

2. Theoretical Framework

2.1 Reading Comprehension in Maritime ESP

Reading comprehension is generally defined as the process of extracting and constructing meaning through interaction with written texts (Cao & Kim, 2021; Snow, 2010; Song et al., 2020). Contemporary perspectives view reading as an active and multidimensional process involving cognitive, linguistic, social, and metacognitive components. Rather than simply decoding words, readers actively construct meaning by integrating textual information with prior knowledge and contextual understanding.

Three major theoretical models have been proposed to explain reading comprehension: the bottom-up model, the top-down model, and the interactive model. The bottom-up model emphasizes linguistic processing, beginning with word recognition and progressing toward overall understanding. In contrast, the top-down model highlights the role of prior knowledge and schema activation in constructing meaning. The interactive model combines these perspectives, suggesting that successful reading comprehension results from the simultaneous interaction of textual processing and background knowledge activation. This model is particularly relevant to ESP learning because students must integrate language skills with professional knowledge to interpret specialized texts effectively.

In Maritime ESP contexts, reading comprehension extends beyond general language understanding. Cadets must interpret technical manuals, operational procedures, safety regulations, weather forecasts, and emergency instructions accurately. Such texts often contain specialized terminology, complex grammatical structures, and domain-specific concepts that differ substantially from those encountered in general English learning. Consequently, Maritime ESP reading requires not only linguistic competence but also professional knowledge and contextual awareness.

Vocabulary mastery represents one of the most critical determinants of reading comprehension success (Fauziati, 2017; Snow, 2010). According to Nation (2001), vocabulary knowledge encompasses both breadth and depth. Readers must not only recognize a large number of words but also understand their contextual meanings, grammatical functions, and professional applications. In maritime contexts, many terms possess specialized meanings that differ from their everyday usage. Therefore, insufficient vocabulary knowledge frequently becomes a major obstacle to effective comprehension.

Furthermore, affective variables such as motivation, anxiety, and self-confidence play important roles in reading performance. Students who experience high levels of anxiety often struggle to maintain concentration and process information effectively. Conversely, motivated learners are more likely to employ strategic reading behaviors, persist through difficulties, and engage actively with texts. These considerations highlight the importance of instructional approaches capable of simultaneously supporting cognitive development and affective engagement.

2.2 Gamification and Language Learning

Gamification has gained considerable attention in educational research due to its potential to transform traditional learning environments into more engaging and motivating experiences (Krath et al., 2021; Sailer et al., 2017). Deterding et al. (2011) define gamification as the use of game design elements in non-game contexts to enhance user engagement and participation. In educational settings, gamification seeks to harness the motivational power of games while maintaining meaningful learning objectives.

The theoretical foundations of gamification can be understood through Self-Determination Theory (SDT) proposed by Ryan and Deci (2000). SDT suggests that intrinsic motivation flourishes when three fundamental psychological needs are satisfied: competence, autonomy, and relatedness. Gamification supports competence through points and achievement systems, autonomy through active participation and decision-making opportunities, and relatedness through social interaction and collaborative competition. When these needs are fulfilled, learners become more intrinsically motivated and engaged in educational activities.

Gamified learning environments can facilitate flow experiences by providing clear goals, immediate feedback, and progressively challenging activities. Such experiences contribute to sustained engagement and improved learning outcomes. Within language education, gamification has been associated with increased motivation, reduced anxiety, enhanced participation, and improved academic achievement. Research has demonstrated positive effects across various language skills, including vocabulary learning, grammar acquisition, listening comprehension, and reading comprehension. However, the effectiveness of gamification depends largely on thoughtful instructional design and alignment with pedagogical objectives rather than entertainment alone.

3. Methods

3.1 Research Design

This study employed a mixed-methods approach using a sequential explanatory design. According to Creswell & Creswell (2018), sequential explanatory designs involve collecting and analyzing quantitative data first, followed by qualitative data to explain and elaborate on quantitative findings. This design was selected because it enabled the researcher to measure the effectiveness of Kahoot quantitatively while also exploring participants' perceptions and experiences qualitatively. The quantitative phase focused on assessing improvements in reading comprehension and vocabulary mastery through pre-tests and post-tests, as well as measuring students' perceptions using questionnaires. Subsequently, the qualitative phase utilized classroom observations and semi-structured interviews to provide deeper insights into how and why the observed improvements occurred.

