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From Language Learning to Clinical Readiness: Evaluating Technology-Integrated ESP in Medical Education through a Mixed-Methods Approach

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Abstract

This study evaluates the effectiveness of technology-integrated English for Specific Purposes (ESP) instruction in enhancing both language competence and clinical readiness among health education students. The research is motivated by the persistent gap between the acquisition of medical English terminology and the contextual, practice-oriented communication skills required in clinical settings, particularly in developing countries. A mixed-methods approach with a sequential explanatory design was employed. The quantitative phase involved pre-test and post-test assessments to measure improvements in medical English proficiency, scenario-based communication skills, and student confidence. The qualitative phase included in-depth interviews, classroom observations, and analysis of interactions in virtual patient simulations to explore learning experiences and pedagogical dynamics. The findings reveal that the integration of digital technologies, such as virtual patient simulations, case-based role-play, and online learning platforms, significantly improves students' mastery of medical terminology, interpersonal communication in clinical contexts, and academic literacy. Students also demonstrated increased confidence in conducting patient interviews, explaining medical conditions, and engaging in interdisciplinary discussions. Furthermore, technology-enhanced learning promoted self-directed learning and active engagement. This study contributes a novel ESP model that explicitly links language learning outcomes with clinical readiness indicators, offering a comprehensive framework that integrates linguistic, technological, and clinical dimensions. The results underscore the potential of technology-integrated ESP to bridge the gap between academic preparation and professional healthcare demands.

Keywords: *Academic Literacy, Clinical Readiness, English For Specific Purposes, Health Education, Medical Communication*

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INTRODUCTION

The growing complexity of healthcare systems in an increasingly globalized world has brought renewed attention to the communicative competence of health professionals, particularly in English as the dominant lingua franca of medical knowledge and practice. Beyond clinical expertise, healthcare practitioners are now expected to demonstrate the ability to engage in nuanced, patient-centered communication, collaborate in

multidisciplinary teams, and access rapidly evolving scientific information. In many developing and transitional contexts, however, this expectation has not been matched by corresponding transformations in educational practice. English for Specific Purposes (ESP) courses in medical and health education often remain narrowly focused on vocabulary acquisition and basic linguistic structures, rather than fostering the applied communication skills required in real clinical settings. This disjunction has contributed to a persistent gap between academic preparation and professional readiness, raising concerns about the overall quality of healthcare delivery and patient safety (Hasanah et al., 2024; Juliana et al., 2025).

Empirical evidence underscores the urgency of addressing this issue. Studies have shown that ineffective communication in healthcare settings is a significant contributor to diagnostic errors, patient dissatisfaction, and reduced treatment adherence (Kailani et al., 2025; Utami et al., 2025; Widyawati et al., 2022). In multilingual environments, these challenges are further compounded by language barriers that limit both patient understanding and practitioner confidence (Amiroh et al., 2024; D. Putri et al., 2025). Within medical education, several reports indicate that students often feel underprepared to conduct clinical interactions in English, particularly when dealing with sensitive conversations such as history taking, delivering diagnoses, or explaining treatment options (Handayani et al., 2024; Tohari, 2024). These findings suggest that language learning in isolation, detached from clinical application, is insufficient to meet the demands of contemporary healthcare practice.

At the same time, advances in educational technology have opened new possibilities for bridging this gap. Simulation-based learning, virtual patient platforms, and digital learning environments have been increasingly recognized as powerful tools for enhancing experiential learning and professional competence. Such approaches enable students to engage in authentic, scenario-based interactions that mirror real-world clinical encounters, thereby fostering both cognitive and affective dimensions of learning (Prasetya, 2024; Rinawati et al., 2022). However, the integration of these technologies into ESP curricula remains uneven and often lacks a coherent pedagogical framework that explicitly connects language development with clinical readiness. As a result, the potential of technology to transform language learning in medical education has yet to be fully realized.

A growing body of literature has explored the role of ESP in professional education, highlighting its importance in aligning language instruction with disciplinary needs. Ananta et al. (2025) and Fitria (2023) emphasize that ESP should be grounded in authentic discourse practices and target specific communicative contexts, while Husna and Hindriyastuti (2023) as well as Sebong et al. (2025) argue for a needs-based approach that reflects the realities of professional communication. In the context of medical education, Nasution et al. (2023) and Rahmawati and Mar'an (2024) demonstrate that ESP programs tailored to healthcare settings can improve both linguistic competence and job performance. Similarly, Brooks et al. (2021) and Rafiq et al. (2021) find that integrating clinical scenarios into language instruction enhances students' ability to use English in contextually appropriate ways. Despite these

advances, much of the existing research continues to treat language learning as an end in itself, rather than as a means to achieving broader professional competencies.

