JOURNAL LA EDUSCI

VOL. 06, ISSUE 04 (840-854), 2025
DOI: 10.37899/journallaedusci.v6i4.2553

Project-Based Learning as a Pedagogical Strategy for Technical Vocabulary Development

Ryan Puby Sumarta[1], Yuniar Ayu Hafita[2], Agus Budiarte[3], Zohri Hamdani[4], Aliong Silalahi[1]

[1]Port and Shipping Management, Sorong Merchant Marine Polytechnic, Sorong, Indonesia
[2]Ship Engineering, Sorong Merchant Marine Polytechnic, Sorong, Indonesia
[3]Manufacturing Technology, Tunas Garuda Polytechnic, Lampung, Indonesia
[4]English Education, Lampung Muhammadiyah University, Lampung, Indonesia
[5]Port and Shipping Management, North Sulawesi Merchant Marine Polytechnic, Manado, Indonesia

**Corresponding Author: Ryan Puby Sumarta*
Email: rps55982@gmail.com

Article Info

Article history:
Received 11 August 2025
Received in revised form 12 September 2025
Accepted 31 October 2025

Keywords:
Maritime Vocabulary
Project-Based Learning
Vocational Education

Abstract

Maritime English is essential for safe and effective communication in the global shipping industry, particularly in multilingual crew environments. Despite its significance, many cadets struggle to master technical maritime vocabulary due to traditional teaching approaches that prioritize grammar and general conversation. This study investigates the effectiveness of Project-Based Learning (PBL) in enhancing cadets' mastery of maritime English technical vocabulary at Sorong Merchant Marine Polytechnic. Using a pre-test and post-test design, 20 cadets participated in simulation-based projects involving navigation planning, safety procedures, and maritime reporting. The results revealed a significant improvement in vocabulary acquisition, with average scores rising from 50.2% in the pre-test to 78.0% in the post-test. Statistical analysis using a paired-sample t-test confirmed the significance of this increase ($p < 0.05$). The findings suggest that PBL not only improves technical vocabulary comprehension but also supports the development of practical communication skills, critical thinking, and teamwork key competencies in maritime professions. This study recommends the integration of PBL into Maritime English curricula to better prepare cadets for real-world operational demands.

Introduction

In the realm of international shipping, Maritime English serves as a fundamental element that bridges communication between ship crews and various stakeholders such as port authorities and maritime agencies. This language is not only used in daily communication but also functions as a core instrument in safety procedures, navigation, ship maintenance, and other technical operations that require precise understanding of technical vocabulary (Apostol-Mates & Barbu, 2015; Heslop, 2023; Schriever, 2011; Tchkonia et al., 2019; Tishchenko, 2021).

As the lingua franca on board multinational crews, Maritime English reduces the risk of miscommunication that could be fatal to maritime safety (Apostol-Mates & Barbu, 2015; Heslop, 2023; Schriever, 2011; Tchkonia et al., 2019; Tishchenko, 2021). Mastery of Maritime English is mandated by international regulations such as the IMO and STCW, including the implementation of Standard Marine Communication Phrases (SMCP), which ensure clarity and accuracy in maritime communication (Astratinei, 2016; Oktavia & Abimanto, 2024; Tchkonia et al., 2019; Tishchenko, 2021). Maritime English plays a critical role in ensuring safety at sea by facilitating standardized communication among crew members (Molt, 2006). As a specialized form of English used in professional settings, it has become the primary

ISSN 2721-0979 (Print), ISSN 2721-1258 (Online)

communication tool in the global shipping industry, which comprises multinational crew members (James et al., 2018; Schriever, 2011; Şişlioğlu & Demirel, 2015). Technical vocabulary is essential for operational activities, including navigation, safety, and maintenance tasks (Balderas & Losey-Leon, 2018; James et al., 2018; Şişlioğlu & Demirel, 2015).

Mastery of technical vocabulary is crucial for effective communication, operational efficiency, and accident prevention due to misinterpretation of terms (Aprillina & Abimanto, 2023). Poor vocabulary knowledge has been shown to affect cadets' professional performance (Simanjuntak, 2024; Simanjuntak et al., 2024, 2025). Technical vocabulary is closely related to professional skills, and its lack may hinder cadets' ability to perform their duties effectively (Bilová, 2018; Đurović, 2021; Đurović et al., 2021). The STCW Convention, established by the International Maritime Organization, underlines the importance of linguistic competence, particularly technical vocabulary, to ensure safe and efficient vessel operations (Barus et al., 2024). Cadets with a broader maritime vocabulary demonstrate higher academic achievement and better workplace readiness (Sumarta et al., 2023, 2024). They are also more capable of adapting to international work environments and standardized procedures (Hryhorash et al., 2021; Simanjuntak et al., 2024).

However, many cadets still face difficulties in mastering and applying maritime technical vocabulary in real-life contexts (Bezhanovi et al., 2018; Đurović et al., 2021; Simanjuntak, 2024). A study at the Surabaya Merchant Marine Polytechnic showed that cadets failed to meet the minimum standard of SMCP mastery in the pre-test, indicating a systemic shortfall in the applied teaching methods (Sukomardojo et al., 2017). This challenge is further exacerbated by the fact that most cadets are non-native English speakers, which often leads to confusion in interpreting technical and non-technical terms whose meanings differ from general usage (Ali & Ismail, 2006). In maritime and military education, linguistic challenges are more demanding due to the need for precision communication in high-risk operational environments (Barus et al., 2024; Yarmolovich, 2022). Poor vocabulary skills hinder maritime communication and operational efficiency (Sartini et al., 2024; Simanjuntak, 2024; Simanjuntak et al., 2024). Many Maritime English curricula still prioritize grammar and general conversation over technical vocabulary that is essential in the workplace context (Arifin & Farida, 2024; Saray et al., 2021; Syaifudin et al., 2020). The lack of contextualized learning also results in cadets knowing only basic terminology without activation strategies in professional settings (Khrolenko, 2022; Pranckevičiūtė, 2019, 2020).