3.2 Participants and Sampling

The study was conducted at North Sulawesi Maritime Polytechnic during the

2025/2026 academic year. The population consisted of 87 third-semester cadets enrolled in the Nautical Study Program across four parallel classes. Using cluster random sampling, one class was randomly selected as the quantitative sample. The final sample consisted of 23 cadets. For the qualitative phase, purposive sampling employing an extreme-case strategy was used. Four cadets were selected for interviews: two cadets demonstrating the highest levels of improvement and positive perceptions, and two cadets exhibiting the lowest levels of improvement and less favorable perceptions. This approach enabled a deeper exploration of contrasting learning experiences.

3.3 Instruments

There are four instruments were employed namely:

1. Reading comprehension tests consisting of 30 multiple-choice items administered as pre-tests and post-tests.
2. Questionnaires containing 20 Likert-scale items adapted from the Technology Acceptance Model (TAM) and Self-Determination Theory frameworks.
3. Observation Sheets adapted from Fredricks' et al. (2004) student engagement framework, focusing on behavioral, emotional, and cognitive engagement.
4. Semi-structured interview guides designed to explore participants' perceptions and motivational experiences in greater depth.

3.4 Procedures

The intervention consisted of three Kahoot-based learning sessions focused on maritime emergency communication and SMCP. The instructional topics included emergency equipment, emergency action verbs, message markers, and distress communication procedures. Each session incorporated reading activities followed by interactive Kahoot quizzes designed to reinforce technical vocabulary and reading comprehension. Data collection followed the sequence of pre-testing, intervention implementation, post-testing, questionnaire administration, observations, and interviews.

3.5 Data Analysis

Quantitative data were analyzed using descriptive statistics and paired-sample t-tests to determine the significance of learning gains. Questionnaire responses were analyzed using means, frequencies, and percentages. Qualitative data obtained from observations and interviews were analyzed using thematic analysis following Braun and Clarke's framework (see Christou, 2023). Finally, quantitative and qualitative findings were integrated to provide comprehensive explanations of the study's results.

4. Results and Discussion

4.1 Overview of Quantitative Findings

The quantitative phase of this study aimed to determine whether Kahoot-based gamification significantly improved maritime cadets' reading comprehension and

mastery of maritime technical vocabulary. Data were collected through three consecutive intervention sessions, each consisting of a pre-test and post-test administered before and after the implementation of Kahoot-assisted ESP reading instruction. The instructional materials focused on maritime emergency communication, emergency equipment, emergency action verbs, and SMCP. The quantitative analysis revealed consistent and statistically significant improvements across all intervention sessions. The findings indicate that Kahoot not only enhanced cadets' academic achievement but also contributed to the development of more effective learning behaviors. These improvements were further supported by questionnaire findings that demonstrated overwhelmingly positive perceptions regarding the usefulness and motivational value of the platform.

Treatment 1: Understanding Emergency Equipment and Basic Emergency Vocabulary

The first intervention session introduced cadets to maritime emergency equipment and essential vocabulary associated with emergency situations on board ships. Before the instructional intervention, participants completed a pre-test designed to assess their baseline understanding of technical vocabulary and reading comprehension related to emergency equipment. The pre-test results indicated that many cadets experienced difficulties in recognizing and interpreting maritime terminology. Several students relied heavily on literal translation and demonstrated limited ability to infer meanings from context. This finding aligns with previous ESP research suggesting that technical vocabulary often constitutes a significant barrier to comprehension among vocational learners.

Following the instructional session, cadets participated in a Kahoot-based quiz that incorporated images, multiple-choice questions, and immediate feedback. The interactive nature of the activity encouraged active participation and continuous engagement throughout the lesson. Analysis of the post-test results demonstrated substantial improvement. The average score increased from 59.57 in the pre-test to 89.13 in the post-test, representing a gain of approximately 29.57 percentage points. This improvement suggests that the combination of contextualized instruction and gamified assessment effectively facilitated vocabulary acquisition and reading comprehension development.

The magnitude of improvement observed in Treatment 1 is particularly noteworthy because it occurred after only a single intervention session. Such findings indicate that gamified learning environments may accelerate comprehension processes by increasing attention, motivation, and opportunities for active recall. Beyond numerical gains, classroom observations revealed noticeable behavioral changes among cadets. Students who initially appeared hesitant became increasingly willing to answer questions and participate in discussions. The competitive atmosphere created by the Kahoot leaderboard stimulated enthusiasm while maintaining a supportive learning environment. These findings suggest that the first intervention successfully established a

foundation for subsequent learning activities by increasing both linguistic competence and learner engagement.