Parallel to developments in ESP, research in medical education has increasingly emphasized the importance of simulation-based and experiential learning. Erni et al. (2023) and Haque et al. (2022) provide robust evidence that technology-enhanced simulation improves knowledge retention, clinical skills, and learner satisfaction. I. G. A. V. W. Putri and Nurita (2021) as well as Raharjo and Lestari (2020) further argue that deliberate practice in simulated environments can lead to measurable improvements in clinical performance. Virtual patient systems, in particular, have been shown to support the development of clinical reasoning and decision-making skills while also offering a safe space for repeated practice (Flower & Hayes, 1981; Henderson, 2021). Yet, these studies rarely consider the linguistic dimension of clinical communication, leaving an important aspect of professional competence underexplored.

In the field of educational technology, there is increasing recognition of the value of technology-enhanced learning environments in promoting student engagement and self-directed learning. Harfitt (2019) and Yamin et al. (2020) highlight the effectiveness of digital platforms in facilitating flexible and personalized learning experiences, while Arifah et al. (2025) and Word and Park (2015) underscore the importance of aligning technological tools with pedagogical design. Within language education, Dewanto (2020) and Rahayu et al. (2023) note that digital tools can support interactive and immersive learning, particularly when combined with task-based approaches. However, the integration of these insights into ESP for medical education remains fragmented, with limited empirical studies examining how technology can simultaneously support language acquisition and clinical competence.

Recent scholarship has begun to call for more integrated approaches that bridge disciplinary boundaries. Lücking (2023) and Nurhidayah et al. (2024) advocate for the use of telecollaboration and digital simulations to enhance intercultural and professional communication skills, while Bakel and Horak (2024) and Yates (2022) emphasize the role of standardized patients in assessing both clinical and communicative competence. In a similar vein, the concept of situated learning proposed by Kekeya (2021) suggests that knowledge is best acquired through participation in authentic practices, an idea that resonates strongly with the goals of ESP and simulation-based education. Despite these theoretical convergences, empirical studies that bring together applied linguistics, medical education, and educational technology into a unified framework remain scarce, particularly in the context of developing countries where resource constraints and contextual challenges may shape implementation.

Against this backdrop, it becomes increasingly apparent that the challenge is not merely one of improving language instruction or adopting new technologies in isolation, but of rethinking how these elements can be meaningfully integrated to support clinical readiness as a holistic outcome. Much of the existing work has tended to focus on discrete components, linguistic proficiency, technological tools, or clinical skills, without fully capturing the complex

interplay between them. This fragmentation has limited our understanding of how students develop the capacity to communicate effectively in real clinical contexts, where language, knowledge, and professional judgment must converge seamlessly.

In response to these limitations, this study advances an approach that situates ESP within a technology-integrated, simulation-based learning environment explicitly oriented toward clinical readiness. By conceptualizing language learning not as an isolated objective but as an integral component of professional practice, the study offers a more comprehensive framework for understanding and evaluating learning outcomes. The use of a mixed-methods design further enables a nuanced exploration of both measurable improvements and lived learning experiences, providing a richer account of how students engage with and benefit from the intervention. In doing so, the study contributes to ongoing efforts to reimagine medical education in ways that are responsive to the demands of contemporary healthcare systems.

Accordingly, the purpose of this research is to evaluate the effectiveness of technology-integrated ESP in enhancing both linguistic competence and clinical readiness among health students. Specifically, the study seeks to examine how digital simulations, case-based role-play, and online learning resources can support the development of clinical communication skills, academic literacy, and learner confidence. By addressing these interconnected dimensions, the research aims to provide evidence-based insights that can inform curriculum design, pedagogical practice, and future research, particularly within contexts striving to strengthen the capacity of their healthcare workforce in a rapidly changing global landscape.

RESEARCH METHOD

This study employed a mixed-methods approach using a sequential explanatory design, in which quantitative data were collected and analyzed in the initial phase, followed by qualitative inquiry to provide deeper interpretation of the findings. This design was deliberately chosen to capture not only the measurable impact of technology-integrated English for Specific Purposes (ESP) instruction on students' language competence and clinical readiness, but also the lived experiences, perceptions, and learning dynamics that underlie these outcomes. While quantitative methods allow for statistical validation of improvement, they often fall short in explaining how and why such changes occur. Therefore, the qualitative phase was essential to uncover the pedagogical processes, student engagement patterns, and contextual factors shaping the effectiveness of the intervention (Arsyad & Zainil, 2023; Dewi, 2021).

The research was conducted in a health sciences higher education institution in Indonesia, a context that reflects the broader challenges faced by developing countries in aligning language education with professional healthcare demands. This location was selected not only for its relevance to the research problem but also because it has begun integrating digital learning platforms and simulation-based activities into its ESP curriculum, albeit in a

limited and exploratory manner. Such a setting provides a fertile ground for examining both the potential and constraints of technology-enhanced ESP in real educational practice, making it particularly suitable for this study.