To address these challenges, Project-Based Learning (PBL) is regarded as a practical and contextual pedagogical approach. PBL allows cadets to actively learn through real-life simulations that reflect actual ship or port scenarios (Fitriani et al., 2023; Huang, 2023; Tymofyeyeva & Konstantynova, 2020). In the context of Maritime English, PBL provides a framework for applying technical vocabulary in navigational procedures, safety protocols, and ship maintenance (Fitriani et al., 2023; Huang, 2023; Tymofyeyeva & Konstantynova, 2020).

This approach also fosters teamwork, communication, personal responsibility, and learning motivation by engaging cadets in real-world projects that demand problem-solving and decision-making (Astuti et al., 2023; Warke & Kukker, 2023). PBL has been shown to be more effective than conventional methods in improving technical vocabulary and language skills in practical situations (Kristianti & Seputro YP, 2023; Kristianto & Harendita, 2022), as well as bridging the gap between theory and practice, particularly in ship maintenance and navigation (Baihaqi, 2024; Saray et al., 2021).

Additionally, PBL promotes the development of professional competencies, creativity, problem-solving, and critical thinking skills key attributes in the maritime industry (Green &

ISSN 2721-0979 (Print), ISSN 2721-1258 (Online)

du Plessis, 2023; Gutiérrez-Romero et al., 2017; Hanan et al., 2023; Jamaludin et al., 2021; Jang, 2022; Menshikova et al., 2019; Timberg et al., 2025).

Based on the aforementioned points, this study aims to explore the effectiveness of Project-Based Learning (PBL) in improving maritime technical English vocabulary among merchant marine cadets. By measuring vocabulary acquisition before and after the implementation of PBL, this study seeks to contribute meaningfully to curriculum enhancement and a more contextual, relevant, and industry-aligned approach to Maritime English instruction.

Methods

This study adopted a quantitative experimental design utilizing a one-group pre-test and post-test approach to evaluate the impact of Project-Based Learning (PBL) on cadets' mastery of maritime English technical vocabulary. The choice of this design was grounded not only in methodological suitability but also in its philosophical coherence with the research objective: to measure learning transformation through observable and measurable progress. The pre-test and post-test model enabled the study to trace linguistic development longitudinally within the same group of learners, capturing their trajectory of vocabulary acquisition before and after exposure to the PBL intervention. Such a structure was particularly relevant in this context, where the interest was less on general comparison across groups and more on the internal pedagogical efficacy of a specific instructional approach within an authentic learning environment.

The research was carried out at Sorong Merchant Marine Polytechnic, a higher maritime institution in Indonesia dedicated to preparing cadets for operational and communicative competence in the maritime industry. The institutional context provided a fertile setting for pedagogical experimentation because English instruction here is not confined to the classroom it is a living instrument of safety, navigation, and coordination on board multinational vessels. The participants consisted of 20 cadets enrolled in the Maritime English course, selected through purposive sampling. This selection was intentional, ensuring that all participants shared a similar educational background and exposure to maritime English training. Such homogeneity was crucial to control external variability and maintain the study's internal validity, allowing the observed changes in vocabulary mastery to be credibly attributed to the PBL intervention rather than to background differences or random fluctuations in learning ability.

The research instrument was a 25-item multiple-choice test developed to measure cadets' comprehension and operational use of maritime technical vocabulary. The test items were constructed around four key thematic areas navigation, safety procedures, ship maintenance, and maritime communication and reporting each of which represented essential communicative domains within the International Maritime Organization's Standard Marine Communication Phrases (SMCP). The instrument's construction was informed by both empirical and professional considerations: items were derived from authentic training manuals, shipboard communication excerpts, and instructor consultations to ensure contextual relevance and linguistic authenticity. Thus, the test measured not only recognition of technical terms but also the learners' ability to interpret and apply them in maritime-specific situations that demanded clarity, accuracy, and procedural understanding.

Before implementation, the instrument underwent pilot testing to establish its psychometric robustness. The validity analysis was conducted using the Pearson Product-Moment correlation, correlating each item score with the total test score. With a sample of 20 respondents and a significance level ($\alpha = 0.05$) producing an r-table value of 0.444, all 25 items

ISSN 2721-0979 (Print), ISSN 2721-1258 (Online)

exceeded this threshold, confirming their individual validity. This result indicated that every item contributed meaningfully to the measurement of maritime vocabulary proficiency. The instrument's reliability was assessed using Cronbach's Alpha, yielding a coefficient of 0.85, which falls within the high reliability range. Such consistency signified that the test items were internally coherent and stable, providing a dependable measure of learners' technical vocabulary knowledge. Establishing this level of reliability and validity was essential to ensure that subsequent data interpretation would rest upon firm empirical foundations.

The study unfolded through three main phases: pre-testing, PBL intervention, and post-testing. In the pre-test phase, cadets completed the vocabulary test to determine their baseline mastery. This phase provided diagnostic insight into the initial state of their lexical competence and established a meaningful point of comparison for evaluating post-intervention learning gains. The PBL intervention phase constituted the pedagogical core of the study. Conducted over four structured sessions spanning two weeks, it was designed to immerse cadets in collaborative, task-driven projects that mirrored authentic maritime scenarios. Each project required cadets to engage directly with technical vocabulary as part of communicative action rather than as isolated linguistic forms. Projects included voyage planning simulations, shipboard safety procedure enactments, incident report drafting, and emergency communication drills. These activities reproduced the dynamic and unpredictable nature of maritime operations, where understanding and using the right terms can determine the accuracy and safety of crew coordination.