Treatment 2: Emergency Action Verbs and SMCP Message Markers

The second intervention focused on emergency action verbs and SMCP message markers frequently encountered in maritime communication. These linguistic elements play a crucial role in ensuring clear and standardized communication during emergency situations. Prior to the intervention, participants completed a second pre-test. The mean score recorded for this assessment was 53.48, indicating that students continued to experience challenges in comprehending specialized maritime expressions and procedural instructions. During the instructional session, Kahoot activities were designed to reinforce the meaning and application of emergency-related verbs and message markers. Visual prompts, scenario-based questions, and timed responses encouraged cadets to process information rapidly while maintaining accuracy.

The post-test results demonstrated remarkable improvement. The mean score increased from 53.48 to 85.22, resulting in a gain of 31.74 percentage points. This increase exceeded the improvement observed during the first intervention, suggesting that students became increasingly familiar with both the content and the learning platform. Several factors may explain this enhanced performance. First, repeated exposure to maritime terminology likely strengthened lexical retention. Second, students had already become comfortable with the Kahoot interface, reducing cognitive load associated with navigating the platform. Third, the competitive features of the system appeared to stimulate greater concentration and effort.

The questionnaire responses further support these interpretations. Many cadets reported that the game-like environment made technical vocabulary easier to remember because the learning process felt enjoyable rather than burdensome. The integration of images and immediate feedback also helped clarify misunderstandings before they became persistent learning obstacles. From a cognitive perspective, the improvement observed during Treatment 2 suggests that Kahoot facilitated active retrieval practice. Educational psychology literature consistently identifies retrieval practice as one of the most effective methods for strengthening long-term memory. By requiring students to repeatedly recall information under time constraints, Kahoot likely contributed to deeper processing and stronger retention of maritime vocabulary. Moreover, observational data revealed increased peer interaction during this session. Students frequently discussed answers, exchanged explanations, and celebrated achievements together. Such collaborative behaviors suggest that gamification promoted not only individual learning but also social engagement.

Treatment 3: Distress Messages and Emergency Communication Procedures

The third intervention addressed one of the most critical components of Maritime English: distress communication. Cadets were introduced to SMCP distress messages, including communication procedures related to fire emergencies, abandon-ship

situations, and distress signaling. This topic represents a particularly challenging area of Maritime ESP because it requires learners to integrate vocabulary knowledge, procedural understanding, and contextual interpretation. Effective comprehension of distress communication is essential for operational safety and professional competence. The third pre-test produced the lowest average score among all interventions, with a mean of 49.57. This result suggests that distress communication terminology and procedures were relatively unfamiliar to many participants. Following instruction and Kahoot-based reinforcement activities, substantial improvement was observed. The post-test mean increased to 86.52, representing a gain of 36.96 percentage points. This was the largest improvement recorded across all three interventions.

The considerable increase indicates that gamified learning was particularly effective in supporting the comprehension of complex and highly specialized maritime content. Several explanations may account for this outcome. First, repeated exposure to Kahoot across multiple sessions likely enhanced students' familiarity with the learning process, allowing them to focus more fully on content acquisition. Second, the contextualized nature of distress communication scenarios may have increased perceived relevance, thereby strengthening motivation and attention. Third, the cumulative effect of previous interventions may have established a stronger foundation of maritime vocabulary knowledge upon which new learning could be built.

Observational evidence demonstrated a marked increase in student confidence during the third session. Cadets responded more quickly, expressed greater certainty in their answers, and displayed improved strategic thinking when interpreting complex communication scenarios. Importantly, the third intervention also revealed evidence of developing metacognitive awareness. Rather than responding impulsively, students increasingly adopted deliberate reading strategies such as identifying keywords, analyzing contextual clues, and verifying interpretations before selecting answers. These findings suggest that Kahoot not only improved immediate learning outcomes but also contributed to the development of more sophisticated reading behaviors.

Paired-Sample t-Test Analysis

To determine whether the observed improvements were statistically significant, paired-sample t-tests were conducted for each intervention session. The results consistently demonstrated statistically significant differences between pre-test and post-test scores across all treatments. In every case, the significance value was below .001, indicating that the probability of obtaining such improvements by chance was extremely low.

