Simulation-Based Experiential Learning for Developing Professional Writing Competency: A Human Capital Perspective

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ABSTRACT

Writing is increasingly recognized as a critical employability skill and a core component of organizational communication. However, traditional instructional approaches often fail to connect technical knowledge with communication capabilities. This study examines the role of simulation-based experiential learning in enhancing professional writing competency within a management and training context. This study adopts a quasi-experimental design using a pretest–posttest approach involving 104 cadets from maritime institutions. The intervention integrates a navigation light simulator within an experiential learning framework to support the development of writing skills in Maritime English. The results indicate a statistically significant improvement in participants' performance, supported by an increase in mean scores, a moderate effect size, and a normalized gain score of 0.33. Additionally, reduced score variability suggests improved competency alignment across participants. From a management perspective, these findings highlight the effectiveness of experiential, simulation-based training as a mechanism for human capital development, particularly in enhancing communication-intensive competencies. The study contributes to the literature by extending experiential learning theory into the domain of professional communication and employability. Practical implications suggest that integrating simulation-based learning into training design can bridge the gap between technical expertise and communication skills required in organizational settings.

Keywords*: Experiential Learning, Employability Skills, Human Capital Development, Professional Writing, Simulation-Based Training.*

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INTRODUCTION

Writing competency has been widely recognized as a critical skill in higher education and, more importantly, as a core component of employability and human capital development in management and professional contexts. In organizational settings, writing is not merely an academic exercise but a fundamental medium for communication, decision-making, and knowledge transfer. Business writing, such as reports, technical documentation, and operational guidelines, plays a vital role in ensuring clarity, coordination, and effectiveness within organizations (Clokie & Fourie, 2016; Knight, 2020). Higher education institutions are increasingly expected to equip students with writing competencies that align with workplace demands and organizational expectations (Lim, 2015; Moore & Morton, 2017; Lutfia & Rahadi, 2020).

From a management perspective, writing competency is closely associated with analytical thinking, problem-solving, and communication effectiveness. Employers consistently identify written communication as a key competency required for graduate readiness, yet a persistent gap remains between academic preparation and workplace expectations (Kavanagh & Drennan, 2008; Sokoloff, 2012; Yoshida & Guzman, 2025). This "communication skills gap" highlights the need for more practice-oriented and contextually relevant approaches in developing students' writing abilities (Kleckner &

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Butz, 2021; Miller & McCullough, 2025). Writing, therefore, should be conceptualized not only as a linguistic skill but as a managerial capability that supports organizational performance and professional effectiveness.

Previous studies have emphasized the importance of writing skills in supporting both academic success and professional readiness. For example, Rose et al. (2020) demonstrate that writing proficiency is closely linked to higher-order cognitive skills and academic performance, while Mascle (2013) highlight the role of structured writing instruction in enhancing argumentation and analytical abilities. In management education, writing has been further associated with self-efficacy, communication competence, and employability outcomes (Pittenger et al., 2006). More recent research also suggests that integrating real-world tasks and digital platforms can enhance students' engagement with writing and improve workplace-relevant competencies (Sharma, 2022; Wu & You, 2022).

In response to these challenges, experiential learning has emerged as a promising approach to bridging the gap between academic learning and professional skill development. Rooted in Experiential Learning Theory (ELT), this approach emphasizes learning through direct experience, reflection, and application (Kolb et al., 2014). Within management education, experiential learning has been shown to enhance employability skills, including critical thinking, problem-solving, and communication (Singh et al., 2022; Shore & Dinning, 2023; Pandita & Kiran, 2023). Studies by Srinivasan et al. (2026) indicate that experiential learning interventions can significantly improve business writing skills, particularly in areas such as content development, persuasion, and interpersonal communication. Furthermore, simulation-based and practice-oriented learning environments have been identified as effective tools for developing workplace readiness and applied competencies (Walters, 2021).

Despite these advancements, there remains limited empirical evidence on how simulation-based experiential learning in technical domains can be utilized to enhance writing competency, particularly in contexts that require the integration of operational knowledge and professional communication. Existing studies largely focus on general business writing or classroom-based interventions, with less attention given to domain-specific simulations that reflect real-world operational challenges. This gap is significant, as industries increasingly demand graduates who are capable of translating technical understanding into clear and structured written communication.