The instructional approach during the PBL sessions was dialogic rather than transmissive. Instructors served as facilitators and mediators, guiding cadets through the language of their profession rather than delivering knowledge in a top-down manner. Learning emerged through interaction, reflection, and the co-construction of meaning as cadets negotiated linguistic accuracy within their team-based problem-solving processes. This shift in classroom dynamics was intentional: PBL situates learners not as passive recipients but as active agents of inquiry who must mobilize their vocabulary to make decisions, communicate procedures, and resolve operational challenges. As a result, the cadets were not merely learning words they were learning how those words work in the real discourse of maritime operations. Such experiential engagement allowed vocabulary to move from rote memory into functional, situational competence a transformation central to communicative mastery in vocational English.

Upon completion of the intervention, participants took the post-test, which mirrored the pre-test in format, content scope, and difficulty level. This test captured the extent of linguistic development resulting from the project-based learning experience. Data from both pre- and post-tests were analyzed using descriptive statistics (mean, standard deviation) to illustrate overall performance trends, and inferential statistics, particularly the paired-sample t-test, to determine the significance of observed differences. The paired t-test was chosen because it allows for a precise evaluation of score differences within the same participant group, controlling for interindividual variance. A significance level of $p < 0.05$ was used as the threshold to confirm whether improvements in post-test scores could be attributed to the pedagogical treatment rather than random chance.

Throughout the research process, ethical principles were carefully observed. Participants were fully informed about the study's objectives and procedures, and their involvement was voluntary. Data were treated with confidentiality, and test results were anonymized to prevent any form of academic or institutional bias. This ethical awareness was essential not only to safeguard participant rights but also to maintain the integrity of the study within a professional training institution where academic hierarchies might inadvertently influence participation.

ISSN 2721-0979 (Print), ISSN 2721-1258 (Online)

Results and Discussion

The purpose of the research was to evaluate the relational proficiency of the maritime English technical vocabulary under the control of different cadet participants before and after the implementation of Project-Based Learning (PBL). The information was obtained with the help of a battery of twenty-five closed-ended questions that included information about navigation, ship-safety procedures, maritime incident reporting measures and ship-maintenance procedures. The test items were scrutinized on validation and reliability before they were administered during the pre-test and post-test phase.

Validity Test and Reliability Test Instrument Test

Before the start of the instructional experiment, the instrument was taken through an intensive validity and reliability test to ascertain that the collected data had empirical and theoretical integrity. Such a preliminary stage was mandatory, because, with respect to quantitative educational research, the accuracy of measurement tools determines the validity of all the subsequent analytical conclusions. The twenty-five multiple-choice questions instrument was aimed at measuring the knowledge of the cadets on technical vocabulary of maritime English in four functional areas: navigation, safety procedures, ship maintenance, and maritime communication. These domains have been chosen intentionally because they are the fundamental linguistic areas in which maritime professionals exchange information, negotiate contingencies of operation, and ensure safety on multinational ships.

Validity was determined through Pearson product-moment correlation coefficients, in which, the item level scores were compared to the aggregate test score measured on a sample of twenty respondents. The critical r-value of 0.05 was set at 0.444. Table 1 results have shown that all items received a coefficient value greater than the critical value, with the highest coefficient value of 0.710 and 0.558 being the lowest. These results confirm that all items make a significant contribution to measuring a desired construct, which is mastery of technical maritime vocabulary.

Validity Test

The validity test was conducted using the Pearson Product-Moment correlation between each item's score and the total score of 20 respondents. The minimum r-table value for significance at $\alpha = 0.05$ was 0.444.

Table 1. Item Validity Test Results

No.	r-calculated	r-table	Result
1	0.602	0.444	Valid
2	0.668	0.444	Valid
3	0.573	0.444	Valid
4	0.690	0.444	Valid
5	0.587	0.444	Valid
6	0.641	0.444	Valid
7	0.612	0.444	Valid
8	0.710	0.444	Valid
9	0.589	0.444	Valid
10	0.663	0.444	Valid
11	0.558	0.444	Valid
12	0.621	0.444	Valid
13	0.599	0.444	Valid

ISSN 2721-0979 (Print), ISSN 2721-1258 (Online)

14	0.682	0.444	Valid
15	0.636	0.444	Valid
16	0.578	0.444	Valid
17	0.605	0.444	Valid
18	0.671	0.444	Valid
19	0.683	0.444	Valid
20	0.590	0.444	Valid
21	0.655	0.444	Valid
22	0.667	0.444	Valid
23	0.692	0.444	Valid
24	0.630	0.444	Valid
25	0.648	0.444	Valid

This validation process confirmed that the test measured not just lexical recall but the cadets' ability to comprehend and apply maritime terminology within contextually bound communicative situations. In professional maritime operations, the meaning of a term such as "port clearance," "engine alarm," or "man overboard" cannot be understood lexically alone it must be understood pragmatically, in terms of its procedural and situational use. Hence, the high item validity across all test items indicates that the instrument captured vocabulary as a communicative act of precision, rather than as an abstract linguistic category. This alignment between construct and operational measure ensures that the research findings genuinely reflect improvements in professional language use.

Beyond validity, instrument reliability was tested using Cronbach's Alpha to examine internal consistency among items.

Reliability Test

The reliability test was conducted using Cronbach's Alpha to measure the internal consistency among items.

Table 2. Instrument Reliability Test Results

Indicator	Value
Number of Items	25
Number of Respondents	20
Cronbach's Alpha	0.85
Reliability Category	High

The Cronbach's Alpha coefficient of 0.85 positions the test squarely in the high reliability range, signaling strong internal coherence among the items. A test with this level of reliability is not only statistically dependable but pedagogically stable, capable of yielding consistent results across repeated administrations or different samples of similar learners. In the context of English for Specific Purposes (ESP) and vocational education, reliability is not merely a psychometric concern it reflects how well an assessment instrument mirrors the cognitive and communicative reality of the discipline it serves.