The statistical findings therefore support the rejection of the null hypothesis and confirm that the Kahoot-based intervention significantly improved cadets' reading comprehension and maritime vocabulary mastery. These results provide strong empirical evidence supporting the effectiveness of gamification in Maritime ESP instruction. The consistency of improvement across three separate interventions strengthens the validity of the findings and suggests that the observed gains were not

isolated or accidental occurrences. Furthermore, the progressively increasing gain scores across treatments indicate that the effectiveness of the intervention may have accumulated over time. As students became more familiar with both the content and the gamified learning environment, their ability to benefit from instructional activities appeared to increase. The statistical evidence therefore confirms that Kahoot functioned as an effective pedagogical tool for enhancing learning outcomes in Maritime English reading classes.

Questionnaire Findings

Following the completion of the intervention, participants completed a questionnaire designed to assess their perceptions of Kahoot. The instrument was adapted from the TAM and SDT, focusing on four major dimensions: *Perceived Ease of Use (PEOU), Perceived Usefulness (PU), Attitude Toward Using, and Motivation and Engagement*. The overall results revealed highly positive perceptions across all dimensions.

a. Perceived ease of use
   Students overwhelmingly agreed that Kahoot was easy to use. Most participants reported that the platform required minimal technical skills and could be accessed conveniently through their mobile devices. The high ratings in this dimension are unsurprising given that the participants belonged to a digitally literate generation accustomed to using smartphones and online applications. Consequently, technical barriers were minimal and did not interfere with learning activities. Many respondents indicated that they quickly learned how to navigate the platform and appreciated its intuitive interface. This ease of use contributed positively to their willingness to participate actively in classroom activities.
b. Perceived usefulness
   Participants also reported strong agreement regarding the usefulness of Kahoot for learning Maritime English. Students perceived that the platform helped them to *remember maritime vocabulary more effectively, understand technical texts more clearly, identify mistakes immediately, improve concentration during reading activities, review learning materials efficiently*. The incorporation of images and contextual cues was frequently cited as particularly helpful in understanding abstract maritime terminology.
c. Attitude toward using
   Students expressed highly favorable attitudes toward the use of Kahoot in ESP classes. The majority indicated that they enjoyed learning through the platform and preferred it to traditional instructional approaches. Many respondents stated that *they wished Kahoot to be integrated more frequently into future Maritime English courses.* The strongest response was associated with the statement: "Learning feels like playing when using Kahoot." This item achieved the highest mean score, approximately 4.83 out of 5.00, indicating exceptionally positive

student reactions.

d. Motivation and engagement
   The motivation dimension produced similarly strong results. Participants reported that Kahoot: *increased their enthusiasm for learning, encouraged active participation, reduced boredom, stimulated healthy competition, increased confidence in answering questions*. The leaderboard feature was particularly influential in motivating students to perform well while maintaining an enjoyable learning atmosphere.

Observation Findings

Classroom observations were conducted throughout all three intervention sessions. The analysis focused on *behavioral engagement, emotional engagement, and cognitive engagement.*

a. Behavioral Engagement
   Initially, several cadets appeared passive and reluctant to participate. However, engagement increased progressively across sessions. Students demonstrated higher attendance, greater participation, and stronger involvement in classroom activities.
b. Emotional Engagement
   Positive emotional responses became increasingly evident throughout the intervention. Students frequently displayed enthusiasm, excitement, and enjoyment while participating in Kahoot activities. Laughter, peer encouragement, and celebratory reactions were commonly observed. Importantly, the competitive environment did not appear to generate excessive anxiety. Instead, the platform created a psychologically safe environment in which students felt comfortable making mistakes and learning from feedback.
c. Cognitive Engagement
   Evidence of deeper cognitive engagement emerged over time. Students increasingly employed reading strategies such as: identifying key information, making inferences, analyzing contextual clues, evaluating alternative answers. These behaviors suggest that the intervention promoted active meaning-making rather than superficial memorization.