This study addresses this gap by investigating how a navigation light simulator prototype, implemented within an experiential learning framework, contributes to the development of students' writing competency. By positioning writing as a form of professional and managerial communication, this study examines how experiential engagement, reflection, and application processes can enhance students' ability to articulate technical rules and operational procedures effectively. In doing so, the study contributes to the literature on management education and human capital development by demonstrating how simulation-based training interventions can strengthen both technical understanding and communication competencies required in professional and organizational contexts.

LITERATURE REVIEW & HYPOTHESIS DEVELOPMENT

Experiential Learning and Human Capital Development

Experiential Learning Theory (ELT), developed by Kolb et al. (2014), conceptualizes learning as a cyclical process where knowledge is created through the transformation of experience. This process involves four stages: concrete experience, reflective observation, abstract conceptualization, and active experimentation, which collectively enhance cognitive engagement and skill acquisition (Morris, 2020). Within the context of management education, experiential learning is not merely a pedagogical approach but a strategic mechanism for human capital development, enabling students to acquire competencies relevant to workplace demands.

A growing body of literature highlights the role of experiential learning in improving employability skills, including critical thinking, problem-solving, and communication

competence (Shore & Dinning, 2023; Pandita & Kiran, 2023). Empirical studies by Johnson (2021) and Singh et al. (2022) demonstrate that experiential learning interventions such as simulations, internships, and project-based learning enhance students' readiness for professional environments by fostering applied knowledge and adaptive capabilities. Additionally, experiential learning has been linked to improved organizational outcomes, as it supports the development of practical competencies aligned with industry expectations (Nenzhelele, 2014; Alshammari et al., 2025).

Importantly, simulation-based experiential learning environments provide opportunities for learners to engage with real-world scenarios in a controlled setting. Such environments facilitate deeper cognitive processing and reflective thinking, which are essential for translating theoretical knowledge into practical skills (Bevan & Kipka, 2012; Walters, 2021). As organizations increasingly demand graduates who are capable of applying knowledge in dynamic contexts, experiential learning becomes a critical tool for bridging the gap between academic preparation and professional performance.

Professional Writing Competency and Employability

Professional writing competency is widely recognized as a key determinant of employability and managerial effectiveness. In business and organizational settings, writing serves as a primary medium for communication, documentation, and decision-making, requiring individuals to articulate ideas clearly, logically, and persuasively (Clokie & Fourie, 2016; Knight, 2020). Despite its importance, numerous studies have identified a persistent gap between the writing skills developed in higher education and those required in the workplace (Lim, 2015; Moore & Morton, 2017).

Employers consistently report that graduates lack adequate communication skills, particularly in written forms, which affects their ability to perform effectively in professional roles (Kavanagh & Drennan, 2008; Sokoloff, 2012). This gap has been described as a "communication readiness paradox," where students perceive themselves as competent, yet fail to meet employer expectations (Yoshida & Guzman, 2025). Consequently, there is an increasing emphasis on integrating writing development into management education as part of broader employability skill frameworks (Kleckner & Butz, 2021; Miller & McCullough, 2025).

Research in business communication further suggests that writing competency is closely linked to self-efficacy, critical thinking, and interpersonal communication skills (Pittenger et al., 2006; Mascle, 2013). Moreover, approaches that incorporate real-world tasks such as report writing, professional emails, and technical documentation have been shown to enhance students' ability to transfer knowledge into workplace contexts (Sharma, 2022; Wu & You, 2022). These findings reinforce the need to position writing not merely as an academic skill but as a managerial capability that supports organizational effectiveness and professional performance.

Experiential Learning and Writing Competency through Simulation-Based Training

The integration of experiential learning with writing competency development represents a critical yet underexplored area in management education. While prior studies have demonstrated that experiential learning enhances communication skills, limited attention has been given to how simulation-based training in technical domains can support the development of professional writing competency. This gap is particularly relevant in fields that require the articulation of complex operational procedures and technical knowledge. Experiential learning provides a structured framework for improving writing through iterative processes of practice, reflection, and application. Learners engage in concrete experiences, reflect on their performance, conceptualize improvements, and apply these insights in subsequent tasks, thereby enhancing both cognitive and communication skills (Groves et al., 2010). In management contexts, such processes are aligned with the development of higher-order competencies, including analytical reasoning and decision-making.