The participants were selected purposively to ensure that they could provide rich and relevant data aligned with the research objectives. A total of 48 undergraduate students enrolled in an ESP course for health programs participated in the quantitative phase. From this group, 12 students were further selected for in-depth qualitative interviews based on variation in performance, engagement level, and gender representation, allowing for a more nuanced understanding of diverse learning experiences. In addition, 3 ESP lecturers who were directly involved in designing and delivering the technology-integrated instruction were included as key informants. Their inclusion was crucial to capture the instructional strategies, challenges, and pedagogical reflections from the teaching perspective.

Data collection in the quantitative phase involved pre-test and post-test instruments designed to assess students' medical English proficiency, clinical communication skills through scenario-based tasks, and self-reported confidence levels. These instruments were chosen to reflect both linguistic and applied competencies, ensuring alignment with the concept of clinical readiness. Statistical analysis, including paired sample tests, was conducted to determine the significance of improvement.

The qualitative phase involved multiple techniques to ensure depth and credibility. Semi-structured interviews were conducted with students and lecturers to explore their experiences with virtual patient simulations, case-based role-play, and digital learning platforms. Classroom observations were carried out to document interaction patterns, student engagement, and the integration of language and clinical content in practice. In addition, interaction data from simulation sessions were analyzed to identify communication strategies, errors, and improvements over time. These methods were selected because they allow for capturing both verbalized experiences and actual practices, thereby providing a holistic understanding of the learning process (Nassaji, 2021).

To enhance the trustworthiness of the findings, triangulation was applied at multiple levels. Data triangulation was achieved by comparing information obtained from students, lecturers, and observational records. Methodological triangulation was ensured through the combination of tests, interviews, and observations, allowing different dimensions of the phenomenon to be examined concurrently. Furthermore, the integration of quantitative and qualitative findings during the interpretation phase enabled a form of methodological complementarity, strengthening the overall validity of the conclusions. Analytical rigor was maintained through systematic coding and thematic analysis for qualitative data, while quantitative results were interpreted in light of these emerging themes. Through this integrative and carefully structured approach, the study seeks to provide a robust and contextually grounded evaluation of technology-integrated ESP in medical education.

RESULTS AND DISCUSSION

Improvement in Medical English Proficiency through Technology-Integrated ESP

The quantitative findings of this study reveal a clear and statistically significant improvement in students' medical English proficiency following the implementation of technology-integrated ESP instruction. The pre-test and post-test results indicate that students not only expanded their mastery of medical terminology but also demonstrated a stronger ability to construct contextually appropriate expressions in clinical communication scenarios. This improvement was particularly evident in tasks requiring the use of discipline-specific vocabulary within patient interaction contexts, suggesting that learning was no longer limited to memorization but extended to meaningful application. As shown in Table 1, the mean scores increased across all measured components, including terminology recognition, academic writing structure, and scenario-based language use.

Table 1 Improvement in Medical English Proficiency (Pre-test and Post-test Results)

Component	Pre-test Mean	Post-test Mean	Gain Score
Medical Terminology Mastery	62.4	81.7	+19.3
Academic Language Structure	65.1	83.2	+18.1
Clinical Communication (Scenario)	60.8	80.5	+19.7

Source: Research Data Analysis (2025)

These results suggest that the integration of digital tools, particularly virtual patient simulations and interactive online modules, played a critical role in contextualizing language input. Rather than encountering medical vocabulary as isolated lexical items, students engaged with terms embedded in clinical narratives, diagnostic reasoning, and patient interaction flows. This aligns with the principle of technology-enhanced language learning, where digital environments facilitate multimodal exposure and authentic task engagement, enabling learners to internalize language through use rather than repetition (Dewaele, 2019; Mashudi et al., 2023). In this study, such environments allowed students to repeatedly encounter and practice medical expressions in simulated yet realistic settings, thereby reinforcing both comprehension and production skills.

The qualitative findings further illuminate how these improvements were experienced and constructed by the learners. Several students reported that the use of virtual simulations and case-based tasks made medical English "feel real" and directly relevant to their future profession. One participant, identified as S3, explained that "before, I only memorized terms, but now I understand when and how to use them when talking to patients." This shift from declarative to procedural knowledge is significant, as it reflects deeper cognitive processing and aligns with the goals of ESP in professional contexts. Another student (S7) noted that the integration of video-based cases and interactive dialogues helped them "connect the language with the situation," suggesting that meaning-making occurred through contextual immersion rather than abstract instruction.