Interview Findings

Semi-structured interviews were conducted with four selected participants representing both high-performing and lower-performing groups. Despite differences in achievement levels, all interviewees expressed positive opinions regarding the use of Kahoot. Several recurring themes emerged:

a. Enhanced Vocabulary Retention. Participants consistently reported that Kahoot helped them remember maritime vocabulary more effectively than conventional classroom activities.
b. Increased Motivation. Students described the learning experience as enjoyable

and engaging. The game-like structure encouraged them to study more actively and pay closer attention to instructional materials.

c. Reduced Anxiety. Interviewees noted that the platform reduced fear of making mistakes because feedback was provided immediately and constructively.
d. Healthy Competition. The competitive elements motivated students to improve their performance while maintaining positive relationships with classmates.
e. Improved Reading Strategies. Many participants reported becoming more careful readers. Rather than answering impulsively, they learned to analyze questions systematically and verify information before responding. The findings of this study demonstrate that Kahoot-based gamification significantly improved maritime cadets' reading comprehension and technical vocabulary mastery. Across three intervention sessions, mean scores increased substantially, and all statistical analyses confirmed significant learning gains. In addition to academic improvements, students developed more positive attitudes toward learning, demonstrated higher levels of engagement, and reported increased motivation. Observational and interview data further revealed the development of metacognitive awareness, collaborative learning behaviors, and psychological confidence.

Taken together, these findings provide compelling evidence that Kahoot represents an effective instructional tool for Maritime ESP education and offers considerable potential for enhancing reading comprehension in vocational language-learning environments.

4.2 Discussion

Kahoot-Based Gamification and Maritime ESP Vocabulary Acquisition

One of the most significant findings of this study is the substantial improvement in maritime technical vocabulary mastery following the implementation of Kahoot-based gamification. Across the three intervention sessions, cadets demonstrated consistent increases in post-test scores, indicating that the platform effectively supported the acquisition and retention of specialized maritime terminology. These findings are particularly important because vocabulary knowledge represents the foundation of reading comprehension in ESP contexts. According to Nation (2001), successful reading comprehension depends largely on learners' breadth and depth of vocabulary knowledge. In Maritime English, vocabulary acquisition is especially challenging because many terms possess highly specialized meanings that differ from their everyday usage. Words such as *draft*, *bridge*, *distress*, *abandon ship*, and *ballast* require contextual understanding grounded in maritime operations rather than general English usage. Consequently, insufficient mastery of technical vocabulary frequently becomes the primary obstacle to effective reading comprehension among maritime cadets.

The present findings suggest that Kahoot successfully addressed this challenge through several mechanisms. First, the platform encouraged repeated exposure to key vocabulary items. Vocabulary learning research consistently demonstrates that multiple

encounters with lexical items are necessary for long-term retention. Through repeated participation in quizzes, students repeatedly processed maritime terminology, strengthening lexical representations in memory.

Second, Kahoot facilitated active retrieval practice. Rather than merely rereading vocabulary lists, cadets were required to recall meanings actively under timed conditions. Cognitive psychology literature identifies retrieval practice as one of the most effective learning strategies because the act of recalling information strengthens memory pathways more effectively than passive review. The improvement observed across all treatment sessions suggests that Kahoot's quiz-based format promoted this retrieval process effectively.

Third, the use of visual supports enhanced vocabulary acquisition. Questionnaire responses and interview findings indicated that images associated with maritime equipment and emergency procedures helped students connect abstract terminology with concrete representations. This result aligns with dual coding theory, which proposes that information processed through both verbal and visual channels is more likely to be retained in long-term memory.

These findings corroborate previous studies demonstrating the positive effects of Kahoot on vocabulary learning, such as Hasanah et al. (2024); Kaya & Sagnak (2022) found significant improvements in vocabulary mastery among English language learners using Kahoot, and also Diahyleva et al. (2024); Gabedava and Hu (2025); Navarro-castillo et al. (2025) reported similar outcomes among engineering students learning technical terminology. However, the present study extends these findings by demonstrating the effectiveness of Kahoot specifically within a Maritime ESP context, an area that has received relatively limited scholarly attention.

The results therefore contribute to the growing body of evidence suggesting that gamification can facilitate the acquisition of specialized vocabulary required for professional communication. Given the critical importance of accurate terminology in maritime operations, these findings have substantial implications for vocational language education.

Enhancing Reading Comprehension through Interactive Learning

Beyond vocabulary acquisition, the study revealed significant improvements in reading comprehension. The increase in post-test scores across all intervention sessions indicates that Kahoot-based instruction positively influenced students' ability to interpret and understand maritime texts. Reading comprehension is widely recognized as a complex process involving linguistic knowledge, cognitive processing, background knowledge, and metacognitive regulation. Modern reading theories emphasize that comprehension results from the interaction between textual information and readers' prior knowledge. Successful readers actively construct meaning, generate inferences, monitor understanding, and apply strategic thinking while engaging with texts.