Recent research by Srinivasan et al. (2026) indicates that experiential learning interventions can significantly improve business writing skills, particularly in areas such as content development, persuasion, and structured communication. Furthermore, simulation-based environments enable learners to engage with realistic scenarios, thereby strengthening the connection between technical understanding and communication practices (Olivares et al., 2020; Fishpaw & Fricker, 2020). These environments also enhance engagement and motivation, which are critical factors in skill development (Scott et al., 2019; Mittal & Raghuvaran, 2021). However, the application of simulation-based experiential learning to domain-specific writing, such as maritime navigation contexts, remains limited. This study addresses this gap by examining how a navigation simulator can facilitate the development of writing competency as a form of professional communication. By integrating experiential learning with technical simulation, the study provides a novel contribution to the literature on management education and skill development.

Simulation-Based Experiential Learning on Writing Competency

The hypothesis in this study posits that simulation-based experiential learning has a significant effect on improving students' writing competency. This assumption is grounded in Experiential Learning Theory (ELT), which emphasizes that learning occurs through a continuous cycle of concrete experience, reflective observation, abstract conceptualization, and active experimentation. In the context of writing development, simulation-based environments provide learners with authentic and contextualized experiences that require them to process information, make decisions, and communicate outcomes in structured written forms. Such immersive learning conditions encourage deeper cognitive engagement compared to traditional lecture-based instruction, as learners actively construct knowledge rather than passively receiving information. This aligns with recent findings indicating that experiential learning models significantly enhance students' academic writing performance by fostering critical thinking, organization of ideas, and clarity of expression (Morris, 2020).

Furthermore, simulation-based experiential learning supports the development of writing competency by bridging the gap between theoretical knowledge and practical application. Through repeated exposure to realistic scenarios, learners are able to refine their ability to articulate technical concepts accurately and coherently, particularly in discipline-specific contexts such as maritime communication. The iterative nature of experiential learning allows students to revise their understanding and improve their written output based on feedback and reflection. This process not only enhances linguistic accuracy but also strengthens the ability to structure professional and technical documents effectively. Recent studies by Al-Nakhle (2022) confirm that simulation-enhanced learning environments contribute significantly to writing skill development by improving learners' engagement, autonomy, and conceptual mastery in applied settings.

H1: There is a significant difference in students' writing competency before and after the simulation-based experiential learning intervention.

RESEARCH METHODS

This study adopts a quasi-experimental research design to evaluate the effectiveness of a simulation-based experiential learning intervention in improving professional writing competency and technical understanding within a training and human capital development framework. The study uses a one-group pretest–posttest design to measure changes in participants' competencies before and after the intervention, which is grounded in Experiential Learning Theory (ELT), emphasizing active engagement, reflection, conceptualization, and application.

The participants consisted of 104 cadets from nautical and maritime programs at STIP Jakarta, PIP Semarang, and AKMI Cirebon. A combination of cluster and stratified random sampling was used to ensure representation across different academic levels. The

intervention was delivered through a simulation-based training module using a navigation light simulator prototype designed to replicate real maritime scenarios based on International Association of Lighthouse Authorities (IALA) regulations.

The training process followed the four-stage cycle of experiential learning. Initially, participants completed a pretest conducted through conventional lecture-based instruction, where theoretical explanations were delivered using PowerPoint presentations and oral instruction. This stage aimed to assess participants' baseline understanding of navigation light concepts and their initial professional writing ability in Maritime English. Subsequently, during the intervention stage, participants engaged in simulation-based experiential learning activities using a navigation light simulator. The learning activities incorporated the experiential learning cycle, consisting of concrete experience, reflective observation, abstract conceptualization, and active experimentation. Throughout this stage, participants actively interacted with simulation scenarios, reflected on navigation situations, and applied technical concepts in practice. Finally, in the posttest stage, participants completed professional writing tasks based on simulation scenarios and real-world navigation problems to evaluate improvements in professional writing competency and conceptual understanding. The assessment focused on the clarity of explanation, logical structure, accuracy of technical content, and the ability to communicate navigation procedures effectively.