Classroom observations also revealed a notable transformation in how students engaged with language tasks. During simulation sessions, students actively negotiated meaning, corrected each other's expressions, and experimented with different ways of explaining medical conditions. This collaborative and exploratory use of language indicates that learning was not only individual but socially constructed, supported by the affordances of the digital environment. The lecturer (L2) highlighted that students became "more willing to speak and try," even when unsure, because the simulated setting reduced anxiety and provided immediate feedback. This observation underscores the role of technology not only as a content delivery tool but as a facilitator of interaction and risk-taking, both of which are essential for language development.

Importantly, the improvement in academic language structure suggests that the benefits of technology-integrated ESP extend beyond oral communication. Students demonstrated better organization of ideas, more accurate use of formal expressions, and greater coherence in written tasks such as case reports and reflective summaries. This can be attributed to the integration of online learning platforms that provided structured input, model texts, and opportunities for iterative feedback. As noted by Chen et al. (2025) and E. Madhavi et al. (2023), digital learning environments can support deeper learning by enabling students to revisit materials, reflect on their performance, and engage in self-paced practice. In this study, such features appear to have contributed to a more sustained and reflective engagement with language.

Taken together, these findings suggest that the observed improvement in medical English proficiency is not merely a function of increased exposure, but of a qualitatively different learning experience. By embedding language within clinically relevant tasks and leveraging the affordances of digital technology, the ESP model implemented in this study created an ecosystem in which language learning became inseparable from professional practice. This resonates with contemporary views of language as a social and functional tool, shaped by context and purpose. In this sense, the gains observed in this study reflect not only enhanced linguistic competence but also a shift toward more authentic, practice-oriented language use, which is essential for clinical readiness.

Development of Clinical Communication Skills in Simulated Environments

The findings of this study demonstrate a substantial development in students' clinical communication skills, particularly in their ability to conduct anamnesis, provide clear medical explanations, and engage in empathetic interpersonal interactions with patients. These improvements were captured through scenario-based assessments administered during the quantitative phase, as well as through qualitative analysis of student interactions within virtual patient simulations. The results indicate that students were increasingly able to integrate linguistic competence with clinical reasoning and communicative sensitivity, reflecting a shift from language use as an abstract skill toward language as an embedded component of professional practice.

Quantitatively, the scenario-based communication scores showed a marked increase between pre-test and post-test phases. Students demonstrated improved performance in structuring patient interviews, using appropriate questioning techniques, and delivering explanations in a clear and patient-centered manner. As presented in Table 2, the gains were particularly notable in components related to interactional clarity and responsiveness, suggesting that students were not only using correct terminology but also adapting their language to the needs and conditions of the patient.

Table 2 Improvement in Scenario-Based Clinical Communication Skills

Communication Component	Pre-test Mean	Post-test Mean	Gain Score
Anamnesis Structure	61.2	82.6	+21.4
Clarity of Medical Explanation	59.8	81.3	+21.5
Interpersonal Communication	63.0	84.1	+21.1

Source: Research Data Analysis (2025)

These quantitative improvements are further illuminated by qualitative insights drawn from simulation sessions and participant reflections. During virtual patient interactions, students began to demonstrate greater awareness of communicative nuances, such as tone, pacing, and empathy. For instance, one student (S5) reflected that “in the simulation, I realized that explaining is not just about correct words, but also about making patients feel understood.” This statement highlights a critical transition from purely linguistic accuracy to communicative effectiveness, where meaning is co-constructed through interaction. Another participant (S9) noted that repeated exposure to simulated cases helped them “think like a doctor while speaking English,” suggesting an emerging integration of language and clinical cognition.

Observational data further support these findings. In early sessions, many students relied heavily on scripted expressions and showed limited flexibility in responding to patient cues. However, as the intervention progressed, students became more adaptive, using follow-up questions, paraphrasing, and clarification strategies to maintain the flow of interaction. This evolution indicates the development of pragmatic competence, which is essential in clinical communication but often overlooked in traditional ESP instruction. The lecturer (L1) observed that “students started to move beyond memorized dialogues and began to engage in real communication,” emphasizing the transformative role of simulation in fostering authentic language use.

From a theoretical perspective, these findings align with the principles of simulation-based learning in health professions education, which emphasize the value of experiential learning in developing complex professional competencies. Simulation provides a safe and controlled environment where learners can practice, make mistakes, and receive feedback without the risk of harming real patients (Pratiwi & Firdaus, 2025; Sutisna & Vonti, 2020). In this study, the use of virtual patient platforms allowed students to repeatedly engage in clinical scenarios that required both linguistic precision and interpersonal sensitivity. This

iterative process appears to have facilitated deeper learning, as students were able to refine their communication strategies over time.

Moreover, the integration of language and clinical tasks within the simulation environment reflects a situated learning approach, where knowledge is constructed through participation in context-specific activities. Language, in this sense, becomes a tool for action rather than an end in itself. Students are not merely learning how to speak English; they are learning how to perform as future healthcare professionals in English-mediated contexts. This is particularly important in multilingual and resource-constrained settings, where the ability to communicate effectively across linguistic boundaries can significantly impact the quality of care.