Thus, the validation and reliability outcomes jointly confirm that this research rested on a methodologically secure foundation. The instrument measured what it claimed to measure, did so consistently, and reflected authentic maritime communicative needs. This empirical robustness provides legitimacy to the subsequent findings on the efficacy of Project-Based Learning (PBL) as a pedagogical intervention.

ISSN 2721-0979 (Print), ISSN 2721-1258 (Online)

Pre-test and Post-test Scores

To determine the effectiveness of the Project-Based Learning (PBL) approach in enhancing cadets' mastery of maritime English technical vocabulary, a pre-test and post-test were administered to 20 participants. Each test consisted of 25 multiple-choice questions covering navigation, maritime reporting, safety procedures, and vessel maintenance terminology. The table below presents individual and average scores before and after the intervention.

Table 3. Pre-test and Post-test Results

Participant	Correct Pre-test	Pre-test Score (%)	Correct Post-test	Post-test Score (%)
Participant 1	14	56.0	23	92.0
Participant 2	13	52.0	20	80.0
Participant 3	15	60.0	20	80.0
Participant 4	18	72.0	17	68.0
Participant 5	12	48.0	19	76.0
Participant 6	12	48.0	20	80.0
Participant 7	18	72.0	18	72.0
Participant 8	15	60.0	21	84.0
Participant 9	12	48.0	19	76.0
Participant 10	15	60.0	19	76.0
Participant 11	12	48.0	19	76.0
Participant 12	12	48.0	24	96.0
Participant 13	14	56.0	20	80.0
Participant 14	7	28.0	18	72.0
Participant 15	8	32.0	22	88.0
Participant 16	11	44.0	18	72.0
Participant 17	10	40.0	20	80.0
Participant 18	14	56.0	16	64.0
Participant 19	10	40.0	17	68.0
Participant 20	9	36.0	20	80.0
Average		12.55	**50.2**	19.5	**78.0**

The data reveal a significant overall gain in vocabulary mastery, with the mean score rising from 50.2% to 78.0%, representing a 27.8 percentage point increase. This magnitude of improvement in such a short intervention window is pedagogically meaningful it suggests not only increased familiarity with maritime terminology but also enhanced capacity to use these terms in task-based communication.

The improvement pattern across participants also reflects the democratic nature of PBL: most cadets benefited substantially, with lower-achieving learners showing considerable upward movement. A few minor fluctuations (e.g., Participant 4's small decline) highlight individual learning differences but do not undermine the overall trend. On the contrary, they humanize the data, reminding us that learning is never a perfectly linear process it involves negotiation, struggle, and gradual internalization.

From a learning theory perspective, this outcome affirms the experiential foundation of PBL. When learners engage with vocabulary as a communicative resource in real or simulated tasks, they encode it more deeply within long-term memory. The shift from abstract recall to applied usage mirrors the transition from declarative knowledge ("knowing what") to procedural knowledge ("knowing how") a key goal in vocational education. In maritime contexts, such

ISSN 2721-0979 (Print), ISSN 2721-1258 (Online)

transformation is critical: cadets must not only know the meaning of "emergency muster," but be able to use it accurately under pressure, in real operational dialogue.

Statistical Verification of the PBL Effect

To ensure that the observed improvements were not due to random chance, a paired-sample t-test was conducted comparing pre-test and post-test scores.

Table 4. Paired t-Test Results

Statistic	Value
Pair	Pre-test vs. Post-test
t-statistic	-8.20
Degrees of Freedom (df)	19
Sig. (2-tailed)	0.0000
Mean Pre-test	50.2
Mean Post-test	78.0
Mean Difference	27.8
SD Pre-test	11.79
SD Post-test	7.95
SD of Differences	15.16

The paired t-test yielded a t-value of -8.20 and a p-value of 0.000, establishing that the increase was statistically significant ($p < 0.05$). This confirms that the PBL intervention had a genuine and measurable effect on learners' vocabulary development. The decrease in standard deviation from 11.79 to 7.95 suggests an additional qualitative outcome: post-intervention learning became more evenly distributed across the group.

This statistical convergence indicates that the PBL environment fostered collective learning stability, minimizing disparities between high and low performers. The structure of PBL where learners work collaboratively on shared projects creates opportunities for peer-to-peer scaffolding, dialogic correction, and co-construction of meaning. These interactions allow weaker learners to internalize concepts through observation and guided participation, while stronger learners consolidate knowledge through explanation and leadership. Such dynamics embody the Vygotskian concept of the "zone of proximal development," where knowledge is socially mediated before it becomes individually mastered. Hence, the significance revealed by Table 4 is not purely numerical it captures a sociocognitive transformation within the learning group. The shift in performance homogeneity underscores that learning in this study was not competitive but collaborative, echoing the cooperative reality of maritime work itself, where communication efficiency is inseparable from teamwork.

Project-Based Learning and the Reimagining of Maritime English Pedagogy

The results of this study demonstrate that Project-Based Learning (PBL) does more than enhance cadets' technical vocabulary it fundamentally reshapes how they experience language as part of their professional becoming. This transformation is not merely quantitative, as reflected in the statistical gains, but qualitative in the way learners begin to inhabit the language of their discipline. The improvement in post-test performance signifies a shift from learning about words to learning through words, where vocabulary is no longer an external object of study but a tool through which cadets think, act, and collaborate. In maritime education, where the clarity of communication directly affects safety, efficiency, and coordination, this shift represents a deeper epistemological reorientation: learning language becomes an act of learning to operate safely and responsibly in a global professional community.