Data were analyzed using SPSS through descriptive statistics, paired sample t-test analysis, Cohen's d effect size analysis, and N-Gain analysis. Descriptive statistics were used to examine pretest and posttest scores, while the paired sample t-test was conducted to determine significant differences before and after the simulation-based experiential learning intervention. Furthermore, Cohen's d and N-Gain analyses were employed to measure the magnitude and effectiveness of the intervention in improving cadets' conceptual understanding and professional writing competency. Data were collected through pretest and posttest assessments, focusing on two key outcomes, namely, understanding of navigation light concepts and professional writing competency in Maritime English.

During the pretest phase, participants were exposed to conventional instruction using presentation-based media (PowerPoint), which primarily emphasized theoretical explanation. In contrast, the posttest followed the simulation-based experiential learning intervention, where participants engaged actively with the navigation simulator and applied their knowledge in writing tasks. Writing competency was assessed based on clarity, structure, accuracy of technical explanation, and ability to communicate procedures effectively.

The N-gain values are interpreted to determine the level of improvement achieved through the intervention. To evaluate the effectiveness of the intervention, this study employs descriptive statistical analysis and normalized gain (N-gain) analysis. The N-gain score is used to measure the magnitude of improvement between pretest and posttest results, calculated using the following formula:

$$N - Gain = \frac{Posttest\ Score - Pretest\ Score}{Maximum\ Score - Pretest\ Score}$$

RESULTS

This study involved 104 cadets enrolled in nautical programs from three maritime education institutions. The participants represented learners with relatively similar academic backgrounds in navigation and maritime operations. The study aimed to evaluate the effectiveness of a simulation-based experiential learning intervention in improving conceptual understanding of navigation light systems and professional writing competency in Maritime English. Prior to the intervention, participants completed a pretest to measure their baseline knowledge and initial writing abilities related to maritime communication and technical procedures. The training process was then conducted

through simulation-based experiential learning activities that integrated practical navigation scenarios with reflective and analytical learning stages.

The descriptive analysis indicates a substantial improvement in both conceptual understanding and professional writing competency following the implementation of the intervention. After participating in the simulation activities, cadets demonstrated better comprehension of navigation light concepts, stronger ability to explain procedures systematically, and more accurate use of technical maritime terminology in written communication. The experiential learning approach also encouraged active engagement, critical reflection, and practical application of concepts, allowing participants to connect theoretical knowledge with real-world maritime situations. These findings suggest that simulation-based experiential learning can effectively enhance both technical understanding and professional communication skills among nautical cadets.

Table 1. Descriptive Statistics of Pretest and Posttest Scores

Measurement	Pretest	Posttest
Total Score	5469	7072
Mean Score	52.59	68.00
Standard Deviation	27.53	20.32
Sample Size (N)	104	104

As presented in Table 1, the descriptive statistical results demonstrate a considerable improvement in participants' learning outcomes following the implementation of the simulation-based experiential learning intervention. The mean score increased from 52.59 in the pretest stage to 68.00 in the posttest stage, indicating a substantial enhancement in students' professional writing competency and conceptual understanding related to navigation light systems. This improvement suggests that the experiential learning activities, which combined simulation practice, reflection, conceptual analysis, and active experimentation, were effective in helping participants better understand technical maritime concepts and communicate them more clearly in written form.

Furthermore, the decrease in the standard deviation value after the intervention indicates that participants achieved a more consistent level of competency across the group. This finding reflects a standardization effect that is commonly associated with structured experiential learning environments, where learners are exposed to similar practical experiences and guided learning processes. The reduced variability in scores suggests that the intervention not only improved overall performance but also minimized disparities in competency levels among participants. In addition, the simulation-based approach appears to have facilitated active engagement and more uniform comprehension of maritime procedures, enabling cadets to develop stronger technical communication skills and a more systematic understanding of navigation-related concepts.