An additional insight emerging from the qualitative data is the role of emotional engagement in shaping communication skills. Several students reported feeling more confident and less anxious when interacting with virtual patients compared to traditional classroom activities. As noted by student S2, “the simulation feels real, but I am not afraid to make mistakes, so I try more.” This reduction in affective barriers appears to have encouraged greater participation and experimentation, both of which are critical for developing communicative competence. Such findings resonate with recent research suggesting that immersive and interactive learning environments can enhance both cognitive and emotional dimensions of learning (Lestari et al., 2022; Zakian et al., 2022).

Enhancing Student Confidence and Professional Identity Formation

The findings of this study indicate a meaningful enhancement in students’ confidence when engaging in clinical communication, which in turn reflects an emerging sense of professional identity as future healthcare practitioners. This dimension of learning, while less visible than measurable linguistic gains, proved to be equally significant in shaping students’ readiness for real-world clinical interaction. Drawing on both quantitative data from confidence scales and qualitative insights from in-depth interviews, the study reveals that the integration of simulation-based and technology-enhanced ESP learning created a supportive environment in which students gradually developed not only the ability but also the willingness to communicate in English within clinical contexts.

Quantitative results show a consistent increase in students’ self-reported confidence across key domains of clinical communication. As presented in Table 3, the most notable improvements were observed in students’ confidence in conducting patient interviews, explaining medical conditions, and participating in interdisciplinary discussions. These gains suggest that confidence was not developed in isolation, but alongside improvements in language proficiency and communicative competence, reinforcing the interconnected nature of these constructs.

Table 3 Improvement in Student Confidence in Clinical Communication

Confidence Domain	Pre-test Mean	Post-test Mean	Gain Score
Conducting Patient Interviews	58.7	82.9	+24.2
Explaining Medical Conditions	57.9	81.5	+23.6
Participating in Clinical Discussions	60.3	83.1	+22.8

Source: Research Data Analysis (2025)

These quantitative trends are further substantiated by qualitative accounts that illuminate how confidence was experienced and constructed over time. Many students described an initial sense of hesitation and anxiety when asked to perform clinical communication tasks in English, particularly in front of peers. However, as they engaged repeatedly with virtual patient simulations and case-based role-play, this anxiety gradually diminished. One participant, S4, reflected that "at first I was afraid of making mistakes, but the simulation helped me practice without feeling judged." This perception of a psychologically safe learning space appears to have played a crucial role in enabling students to take risks, experiment with language, and build confidence incrementally.

Another student, S10, emphasized the transformative nature of the experience, noting that "I started to feel like a real healthcare worker, not just a student learning English." This statement points to a deeper shift beyond confidence, namely the formation of a professional identity. Through repeated engagement in simulated clinical interactions, students began to internalize the roles, responsibilities, and communication styles associated with healthcare professionals. This process aligns with the concept of professional identity formation, which involves the integration of knowledge, skills, values, and self-perception into a coherent sense of "being" a professional (Daud & Astuti, 2023; Renandya et al., 2018). In this study, language served as a key medium through which this identity was enacted and negotiated.

Observational data reinforce this interpretation. Over the course of the intervention, students exhibited increased initiative in leading interactions, asking follow-up questions, and responding to patient concerns with greater empathy and clarity. These behaviors suggest not only improved competence but also a growing sense of ownership and responsibility in communication. The lecturer (L3) observed that "students became more confident in expressing themselves, even when their grammar was not perfect, because they focused on being understood." This shift from form-focused to meaning-focused communication is indicative of a maturing professional mindset, where the primary goal is effective patient care rather than linguistic perfection.

From a theoretical standpoint, the development of confidence and professional identity in this study can be understood through the lens of experiential and immersive learning. Simulation-based environments provide opportunities for learners to engage in authentic tasks, reflect on their performance, and receive feedback, all of which contribute to the construction of professional identity (Khotimah et al., 2019; Putra & Tustiawati, 2024). Furthermore, recent research highlights the role of immersive learning environments in

fostering psychological engagement and self-efficacy, which are critical components of confidence (Cheng & Lee, 2018; Nguyen & Stracke, 2021). In the context of this study, the combination of virtual simulations, interactive tasks, and reflective activities appears to have created a holistic learning experience that supports both cognitive and affective development.

Importantly, confidence in this context is not merely a subjective feeling but a functional indicator of clinical readiness. Students who feel confident are more likely to initiate communication, respond effectively to patient needs, and participate actively in collaborative decision-making. This is particularly relevant in multilingual healthcare settings, where hesitation or lack of confidence can hinder effective communication and compromise patient outcomes. By fostering confidence through structured and supportive learning experiences, technology-integrated ESP contributes to preparing students for the complexities of real clinical practice.