ISSN 2721-0979 (Print), ISSN 2721-1258 (Online)

The pedagogical logic underpinning this transformation is anchored in the principles of situated and experiential learning. Fitriani et al. (2023) emphasize that the power of PBL lies in its capacity to situate language learning within contexts that mirror real-world communication, enabling learners to construct meaning through purposeful action. This resonates directly with the present study, in which cadets learned maritime vocabulary not as static lexical items but as discourse tools embedded in authentic scenarios navigational planning, safety reporting, or engine maintenance coordination. Within these tasks, words gained function, context, and urgency. Learners no longer memorized terminology in isolation but deployed it in simulated operations that demanded precision, negotiation, and mutual understanding. This process aligns with Dewey's idea of learning by doing and Kolb's cycle of experiential reflection, where learners transform concrete experience into conceptual understanding. Thus, the improvement observed is not simply the result of more exposure to vocabulary but the product of engaging language as action within an environment that made communication necessary and meaningful.

Yet, the success of PBL observed here is not a product of chance or novelty. It is contingent upon the careful orchestration of structure, scaffolding, and reflective mediation. Germo et al. (2024), in their investigation of blended PBL in maritime training, observed that poorly scaffolded projects often fail to produce durable learning outcomes because learners may misinterpret autonomy as self-direction without guidance. In contrast, when projects are carefully structured with progressive tasks, feedback checkpoints, and collaborative evaluation, the learning process becomes a shared intellectual journey rather than a solitary endeavor. The present study echoes this insight: the consistent improvement across participants and the reduced variability in post-test performance suggest that the instructional design maintained a delicate equilibrium between independence and support. Cadets were challenged to act autonomously within the safety of guided collaboration a pedagogical balance that mirrors the very conditions of shipboard teamwork, where initiative and interdependence must coexist.

The collaborative and dialogic nature of PBL thus emerges as a central explanatory factor. The reduced variance in post-test scores reflects not only cognitive progress but also the social equalization that occurs when learning is mediated through interaction. Weaker learners benefited from peer scaffolding; stronger learners deepened understanding by articulating and modeling. This mutual engagement transforms the classroom from a site of instruction into a microcosm of professional practice. As Vygotsky's sociocultural theory predicts, learning becomes a social accomplishment before it becomes an individual one. The maritime learning space, under PBL, becomes an anticipatory rehearsal for the communicative demands of maritime operations, where meaning is continuously negotiated under conditions of interdependence and shared accountability.

Equally important, the findings reveal the affective dimension of PBL the way it mobilizes motivation, confidence, and professional identity. Kristianti & Seputro (2023) note that in technical English contexts, project work fosters intrinsic motivation because it validates learners' sense of purpose: they see themselves not as students completing assignments but as practitioners solving real problems. This dynamic was evident among the cadets in the present study, whose engagement during PBL extended beyond compliance to ownership. In performing as navigators, safety officers, and communicators, they were not merely rehearsing English sentences they were enacting the discursive persona of maritime professionals. Such identity work is not peripheral to language learning; it is the very mechanism through which vocational communication competence emerges. In other words, PBL does not only teach learners how to speak the language of their trade but also how to inhabit it. The acquisition of

ISSN 2721-0979 (Print), ISSN 2721-1258 (Online)

specialized vocabulary thus becomes intertwined with the internalization of professional values such as precision, accountability, and teamwork.

The growing corpus of maritime English scholarship supports this interpretation. Hafita et al. (2024) found that the persistent difficulty among maritime students lies not in general linguistic ability but in the inability to perform technical communication authentically in professional situations. Their findings, drawn from a broad needs analysis across Indonesian maritime polytechnics, emphasize that vocabulary mastery must be functionally tied to specific communicative tasks especially those involving safety procedures and operational coordination. The present study provides empirical confirmation of this principle: the cadets' significant gains in vocabulary occurred precisely because learning was tied to realistic tasks that mirrored workplace discourse. When language is experienced as an operational necessity rather than a classroom requirement, learning becomes naturally purposeful, and retention becomes durable.

This connection between language and operational readiness brings the discussion to a more consequential dimension safety. As Simanjuntak et al. (2024) underline, communication failures remain one of the critical human factors contributing to maritime accidents, often rooted in misused or misunderstood Standard Marine Communication Phrases (SMCP). From this perspective, the improved vocabulary mastery observed here carries implications beyond the classroom. It gestures toward the cultivation of a more linguistically aware and operationally competent maritime workforce. Teaching cadets to command precise technical language is not only an academic goal but a contribution to global maritime safety. PBL, by embedding vocabulary in authentic operational scenarios, integrates linguistic accuracy with professional responsibility, turning language instruction into a form of safety training. In this sense, the pedagogical significance of PBL transcends learning efficiency; it assumes ethical and institutional weight.

The social structure of PBL also deserves closer attention as a mechanism for equity. The collective work format requiring cadets to collaborate, delegate, and coordinate appears to have fostered an inclusive learning environment that mitigated disparities in language proficiency. Similar patterns are reported in Germo et al.'s (2024) research, where cooperative PBL projects narrowed performance gaps between students of varying competence levels. This equalizing effect arises because knowledge circulates horizontally within teams rather than vertically from teacher to student. In maritime English, this model aligns with the ethos of seamanship itself, which is inherently collective and communication-driven. The cadet who learns to articulate technical instructions in a project team today rehearses the communicative precision needed to manage crises at sea tomorrow.

In the wider landscape of recent scholarship, this study also contributes to what Tuna Cerit (2023) describes as the "reconceptualization stage" of maritime English pedagogy. Cerit observes that while awareness of PBL's potential has increased, empirical studies that quantify its effect in maritime contexts remain scarce. Most existing work has been exploratory or anecdotal. By demonstrating statistically verified vocabulary gains, this research adds weight to the growing claim that PBL is not merely a progressive teaching idea but a demonstrably effective approach for maritime communication training. Nonetheless, the field still faces methodological limitations short intervention durations, lack of follow-up on language retention, and minimal exploration of onboard transferability. Future research should extend this line of inquiry longitudinally, tracing how gains in vocabulary manifest in real shipboard performance and whether they persist under operational pressure.