The findings suggest that Kahoot supported these processes in several ways. First, the platform encouraged active engagement with textual content. Rather than passively receiving information, students were required to analyze questions, interpret textual clues, and select appropriate responses within limited time frames. Such activities promoted deeper cognitive processing than traditional teacher-centered instruction. Second, immediate feedback allowed students to identify and correct misunderstandings promptly. Feedback plays a crucial role in learning because it helps learners evaluate their performance and adjust their strategies. In conventional classrooms, feedback is often delayed, reducing its effectiveness. Kahoot's instant feedback system enabled students to recognize errors immediately and modify their understanding accordingly. Third, the competitive nature of the platform increased attention and concentration. Reading comprehension often suffers when learners lose focus or disengage from the task. The game-like structure of Kahoot maintained students' attention by creating clear goals, measurable outcomes, and immediate rewards. The progressive increase in learning gains across the three intervention sessions is particularly noteworthy. Improvement was not limited to isolated vocabulary items but extended to broader reading abilities, including inference-making, contextual interpretation, and procedural understanding. Such developments indicate that Kahoot supported the cultivation of higher-order comprehension skills rather than mere memorization.

These findings align with studies conducted by Rachman et al. (2020) reported significant improvements in reading comprehension among students using Kahoot. However, the present study contributes additional evidence by demonstrating effectiveness within authentic maritime reading contexts involving emergency communication procedures and SMCP. Given the critical role of reading comprehension in maritime operations, the observed improvements represent more than academic achievement. The ability to understand safety instructions, emergency procedures, and technical documentation accurately has direct implications for operational effectiveness and occupational safety.

Interpretation through Self-Determination Theory

The motivational effects observed in this study can be effectively interpreted through the lens of Self-Determination Theory (SDT). According to Deci and Ryan (2000), intrinsic motivation develops when three basic psychological needs are satisfied: competence, autonomy, and relatedness. The findings suggest that Kahoot successfully supported all three dimensions.

Competence

The need for competence refers to individuals' desire to feel effective and capable in their activities. Kahoot addressed this need through its scoring system, immediate feedback mechanisms, and achievement indicators. Students received continuous information regarding their performance, allowing them to monitor progress and

experience success. As their scores improved across sessions, many participants reported increased confidence in their ability to understand Maritime English texts. This growing sense of competence likely contributed to the positive attitudes and sustained engagement observed during the intervention.

Autonomy

Autonomy involves a sense of personal agency and control over one's learning experiences. Although classroom activities were structured, Kahoot allowed students to make independent decisions, evaluate alternatives, and respond actively rather than passively receiving information. The interactive nature of the platform encouraged learners to take responsibility for their answers and engage directly with content. This active participation contrasts with traditional lecture-based approaches, where students often occupy relatively passive roles.

Relatedness

Relatedness refers to feelings of social connection and belonging. The classroom observations revealed that Kahoot fostered positive social interaction among cadets. Students encouraged one another, discussed answers, and celebrated achievements collectively. Importantly, competition did not appear to create hostility or excessive pressure. Instead, it promoted a shared sense of engagement and collective participation. Such outcomes demonstrate that gamification can strengthen social bonds while maintaining academic rigor. Taken together, these findings suggest that Kahoot created a learning environment that effectively satisfied the psychological needs identified by SDT. Consequently, students experienced higher levels of intrinsic motivation, which likely contributed to improved academic performance.

Technology Acceptance Model (TAM) and Student Perceptions

The overwhelmingly positive questionnaire responses can be interpreted through the TAM, proposed by Davis (1989). According to TAM, users' acceptance of technology depends primarily on two factors: perceived usefulness and perceived ease of use.

Perceived Ease of Use

The findings revealed exceptionally positive evaluations regarding ease of use. Students considered Kahoot intuitive, accessible, and easy to navigate. Several factors may explain these perceptions. First, participants belonged to a generation characterized by extensive exposure to digital technologies. Second, Kahoot's interface is specifically designed to minimize technical complexity. Third, participation required only basic smartphone skills already familiar to most students. High levels of perceived ease of use are important because technological barriers can reduce engagement and hinder learning. The absence of such barriers allowed students to focus on learning content rather than technological procedures.