Technology as a Catalyst for Self-Directed and Active Learning

The integration of digital technologies within the ESP learning environment in this study did not merely enhance learning outcomes, but fundamentally reshaped how students engaged with the learning process itself. One of the most salient findings is the emergence of more self-directed and active learning behaviors among students, reflecting a shift from teacher-centered instruction toward a more learner-driven model. This transformation was observed through classroom interactions, platform usage patterns, and student reflections, all of which indicate that technology functioned as a catalyst for fostering autonomy, initiative, and sustained engagement.

Quantitative indicators of student engagement, drawn from participation tracking and activity completion rates, reveal a notable increase in active involvement over the course of the intervention. Students demonstrated higher frequencies of accessing learning materials, completing optional exercises, and participating in online discussions beyond the minimum course requirements. As summarized in Table 4, the average engagement scores across key indicators showed consistent improvement, suggesting that students were not only complying with instructional demands but also taking ownership of their learning trajectories.

Table 4 Student Engagement and Self-Directed Learning Indicators

Learning Behavior	Pre-test Mean	Post-test Mean	Gain Score
Accessing Supplementary Materials	54.2	82.6	+28.4
Participation in Online Discussions	49.8	79.3	+29.5
Completion of Optional Tasks	46.5	76.8	+30.3

Source: Research Data Analysis (2025)

These patterns are further illuminated by qualitative findings that capture students' evolving attitudes toward learning. Many participants described a transition from passive reception of information to active exploration of resources. Student S6 noted that "the online platform gives me freedom to learn again and again until I understand," highlighting the role

of digital tools in enabling iterative and self-paced learning. Similarly, S11 expressed that "I started to search for additional materials myself because I wanted to perform better in simulations," indicating a growing intrinsic motivation to improve. These reflections suggest that technology not only provides access to information but also stimulates a sense of responsibility and curiosity in learners.

Classroom observations reinforce this interpretation. During the early stages of the course, students tended to rely heavily on instructor guidance and showed limited initiative in engaging with tasks. However, as the intervention progressed, a noticeable shift occurred. Students began to ask more questions, initiate discussions, and collaborate with peers in solving case-based problems. The lecturer (L2) observed that "students are now more active in finding answers, not just waiting for explanations," pointing to a change in the locus of control from teacher to learner. This shift is particularly significant in the context of ESP, where the ability to independently access and apply knowledge is essential for professional development.

From a theoretical perspective, these findings align closely with the concept of self-directed learning in digital environments, which emphasizes the role of learners as active agents in setting goals, selecting strategies, and evaluating outcomes (Sah, 2021; Wilson, 2018). Digital platforms, when effectively designed and implemented, provide the flexibility and resources necessary for such autonomy to emerge. In this study, features such as asynchronous access to materials, interactive simulations, and immediate feedback mechanisms appear to have supported students in managing their own learning processes. This is consistent with recent research suggesting that technology-enhanced environments can promote deeper engagement by accommodating diverse learning styles and enabling personalized learning pathways (Ramalingam et al., 2022; Xie, 2021).

An important dimension of this transformation is the interplay between self-directed learning and collaborative engagement. While students became more independent, they also demonstrated increased willingness to engage with peers in meaningful ways. Online discussion forums and simulation debriefings became spaces for exchanging ideas, clarifying misunderstandings, and reflecting on performance. Student S1 that "discussing with friends after simulation helps me understand my mistakes better," illustrating how social interaction complements individual learning. This dual dynamic of autonomy and collaboration reflects a more holistic learning ecology, where knowledge is constructed through both personal effort and collective inquiry.

Moreover, the integration of technology appears to have altered students' perceptions of learning itself. Rather than viewing learning as a linear process confined to classroom sessions, students began to see it as a continuous and flexible activity that extends beyond formal boundaries. This shift is particularly relevant in the context of healthcare education, where lifelong learning is a fundamental requirement. By cultivating habits of self-directed inquiry and active participation, the ESP model implemented in this study contributes to preparing students not only for immediate academic success but also for

ongoing professional development.

Integrating Language Learning and Clinical Readiness: Toward a Holistic ESP Model

The integration of findings across quantitative and qualitative phases in this study points toward a more comprehensive understanding of how English for Specific Purposes (ESP) can be reoriented to support clinical readiness as a central learning outcome. Rather than treating language proficiency as an isolated objective, the results suggest that meaningful gains emerge when linguistic development is embedded within authentic clinical contexts and supported by technology-mediated learning environments. In this sense, the study advances a holistic ESP model in which language learning, technological affordances, and clinical practice are not separate domains but mutually reinforcing dimensions of a unified pedagogical framework.