ISSN 2721-0979 (Print), ISSN 2721-1258 (Online)

The present discussion suggests that the strength of PBL lies in its capacity to integrate cognitive, social, affective, and ethical dimensions of learning into one coherent pedagogical experience. It transforms maritime English instruction from an academic exercise into a rehearsal of professionalism, linking linguistic knowledge with the moral and operational imperatives of safety and communication. The cadets' progress thus signifies more than success in mastering words it marks a developmental shift toward communicative competence that is both practical and principled. PBL enables this shift because it teaches not only through projects but through participation: learners become active agents in constructing meaning, responsibility, and identity.

Conclusion

This study confirms that Project-Based Learning (PBL) is an effective approach for improving cadets' mastery of maritime technical English vocabulary. The significant increase in post-test scores demonstrates that cadets learned and retained technical terms more effectively when they engaged in realistic, hands-on projects that reflected actual maritime operations. Rather than relying on rote memorization or abstract instruction, PBL enabled students to internalize vocabulary through active use in navigation planning, maritime safety drills, and incident reporting scenarios. These findings also highlight the shortcomings of traditional Maritime English instruction, which often emphasizes grammar and general conversation at the expense of job-relevant terminology. By aligning learning with the real-world communication demands of the maritime industry, PBL not only enhances vocabulary acquisition but also builds essential soft skills such as teamwork, communication, and problem-solving skills highly valued in the international shipping sector. In conclusion, PBL offers a contextual, engaging, and pedagogically sound alternative to conventional language teaching approaches. It provides a clear pathway to bridge the gap between classroom learning and professional practice, making it a valuable strategy for maritime education institutions seeking to produce globally competent and communication-ready seafarers. Future research may expand on these findings by exploring long-term vocabulary retention and performance in on-board environments.

References

Ali, M., & Ismail, Z. (2006). Comprehension Level Of Non-Technical Terms In Science: Are We Ready For Science In English. *Jurnal Pendidik Dan Pendidikan*, *21*, 73–83. http://www.usm.my/education/publication/5 Maznah (73-83).pdf

Apostol-Mates, R., & Barbu, A. (2015). Is Maritime English The Key In Solving Communication Problems Within Multinational Crews? *International Conference KNOWLEDGE-BASED ORGANIZATION*, *21*(2), 541–544. https://doi.org/10.1515/kbo-2015-0092

Aprillina, A., & Abimanto, D. (2023). Karakteristik Bahasa Inggris Maritim Secara Kata dan Frasa. *Sintaksis : Publikasi Para Ahli Bahasa Dan Sastra Inggris*, *1*(6), 72–83. https://doi.org/https://doi.org/10.61132/sintaksis.v1i6.365

Arifin, S., & Farida, E. K. (2024). Efektivitas Penerapan Jam Tambahan Dalam Maritim Di Politeknik Pelayaran Malahayati Tahun 2023. *Jurnal Maritim Malahayati (JuMMa)*, *5*(1), 144–149. https://doi.org/https://doi.org/10.70799/jumma.v5i1.73

Astratinei, C. (2016). E-Learning Course For Maritime English. *ELearning and Software for Education*, 308–312. https://doi.org/https://doi.org/10.12753/2066-026x-16-132

ISSN 2721-0979 (Print), ISSN 2721-1258 (Online)

Astuti, P., Febrian, F., Fera, M., Putri, N. H. S., Azmi, R. D., & Rosmery, L. (2023). Project-based Learning Design: Developing Maritime Context-based Tasks in English for Mathematics Course. *BIO Web of Conferences*, *79*. https://doi.org/10.1051/bioconf/20237905002

Baihaqi, B. (2024). Enhancing Cadet Preparedness For Engine Maintenance Challenges: A Qualitative Study In Maritime Education. *International Journal of Mechanical, Electrical and Civil Engineering*, *1*(3), 172–182. https://doi.org/10.61132/ijmecie.v1i3.37

Balderas, A., & Losey-Leon, M. A. (2018). Virtual learning tool for the training of the standard marine communication phrases. *SIIE 2018 - 2018 International Symposium on Computers in Education, Proceedings*. https://doi.org/10.1109/SIIE.2018.8586750

Barus, I. R. G., Simanjuntak, R., Siahaan, R. Y., Toko, G. P., & Resmayasari, I. (2024). Cultural and Linguistic Challenges in Global Maritime Education (Navigating English Usage). *Meteor Stip Marunda*, *17*(1), 121–130. https://doi.org/10.36101/msm.v17i1.358

Bezhanovi, Z., Mikeladze, T., Zarbazoia, K., & Rodinadze, S. (2018). The case-studies based approach in maritime english teaching. In M. A., G. M., M. de O. F.X., & C. M. (Eds.), *AGA 2018 - 19th Annual General Assembly (AGA) of the International Association of Maritime Universities (IAMU)* (pp. 54–60). International Center for Numerical Methods in Engineering.

Bilová, Š. (2018). Collaborative and Individual Vocabulary Building Using ICT. *Studies in Logic, Grammar and Rhetoric*, *53*(66), 31–48. https://doi.org/10.2478/slgr-2018-0002

Đurović, Z. (2021). Corpus linguistics methods for building ESP word lists, glossaries and dictionaries on the example of a marine engineering word list. *Lexikos*, *31*, 259–282. https://doi.org/10.5788/31-1-1647

Đurović, Z., Vuković-Stamatović, M., & Vukičević, M. (2021). How much and what kind of vocabulary do marine engineers need for adequate comprehension of ship instruction books and manuals? *Circulo de Linguistica Aplicada a La Comunicacion*, *88*, 123–133. https://doi.org/10.5209/clac.78300

Fitriani, R., Dwi Febriyani, S., Pratama, G., Andika, K., Aprilla, R., Nurfajrina, R., Stivani Suherman, D., & Fitra Ritonga, A. (2023). The Influence Of Maritime Education Through Project Based Learning-A Review. *BIO Web of Conferences*, *79*. https://doi.org/10.1051/bioconf/20237902004

Germo, R., Tan, V. S., & Casañare, A. F. (2024). Effectiveness of problem-based learning (PBL) on maritime courses in a blended learning modality. *TransNav, International Journal on Marine Navigation and Safety od Sea Transportation*, *18*(3), 649-655.