Perceived Usefulness

Students also perceived Kahoot as highly useful for learning Maritime English. They believed that the platform improved vocabulary retention, enhanced reading comprehension, and increased learning efficiency. The usefulness dimension appears particularly important because students were able to connect the learning activities directly to their professional needs. Maritime cadets recognized that understanding technical terminology and emergency communication procedures would benefit their future careers. This perceived relevance likely strengthened their motivation and commitment to learning.

Behavioral Intention

The strongest evidence of technology acceptance emerged from students' expressed desire to continue using Kahoot in future courses. The conclusion chapter reported a virtually unanimous willingness to reuse the platform, indicating exceptionally high levels of acceptance. These findings reinforce the explanatory power of TAM and suggest that successful technology integration in ESP education depends not only on technological functionality but also on users' perceptions of relevance and usability.

Development of Metacognitive Awareness

One of the most interesting findings emerging from the qualitative data concerns the development of metacognitive awareness. Initially, many cadets demonstrated impulsive response patterns. They tended to answer quickly without thoroughly analyzing questions or evaluating alternatives. However, observations and interviews revealed a gradual transformation in learning behavior throughout the intervention. By the third treatment session, students increasingly employed deliberate reading strategies, including:

1. identifying keywords,
2. analyzing contextual clues,
3. comparing answer options,
4. verifying interpretations,
5. monitoring comprehension.

These behaviors reflect metacognitive regulation, which refers to learners' ability to monitor and control their cognitive processes. The development of such strategies is particularly significant because metacognition is strongly associated with successful reading comprehension. Skilled readers continuously evaluate their understanding, identify comprehension difficulties, and implement corrective actions when necessary. These findings suggest that Kahoot may support not only content learning but also the development of transferable cognitive skills that benefit future academic and professional performance.

Psychological Safety and Reduction of Language Anxiety

Another important theme emerging from the data concerns psychological safety and reduced language anxiety. Language anxiety has long been recognized as a significant obstacle to second-language learning. Students who fear making mistakes often avoid participation, limit risk-taking, and experience reduced confidence. The present study suggests that Kahoot helped mitigate these challenges. Several factors contributed to this outcome. First, immediate feedback transformed errors into learning opportunities rather than sources of embarrassment. Students could identify mistakes quickly and correct misunderstandings without prolonged uncertainty. Second, the leaderboard system displayed only top-performing participants rather than publicly ranking all students. As noted in the conclusion chapter, this feature protected lower-performing students from negative social comparison while still preserving motivational benefits for higher achievers. Third, the playful nature of the platform reframed assessment as an enjoyable activity rather than a threatening evaluation. Students frequently described learning as feeling more like playing than testing. These findings support Krashen's Affective Filter Hypothesis, which proposes that anxiety can inhibit language acquisition by reducing learners' receptivity to input. By lowering the affective filter, Kahoot may have facilitated more effective learning experiences.

The findings carry several important implications for Maritime ESP instruction. First, they demonstrate that gamification can serve as an effective bridge between technical content and learner engagement. Maritime English often involves dense terminology and complex procedures that students may perceive as difficult or monotonous. Gamification offers a means of maintaining academic rigor while increasing motivation and participation. Second, the results highlight the value of integrating authentic maritime materials into interactive learning environments. The success of the intervention suggests that technology-enhanced instruction should focus not merely on entertainment but on meaningful engagement with professionally relevant content. Third, the findings support the incorporation of formative assessment technologies into vocational education. Immediate feedback systems allow instructors to monitor learning progress continuously and address misconceptions before they become entrenched. Finally, the study provides evidence supporting broader digital transformation initiatives within maritime education. As maritime industries become increasingly technology-driven, educational institutions must prepare graduates capable of learning effectively within digital environments.

This study contributes to existing scholarship in several ways. First, it extends the growing body of gamification research into an underexplored context: Maritime ESP education. Second, it demonstrates that Kahoot can improve not only motivation and engagement but also domain-specific outcomes such as technical vocabulary mastery and procedural reading comprehension. Third, the mixed-methods design provides a comprehensive understanding of both outcomes and underlying mechanisms, offering insights into how gamification influences

cognitive, motivational, and social dimensions of learning. Finally, the study responds directly to calls for more empirical research examining technology-enhanced learning in vocational and professional education settings. By focusing on authentic maritime content and operationally relevant competencies, it provides evidence with direct practical relevance for maritime institutions worldwide.