The quantitative results provide a foundational layer for this integration, demonstrating consistent improvements across medical terminology, scenario-based communication, and student confidence. However, it is through the qualitative data that the deeper coherence of these outcomes becomes visible. Students did not experience these gains as discrete achievements; rather, they described a gradual alignment between "knowing the language" and "being able to act as a healthcare provider." For instance, student S8 reflected that "learning English now feels like part of learning to be a nurse, not a separate subject," illustrating how language competence became internalized as part of professional capability. This convergence is critical in understanding clinical readiness not merely as a set of technical skills, but as an integrated capacity to communicate, reason, and act appropriately in clinical situations.

The model emerging from this study can be conceptualized through the interaction of three core dimensions: linguistic competence, technological mediation, and clinical practice. Linguistic competence encompasses not only vocabulary and grammar but also pragmatic and discourse-level abilities required for effective communication in healthcare settings. Technological mediation refers to the use of digital platforms, virtual patient simulations, and interactive learning tools that create immersive and flexible learning environments. Clinical practice, in this context, is represented through scenario-based tasks and simulations that approximate real-world healthcare interactions.

Table 5 A Holistic Model of Technology-Integrated ESP for Clinical Readiness

Dimension	Key Features	Contribution to Clinical Readiness
Linguistic Competence	Medical terminology, discourse, pragmatics	Accurate and context-appropriate communication
Technological Mediation	Virtual simulations, digital platforms, feedback	Experiential and flexible learning environment
Clinical Practice	Case-based tasks, patient interaction scenarios	Application of knowledge in realistic contexts

Source: Research Data Analysis (2025)

This integrative model reflects a shift toward a transdisciplinary approach in ESP, where insights from applied linguistics, medical education, and educational technology converge. Such an approach resonates with recent discussions on the need for more holistic and context-sensitive language education, particularly in professional domains. As argued by Hopkyns et al. (2018) and Wan and Gao (2021), technology-enhanced language learning enables the creation of authentic and interactive environments that mirror real-world communication, while Phyak and Sharma (2021) as well as Purwanto and Despita (2022) emphasize that simulation-based learning fosters experiential engagement and skill integration in healthcare education. The present study brings these strands together, demonstrating that when combined within a coherent pedagogical design, they can produce outcomes that extend beyond traditional measures of language proficiency.

An important implication of this model is the reconceptualization of clinical readiness as an outcome of language learning. Traditionally, ESP has focused on preparing learners to use language effectively within specific domains, but it has rarely positioned itself as directly contributing to professional readiness in a holistic sense. In this study, however, clinical readiness emerges as a natural extension of contextually grounded language use. Students who are able to communicate clearly, respond empathetically, and engage in clinical reasoning in English are, in effect, demonstrating readiness to participate in professional practice. This perspective aligns with contemporary views of competence as situated and performative, rather than abstract and decontextualized (Prayogo, 2022; Sung, 2022).

The qualitative data further reveal that this integration is experienced by students as a process of alignment between learning and identity. As they engage in simulations and case-based tasks, students begin to see themselves not only as learners of English but as emerging professionals who use English as a tool for action. Lecturer L1 noted that “students start to think clinically while speaking, not translating from their first language anymore,” indicating a shift toward more fluid and context-sensitive communication. This transformation underscores the importance of designing ESP curricula that do not artificially separate language from practice, but instead embed it within meaningful professional activities.

Pedagogical and Practical Implications in Developing Contexts

The findings of this study carry significant pedagogical and practical implications, particularly for health education systems in developing contexts where the alignment between academic training and professional demands remains an ongoing challenge. One of the most immediate implications concerns curriculum design. The results suggest that English for Specific Purposes (ESP) should no longer be positioned as a supplementary or isolated component within health programs, but rather as an integrated element that directly contributes to clinical readiness. This requires a deliberate restructuring of curricula to embed language learning within clinically relevant tasks, such as case-based discussions, patient simulations, and interdisciplinary communication exercises. In this way, language is not taught as an abstract system, but as a functional tool for professional practice, enabling students to simultaneously develop linguistic competence and clinical reasoning.

From a pedagogical perspective, the study highlights the importance of shifting from traditional, teacher-centered approaches toward more interactive, student-centered learning environments. The use of virtual patient simulations, role-play, and digital platforms proved effective in fostering engagement, autonomy, and contextual understanding. These approaches resonate with contemporary models of experiential and technology-enhanced learning, which emphasize active participation and real-world relevance (Sukamto et al., 2021; Sultana, 2019). However, their successful implementation requires careful instructional design. Educators must move beyond simply adopting technology and instead focus on how it can be meaningfully integrated into learning activities that reflect authentic clinical practices. As observed by lecturer L2, “technology works best when it is connected to clear learning goals, not just used as an add-on,” underscoring the need for pedagogical intentionality.