Green, S. L., & du Plessis, E. C. (2023). Project-based Learning to Promote Learner Autonomy in Training Hospitality Education at a Technical and Vocational Education and Training College. *International Journal of Learning, Teaching and Educational Research*, *22*(7), 136–155. https://doi.org/10.26803/ijlter.22.7.8

Gutiérrez-Romero, J. E., Zamora-Parra, B., & Esteve-Pérez, J. A. (2017). Acquisition of offshore engineering design skills on naval architecture master courses through

ISSN 2721-0979 (Print), ISSN 2721-1258 (Online)

potential flow CFD tools. *Computer Applications in Engineering Education*, *25*(1), 48–61. https://doi.org/10.1002/cae.21778

Hafita, Y. A., Sumarta, R. P., Riyanto, B., & Sulistiono, A. (2024). a Comprehensive Needs Analysis of Maritime English for Ship Machinery Students. *Exposure: Jurnal Pendidikan Bahasa Inggris*, *13*(2), 554-569.

Hanan, A., Marjani, G. I., Suherman, U., Firdaus, A., Albustomi, A. G., Solehudin, Goffary, I., Anwar, S., Mu'Min, & Arken, M. R. (2023). Harnessing Technology for Environmental Method: Cultivating High Order Thinking Skills for Sustainable Maritime Development Knowledge. *IOP Conference Series: Earth and Environmental Science*, *1265*. https://doi.org/10.1088/1755-1315/1265/1/012004

Heslop, I. Q. (2023). Seafarers' Perception on Maritime English Utilization on Board. *International Journal of Science and Management Studies (IJSMS)*, *6*(4), 171–178. https://doi.org/10.51386/25815946/ijsms-v6i4p120

Hryhorash, V. S., Kravets, H. B., & Tsynova, M. V. (2021). Effectiveness Of Task-Based Learning In Improving Speaking Skills And Professional Vocabulary Knowledge While Teaching Maritime English. *International Journal of Philology*, *12*(3), 116–121.

Huang, X. (2023). Research on the Implementation Difficulties and Optimization Measures of Project-based Teaching in Maritime English. *International Journal of Education and Humanities*, *10*(3), 114–118. https://doi.org/10.54097/ijeh.v10i3.12235

Jamaludin, Susila, I. W., Sutiadiningsih, A., Suparji, & Anifah, L. (2021). Influence of Project-Based Learning Model To Increase Cadet Creativity In Politeknik Penerbangan Surabaya: Literatur Review. *International Journal of Science, Technology & Management*, *2*(1), 201–209. https://doi.org/10.46729/ijstm.v2i1.125

James, A., Schriever, U., Jahangiri, S., & Girgin, S. C. (2018). Improving Maritime English Competence as the Cornerstone of Safety at Sea: A Focus on Teaching Practices to Improve Maritime Communication. *Wmu Journal of Maritime Affairs*, *17*(2), 293–310. https://doi.org/10.1007/s13437-018-0145-4

Jang, S.-H. (2022). Case Analysis of Overseas Countries in Project-based Learning for Vocational Education and Workforce Development. *International Journal of Emerging Technology and Advanced Engineering*, *12*(4), 78–85. https://doi.org/10.46338/ijetae0422_11

Khrolenko, O. (2022). Specifics of Cognitive and Communicative Approach to Teaching the English Profession-Related Vocabulary to Future Navigators. *Scientific Bulletin of South Ukrainian National Pedagogical University Named After K D Ushynsky*, *2022*(1 (138)), 87–93. https://doi.org/10.24195/2617-6688-2022-1-11

Kristianti, T., & Seputro YP, H. (2023). The Effectiveness of Project-Based Learning (Pbl) for Engineering Students in Esp Class. *Journal of Educational Learning and Innovation (ELIa)*, *3*(1), 146–154. https://doi.org/10.46229/elia.v3i1.619

Kristianto, I. I., & Harendita, M. E. (2022). The Implementation Of Project-Based Learning In An Esp Class To Improve Reading And Speaking Skills. *English Language Teaching and Research Journal*, *6*(1), 1–10.

Menshikova, M. A., Gavrilova, T. V, Smirnova, P. V, & Piunova, Y. V. (2019). Improving the Quality of Higher Education with the Project Based Learning. In S. S.O. & P. S. 5

ISSN 2721-0979 (Print), ISSN 2721-1258 (Online)

Saint Petersburg Electrotechnical University "LETI" Saint Petersburg (Eds.), *Proceedings of the 2019 IEEE International Conference Quality Management, Transport and Information Security, Information Technologies IT and QM and IS 2019* (pp. 50–53). Institute of Electrical and Electronics Engineers Inc. https://doi.org/10.1109/ITQMIS.2019.8928306

Molt, E. (2006). No Double-Dutch at Sea: How English Became the Maritime Lingua Franca . *International Journal of Maritime History*, *18*(2), 245–256. https://doi.org/10.1177/084387140601800211

Oktavia, A., & Abimanto, D. (2024). Using Innovative Technologies in the Process of Teaching Maritime English. *International Journal of Educational Development*, *1*(3), 61–68. https://doi.org/10.61132/ijed.v1i3.69

Pranckevičiūtė, V. (2019). Setting the Guidelines for Teaching Maritime English on the Basis of Language Skills and the Evaluation of the Vocabulary Themes Importance in the Context of Seagoing Practice. A Case Study. *Šiuolaikinės Visuomenės Ugdymo Veiksniai*, *4*(1), 183–194. https://doi.org/10.47459/svuv.2019.4.11