To determine whether the observed improvement was statistically significant, a paired sample t-test was conducted to compare participants' pretest and posttest scores before and after the implementation of the simulation-based experiential learning intervention. The analysis revealed a statistically significant difference between the two sets of scores, indicating that the intervention contributed meaningfully to the enhancement of participants' professional writing competency and conceptual understanding of navigation light systems. The higher posttest scores suggest that the experiential learning activities, which integrated simulation exercises, reflective observation, conceptual analysis, and practical application, effectively supported participants in developing stronger technical comprehension and more structured professional communication skills. These findings provide empirical evidence that simulation-based experiential learning can produce measurable improvements in both cognitive and communication-related learning outcomes within maritime education and training contexts.

Table 2. Paired Sample t-Test Results

Component	Value
Test	Pretest–Posttest
Mean Difference	15.41
t-test	8.72
Significance (p-value)	0.000

As shown in Table 2, the paired sample t-test results indicate a statistically significant difference between the pretest and posttest scores before and after the implementation of the simulation-based experiential learning intervention ($t = 8.72$, $p = 0.000$). This finding demonstrates that participants achieved significantly higher learning outcomes after receiving the intervention compared to their initial performance. The results suggest that simulation-based experiential learning effectively enhanced cadets' conceptual understanding of navigation light systems and professional writing competency in Maritime English. From an educational and management perspective, these findings highlight the potential of experiential learning interventions as an effective strategy for developing communication-intensive competencies, improving workforce readiness, and supporting more consistent learning outcomes in maritime education and training contexts.

To assess the practical significance of the intervention, Cohen's d effect size was calculated to determine the magnitude of the difference between pretest and posttest scores beyond statistical significance. This analysis provides a standardized measure of the intervention's impact on participants' learning outcomes, particularly in terms of improvements in professional writing competency and technical understanding. By quantifying the effect size, the study offers a clearer interpretation of the practical effectiveness of the simulation-based experiential learning approach in enhancing cadets' performance, complementing the results obtained from the paired sample t-test analysis.

$$d = \frac{M_{post} - M_{pre}}{SD_{pooled}}$$

The calculated effect size is $d = 0.65$, indicating a moderate-to-large effect according to conventional benchmarks. This suggests that the simulation-based experiential learning intervention not only produced statistically significant improvements but also yielded a meaningful practical impact on students' competencies. In particular, the magnitude of the effect demonstrates that the intervention had a substantial influence on enhancing both professional writing competency and technical understanding among cadets, highlighting its effectiveness as a learning strategy within maritime education and training contexts.

Table 3. N-Gain Analysis

Variable	Value
N	104
Pretest Mean	52.59
Posttest Mean	68.00
N-Gain Score	0.33 (33%)
Category	Moderate

As shown in Table 3, the N-Gain score of 0.33 indicates a moderate level of improvement in participants' learning outcomes following the implementation of the simulation-based experiential learning intervention. This result suggests that the intervention was effective in enhancing students' professional writing competency and technical understanding, although the magnitude of improvement remains within the medium category rather than reaching a high gain level (Hake, 1998). The finding reflects that the learning process was able to facilitate measurable progress in participants' cognitive and communication skills, particularly in understanding navigation light

systems and expressing technical concepts in structured Maritime English writing. From an instructional perspective, this outcome implies that while the experiential learning approach contributed positively to overall learning gains, there is still potential for further optimization in instructional design, simulation realism, scaffolding strategies, and learning facilitation to achieve higher levels of student performance and mastery.

DISCUSSION

From a management and training perspective, the findings demonstrate that simulation-based experiential learning functions as an effective capability development mechanism, particularly in strengthening professional writing as a form of organizational communication competence. The observed improvement in scores, coupled with reduced variability, suggests not only enhanced individual performance but also competency alignment, which is essential in standardized operational environments (Cullen, 2011; Hadley, 2025; Cong & Ironsi, 2025).