5. Conclusion

This study investigated the effectiveness of Kahoot-based gamification in improving reading comprehension and maritime technical vocabulary mastery among cadets enrolled in ESP courses at North Sulawesi Maritime Polytechnic. Using a mixed-methods sequential explanatory design, the research combined quantitative evidence from pre-tests, post-tests, and questionnaires with qualitative evidence from classroom observations and semi-structured interviews. The integration of these data sources provided a comprehensive understanding of both the learning outcomes and the underlying processes associated with the implementation of gamified instruction.

The findings demonstrated that Kahoot significantly enhanced cadets' reading comprehension and mastery of Maritime English vocabulary. Across the three intervention sessions, substantial improvements were observed in post-test scores, with all paired-sample t-tests yielding statistically significant results ($p < .001$). These findings indicate that the use of gamification can effectively facilitate the acquisition of specialized maritime terminology and improve students' ability to comprehend technical texts related to emergency communication, maritime procedures, and SMCP. The progressive increase in learning gains across intervention sessions further suggests that repeated engagement with gamified learning environments may strengthen both vocabulary retention and reading proficiency over time. Beyond cognitive achievement, the study revealed highly positive student perceptions toward Kahoot.

The questionnaire findings indicated strong agreement regarding the platform's ease of use, usefulness, and motivational value. Students viewed Kahoot as an engaging instructional tool that transformed conventional reading activities into interactive learning experiences. The platform's intuitive interface, visual supports, immediate feedback mechanisms, and competitive features contributed to positive attitudes and a strong willingness to continue using the application in future learning activities. These results support the TAM, which posits that perceived usefulness and perceived ease of use are critical determinants of technology acceptance in educational contexts. The qualitative findings provided further insights into the motivational impact of gamification. Observational and interview data demonstrated that Kahoot increased student engagement, promoted active participation, reduced boredom, and encouraged collaborative learning behaviors. Importantly, the platform also contributed to the development of psychological safety by allowing students to learn from mistakes without experiencing excessive

anxiety. The leaderboard system stimulated healthy competition while protecting lower-performing students from negative public comparison.

These outcomes align with SDT, which emphasizes the importance of competence, autonomy, and relatedness in fostering intrinsic motivation. Another important finding concerns the development of metacognitive awareness. Throughout the intervention, cadets gradually shifted from impulsive response patterns toward more strategic and reflective reading behaviors. Students increasingly demonstrated the ability to identify keywords, analyze contextual clues, evaluate alternatives, and monitor their understanding. This development suggests that gamification may contribute not only to immediate learning outcomes but also to the cultivation of higher-order cognitive skills that support lifelong learning and professional performance. From a pedagogical perspective, the study confirms that gamification can serve as an effective instructional strategy in Maritime ESP education.

The findings demonstrate that technology-enhanced learning environments can bridge the gap between professional language requirements and student engagement. By integrating authentic maritime content with interactive digital tools, educators can create learning experiences that are both academically rigorous and motivationally stimulating. The study also contributes to the broader literature on gamification and ESP by addressing a context that has received relatively limited scholarly attention. While previous research has documented the effectiveness of Kahoot in general language education and several ESP disciplines, empirical investigations within maritime education remain scarce. Therefore, the present study provides valuable evidence regarding the applicability of gamified learning approaches in highly specialized vocational settings. Despite its contributions, several limitations should be acknowledged. The study involved a relatively small sample drawn from a single maritime institution, which may limit the generalizability of the findings. Additionally, the intervention focused specifically on reading comprehension and vocabulary acquisition; other language skills such as listening, speaking, and writing were not examined. Future research should therefore involve larger and more diverse samples, compare different gamification platforms, and explore the long-term effects of gamification on various dimensions of Maritime English proficiency.

In conclusion, the findings demonstrate that Kahoot-based gamification is an effective and pedagogically valuable approach for enhancing reading comprehension, technical vocabulary mastery, motivation, engagement, and metacognitive development among maritime cadets. As maritime education continues to adapt to the demands of digital transformation and global communication, gamified learning platforms offer promising opportunities for improving ESP instruction and preparing future maritime professionals for the linguistic challenges of international shipping operations.

Conflict of Interest

None

Authors' contribution

The authors create substantial contributions to the conception and design of the study. The authors took responsibility for data analysis, interpretation and discussion of results. The authors read and approved the final manuscript.

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