Pranckevičiūtė, V. (2020). Learning of Maritime Vocabulary in Maritime Studies. *Šiuolaikinės Visuomenės Ugdymo Veiksniai*, *5*(1), 169–178. https://doi.org/10.47459/svuv.2020.5.11

Saray, S., Satır, T., & Doğan-Sağlamtimur, N. (2021). Proficiency of Maritime English course: An investigation in Istanbul, Turkey. *Heritage and Sustainable Development*, *3*(1), 6–15. https://doi.org/10.37868/hsd.v3i1.48

Sartini, S., Triyono, S., & Triastuti, A. (2024). Unveiling maritime English communication needs for seafarer: Strategic reformation for classroom instructional design. *Maritime Technology and Research*, *7*(2), Manuscript. https://doi.org/10.33175/mtr.2025.271921

Schriever, U. (2011). Maritime english - The need to bridge linguistic and cultural barriers in the international shipping industry. In Q. Le & T. Le (Eds.), *Linguistic Diversity and Cultural Identity: A Global Perspective* (pp. 15–24). Nova Science Publishers.

Simanjuntak, M. B. (2024). Enhancing maritime ESG leadership through english communication skills. *E3S Web of Conferences*, *577*. https://doi.org/10.1051/e3sconf/202457702014

Simanjuntak, M. B., Rafli, Z., & Utami, S. R. (2024). Impact of english language proficiency on maritime safety and environmental protection. *E3S Web of Conferences*, *577*, 1–8. https://doi.org/10.1051/e3sconf/202457701002

Simanjuntak, M. B., Rafli, Z., & Utami, S. R. (2025). A Maritime English learning model for enhancing operational effectiveness. *BIO Web of Conferences*, *175*. https://doi.org/10.1051/bioconf/202517506002

Şişlioğlu, M., & Demirel, E. (2015). *Evaluation of delivery of maritime education and training in English in Turkey*. International Educational Technology Conference (IETC) 2015. https://www.researchgate.net/publication/342834924

Sukomardojo, T., Ratnaningsih, D., & Jama'an, A. (2017). Penggunaan Media Games Untuk Meningkatkan Kosakata Smcp (Standard Marine Communication Phrases) Dalam Bahasa Inggris Maritim. *Jurnal 7 Samudra*, *2*(1), 18–23. https://doi.org/10.54992/7samudra.v2i1.5

ISSN 2721-0979 (Print), ISSN 2721-1258 (Online)

Sumarta, R. P., Hafita, Y. A., Budiarte, A., & Utami, H. (2024). Investigating The Cadets' Vocabulary Learning Strategies And Their Maritime Vocabulary Mastery. *Exposure: Jurnal Pendidikan Bahasa Inggris*, *13*(2), 360–369. https://doi.org/https://doi.org/10.26618/exposure.v13i2.15108

Sumarta, R. P., Widarbowo, D., Haryanto, D., & Budiarte, A. (2023). How Does Vocabulary Size Affect Maritime English Achievement? a Correlational Study of Cadets in Sorong Merchant Marine Polytechnic. *RSF Conference Series Engineering and Technology*, *3*(1), 236–243. https://doi.org/10.31098/cset.v3i1.753

Syaifudin, R., Sari, A. W., A.P, T. P., & Yanti, T. S. (2020). Students' Receptive Vocabulary Size and Academic Performance: Exploring Possible Relationship. *International Conference on English Language Teaching (ICONELT 2019) Students'*, *434*, 208–213. https://doi.org/10.2991/assehr.k.200427.041

Tchkonia, N., Kalandadze, E., & Dolidze, N. (2019). Teaching Maritime English with Innovative Technologies. *International Conference on New Trends in Social Sciences*, 46–51. https://doi.org/https://www.doi.org/10.33422/ntss.2019.08.492

Timberg, L., Alop, A., Tombak, M.-L., Hunt, T., Zaitseva-Pärnaste, I., Usmanov, R., Priimets, J., Pahapill, L., Laid, N., Moosaar, H., Heinmets, V., Kaurla, K., Post, T., Ruus, T., Tammela, J., Saksa, A., Karu, H., Šestak, L., Saarinen, Y., & Joonsaar, R. (2025). Maritime Problem Based Learning and Student Engagement. In A. M.E. & R. T. (Eds.), *Lecture Notes in Networks and Systems: Vol. 1280 LNNS* (pp. 302–311). Springer Science and Business Media Deutschland GmbH. https://doi.org/10.1007/978-3-031-83523-0_28

Tishchenko, O. (2021). Development of Foreign Language Communicative Competence In Process Of Future Navigators' Education. *Series: Pedagogical Sciences*, *2*, 305–312. https://doi.org/10.31494/2412-9208-2021-1-2

Tymofyeyeva, O. Y., & Konstantynova, T. M. (2020). The Strategies of Student-Centered Approach At the Maritime English Learning Process. *Visnik Zaporiz'kogo Naciohai'nogo Universitetu. Pedagogicni Nauki*, *1*(1), 207–212. https://doi.org/10.26661/2522-4360-2020-1-33

Warke, A., & Kukker, A. (2023). Role of Engineering Projects in Prospective of Teaching-Learning Process. *2023 IEEE Pune Section International Conference, PuneCon 2023*. https://doi.org/10.1109/PuneCon58714.2023.10450085

Yarmolovich, O. I. (2022). Preparation of Cadets of Higher Military Educational Institutions in Ukraine for Teaching (Perception) of Professional Vocabulary (Terminology) in English Classes. *Journal of Curriculum and Teaching*, *11*(8), 467–475. https://doi.org/10.5430/jct.v11n8p467

ISSN 2721-0979 (Print), ISSN 2721-1258 (Online)