Kolb et al. (2014) and Morris (2020) state that these results are consistent with Experiential Learning Theory (ELT), which emphasizes that knowledge is constructed through iterative cycles of experience, reflection, conceptualization, and application. The use of simulation as a concrete experience allows learners to engage with realistic scenarios, while reflective writing tasks reinforce cognitive processing and knowledge internalization (Fidalgo & Torrance, 2017; Foo & Foo, 2022). Prior studies by Groves et al. (2010) and Srinivasan et al. (2026) confirm that experiential learning enhances higher-order thinking and skill transfer, particularly when learners actively articulate their experiences. In this study, writing serves as a medium through which experiential knowledge is transformed into structured, professional communication, aligning with findings that writing development improves analytical and reasoning capabilities (Pittenger et al., 2006; Ortiz, 2013).

From an employability perspective, the results address a critical gap between academic preparation and workplace expectations. Communication, especially written communication, has been consistently identified as a key employability skill demanded by employers (Clokie & Fourie, 2016; Knight, 2020). However, previous research by Lim (2015) and Moore and Morton (2017) highlights persistent mismatches between graduates' competencies and organizational needs. The integration of simulation-based tasks with writing activities in this study creates an authentic learning environment that mirrors workplace communication demands, thereby enhancing students' readiness (Kerby & Romine, 2009; Islam et al., 2025). This aligns with studies by Alharahsheh and Pius (2021), Scott and Willison (2021), and Tushar and Sooraksa (2023) showing that experiential and practice-oriented learning improves employability by fostering transferable skills such as problem-solving, critical thinking, and communication.

Moreover, the findings support the notion that employability is developed incrementally through contextualized learning experiences rather than isolated instruction (Shore & Dinning, 2023; Le & Tran, 2023). Simulation-based experiential learning enables students to engage with domain-specific knowledge while simultaneously developing communication competencies, addressing calls for more integrated and applied approaches in higher education (Kleckner & Butz, 2021; Miller & McCullough, 2025). The moderate N-gain result further reinforces that competency development is cumulative and requires sustained exposure to experiential learning environments (Walters, 2021).

From a Human Resource Management (HRM) perspective, these findings have direct implications for training design and human capital development. Organizations increasingly emphasize training approaches that are experiential, technology-enhanced, and aligned with real-world tasks (Olivares et al., 2020; Johnson, 2021). Simulation-based learning, as demonstrated in this study, provides a controlled environment for developing both technical and communication competencies, which are critical for operational effectiveness and risk management. The ability to clearly articulate procedures, as developed through writing tasks, is particularly important in safety-critical industries,

where miscommunication can have significant consequences (Sharma, 2023; Pepple et al., 2025).

Additionally, the reduction in performance variability suggests that experiential training contributes to standardization of competencies, a key objective in HRM practices aimed at ensuring consistent performance across employees (Singh et al., 2022; Pandita & Kiran, 2023). This aligns with evidence that experiential learning enhances not only individual skill acquisition but also organizational readiness by aligning competencies with industry requirements (Nie & Mastor, 2024; Pianda et al., 2025).

CONCLUSION

This study demonstrates that simulation-based experiential learning enhances students' writing competency as a form of professional communication while improving their conceptual understanding in a technical context. The findings indicate a statistically significant increase in performance between pretest and posttest results, supported by a moderate effect size and normalized gain score. In addition, the reduction in score variability suggests improved competency alignment among participants, which is particularly relevant in training environments that require standardized performance. These results confirm that writing skills can be effectively developed through domain-specific experiential activities rather than isolated instruction.

From a theoretical perspective, this study extends Experiential Learning Theory by positioning writing as a managerial and organizational communication capability embedded within experiential processes. It also integrates perspectives of employability and human capital development, highlighting how experiential learning contributes to workplace readiness. The findings suggest that educators and training designers should incorporate simulation-based learning to simultaneously develop technical knowledge and communication skills. For organizations, especially in safety-critical sectors, such approaches can strengthen employees' ability to communicate procedures and decisions effectively.

However, the study has several limitations. The use of a quasi-experimental design without a control group limits causal inference, and the relatively small, domain-specific sample constrains generalizability. Furthermore, the study focuses on short-term outcomes without examining long-term retention. Future research should adopt more rigorous experimental designs, include broader samples, and explore longitudinal effects. Investigating mediating factors such as cognitive engagement or self-efficacy would also provide deeper insight into how experiential learning influences professional communication development.

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