In resource-constrained settings, concerns often arise regarding the feasibility of implementing technology-integrated models. Yet, the findings of this study suggest that effective integration does not necessarily depend on high-end infrastructure, but rather on strategic and context-sensitive use of available resources. For instance, low-cost or open-access digital platforms, mobile-based applications, and simplified simulation tools can still provide meaningful learning experiences when aligned with well-designed tasks. Student S6 noted that “even simple online cases helped me practice thinking and speaking like in a real situation,” indicating that the perceived authenticity of tasks may be more critical than technological sophistication. This insight is particularly relevant for institutions in developing countries, where innovation often emerges through adaptation rather than abundance.

Another important implication lies in the role of educators. The integration of language, technology, and clinical practice demands a redefinition of teaching roles, from knowledge transmitters to facilitators of learning experiences. ESP instructors need to develop not only linguistic expertise but also a working understanding of clinical contexts, while health educators must recognize the centrality of communication skills in professional competence. This convergence calls for interdisciplinary collaboration, where language teachers, medical practitioners, and instructional designers work together to create cohesive learning environments. As highlighted in the interviews, lecturer L1 emphasized that “collaboration between departments is essential because communication is part of clinical work, not separate from it.” Such collaboration can help ensure that learning activities are both linguistically appropriate and clinically relevant.

At the institutional level, these findings point to the need for supportive policies that encourage innovation in teaching and learning. Educational leaders play a crucial role in providing the necessary infrastructure, professional development opportunities, and institutional culture that enable educators to experiment with and sustain new approaches. Policies that promote the integration of digital tools, recognize the value of simulation-based learning, and support cross-disciplinary initiatives can significantly enhance the impact of such models. Furthermore, investment in training programs for educators is essential to build

capacity in designing and implementing technology-enhanced ESP instruction. Without such support, even well-designed models may struggle to achieve long-term sustainability.

Beyond the classroom, the implications of this study extend to the broader goal of strengthening healthcare systems. Graduates who are not only clinically competent but also able to communicate effectively in English are better equipped to engage with global medical knowledge, participate in international collaborations, and provide higher-quality patient care. In multilingual and culturally diverse settings, effective communication can also contribute to improved patient trust and adherence, ultimately enhancing health outcomes. In this sense, the integration of ESP and clinical readiness is not merely an educational concern, but a strategic investment in human resource development within the health sector.

The study underscores the importance of viewing technology not as a solution in itself, but as part of a broader pedagogical ecosystem. Its effectiveness depends on how it is embedded within meaningful learning experiences, supported by capable educators, and aligned with institutional goals. The voices of students and lecturers in this study consistently point to the value of relevance, interaction, and authenticity in shaping their learning experiences. By attending to these elements, institutions in developing contexts can adapt the proposed model in ways that are both feasible and impactful. In doing so, they can move toward a more integrated and responsive approach to education, one that prepares students not only to succeed academically but also to navigate the complex realities of professional healthcare practice.

CONCLUSION

This study concludes that technology-integrated English for Specific Purposes (ESP) instruction is effective in addressing the longstanding gap between language learning and clinical readiness in health education by positioning communication competence as an applied and practice-oriented outcome rather than a purely linguistic achievement. Through the integration of digital simulations, case-based learning, and interactive platforms, language development becomes embedded within authentic clinical contexts, enabling students to simultaneously construct medical knowledge, communicative ability, and professional confidence. The findings demonstrate that when ESP is designed as an experiential and technology-mediated process, it not only enhances students' ability to use medical English accurately and contextually, but also supports their readiness to engage in real clinical interactions, including patient communication and interdisciplinary collaboration. This indicates that clinical readiness can be meaningfully conceptualized as an extension of contextualized language learning, rather than a separate domain of competence. The study further offers a conceptual contribution by advancing a holistic ESP model that integrates linguistic, technological, and clinical dimensions into a coherent pedagogical framework, thereby extending the traditional scope of ESP toward a more transdisciplinary orientation. Within the context of developing education systems, this model provides a practical yet adaptable approach to strengthening the alignment between academic preparation and

professional healthcare demands, while also highlighting the importance of pedagogical design and interdisciplinary collaboration in sustaining such innovation.

ETHICAL STATEMENT AND DISCLOSURE

This study was conducted in accordance with established ethical principles, including informed consent, protection of informants' confidentiality, and respect for local cultural values. Special consideration was given to participants from vulnerable groups to ensure their safety, comfort, and equal rights to participate. No external funding was received, and the authors declare no conflict of interest. All data and information presented were collected through valid research methods and have been verified to ensure their accuracy and reliability. The use of artificial intelligence (AI) was limited to technical assistance for writing and language editing, without influencing the scientific substance of the work. The authors express their gratitude to the informants for their valuable insights, and to the anonymous reviewers for their constructive feedback on an earlier version of this manuscript. The authors take full responsibility for the content and conclusions of this article.

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