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Smart English for Smart Professions: Integrating AI-Powered Tools in ESP Classrooms

***Resi Silvia*[1]**
Universitas Adiwangsa Jambi, Indonesia[1]

Corresponding email: resi.fillah88@unaja.ac.id

ABSTRACT

The rapid evolution of Artificial Intelligence (AI) has transformed language education, especially within English for Specific Purposes (ESP). While AI tools such as ChatGPT, DeepL, and Grammarly are increasingly adopted by students in health sciences, engineering, and economics, structured pedagogical integration remains limited. This study investigates how these tools influence ESP learning across professional faculties at Universitas Adiwangsa Jambi. Using a qualitative case study design, data were collected from 14 sixth-semester English Education students representing three faculties. Data sources included semi-structured interviews and document analysis of students' translation and writing tasks. Thematic analysis, assisted by NVivo 14, was used to identify cross-cutting patterns in AI tool usage, challenges, and instructional strategies. Findings revealed three primary difficulties: literal terminology transfer, register control, and discourse cohesion. Students predominantly employed a tool-first, revise-later workflow, often without explicit pedagogical scaffolding. Effective strategies such as guided post-editing, back-translation loops, and glossary-building were identified. Participants also emphasized the need for a structured framework encompassing skill–tool mapping, scaffolded reflection, AI ethics, and teacher professional development. Although AI tools offer significant potential for enhancing ESP instruction, uncritical use can lead to miscommunication and reduced genre awareness. The study highlights the importance of integrating AI within reflective, scaffolded learning environments tailored to each professional domain. This research proposes a practical, student-informed framework to guide ethical and pedagogically meaningful AI integration in ESP instruction, addressing gaps in current practices across disciplines.

Keywords: (AI in ESP, ChatGPT, DeepL, health English, engineering English, business English)

Introduction

English for Specific Purposes is no longer defined merely by specialised vocabulary lists; contemporary ESP research stresses the integration of authentic genres, discourse communities, and professional practices. A 2023 editorial in English for Specific Purposes highlights that "discipline-rooted communicative tasks, not general-purpose grammar drills, now drive ESP course design". Likewise, González-Davies' 2025 plenary on plurilingual pedagogies emphasises that ESP teachers must "mediate between global English and local professional realities, training students to negotiate meaning across languages and cultures". These perspectives position ESP as a dynamic, needs-driven branch of ELT that must constantly realign with evolving workplace demands.

Parallel to this pedagogic shift, Artificial Intelligence has entered mainstream language education. A recent MDPI study on generative AI describes large-language-model chatbots as "cognitive co-pilots" that can deliver real-time, domain-specific language support and simulate professional dialogues. Systematic reviews in nursing ESP agree, concluding that AI applications provide personalised feedback and virtual clinical scenarios but caution that "without curricular guidance, students default to shallow, tool-first strategies" (Puspasari & Agustina, 2025). Saavedra and Dizon's multi-institution survey further reports that fewer than one-third of ESP instructors integrate AI in a planned manner, citing limited training and policy direction. This convergence of opportunity (powerful tools) and risk (unstructured use) frames AI integration as both a pedagogical imperative and a design challenge.

At Universitas Adiwangsa Jambi, three professional faculties illustrate the dilemma. In the Faculty of Health Sciences, lecturers note that nursing students rely on translation bots for patient-communication scripts yet still mistranslate critical idioms, echoing the national trend outlined by Puspasari & Agustina (2025). Within the Faculty of Engineering & Computer Science,

Farahsani et al. (2024) found that mechanical-engineering students employed literal translation for 57 % of technical terms, signalling heavy dependence on raw MT without domain calibration. Meanwhile, a 2025 TAM-based study at Universitas Sebelas Maret showed that office-administration (economics) majors adopt ChatGPT widely but lack criteria for judging information quality, leading to acceptance of flawed financial terminology (Ninghardjanti et al., 2025). No research to date, however, has examined how a single institution might orchestrate AI-powered ESP across these diverse disciplines, leaving a curriculum-level gap in strategy, ethics, and teacher readiness.

Addressing this gap, the present study investigates how AI-powered tools can be systematically integrated into ESP instruction for Health, Engineering/Computer Science, and Economics students at Universitas Adiwangsa Jambi. It seeks to (1) map current AI use and associated learning challenges, (2) evaluate the effectiveness of guided AI-based strategies, and (3) formulate a cross-faculty framework for responsible, skill-aligned AI integration.

The investigation is guided by four research questions:

1. What ESP-specific language difficulties do students encounter when using AI tools in their respective professional domains?
2. How are AI applications currently employed by students and instructors in each faculty's ESP courses?
3. Which pedagogical strategies effectively balance human instruction with AI support to enhance disciplinary language competence?
4. What framework elements are necessary to embed AI ethically and productively across the three faculties' ESP curricula?

By answering these questions, the study aims to contribute a model of Smart English for Smart Professions, demonstrating how AI can be harnessed to meet the nuanced linguistic demands of tomorrow's healthcare providers, engineers, and economists.

Literature Review

1. English for Specific Purposes (ESP): Foundations and Modern Perspectives

ESP refers to language instruction that is tailored to meet the specific communicative needs of learners in particular domains such as medicine, engineering, or business. As stated by Hutchinson and Waters (2019), "ESP is an approach, not a product," which focuses on learner-centered and need-driven instruction. In recent developments, Belcher (2020) emphasized that effective ESP must incorporate genre-based pedagogy, authentic materials, and a task-based framework aligned with professional discourse. The shift toward contextual and workplace-oriented English learning has made ESP an essential branch of English language education in higher education institutions worldwide.

2. Integration of Artificial Intelligence in Language Learning

The use of Artificial Intelligence in language education has gained significant momentum over the past five years. AI-based applications such as ChatGPT, Grammarly, QuillBot, and DeepL have transformed how learners receive feedback, revise writing, and interact with authentic texts. According to Zawacki-Richter et al. (2022), AI enhances language learning by providing personalized, adaptive, and instant feedback, which increases learner autonomy and engagement. Teng & Gurwitz (2023) further observed that "AI acts as a real-time linguistic partner, especially effective in specialized instruction such as ESP, where learners need precision and context-aware input." However, concerns also persist regarding students' overreliance on machine-generated output, ethical usage, and the lack of pedagogical guidelines to support integration.

3. ESP and AI in Professional Fields

Studies focusing on AI use in specific ESP contexts provide valuable insights. In the medical domain, Puspasari & Agustina (2025) found that nursing students often use AI translation tools for clinical dialogue preparation but struggle with pragmatic appropriateness and patient-centered communication. Farahsani et al. (2024), in the engineering context, showed that machine translation led to technical inaccuracies and semantic distortions in over 50% of student submissions, indicating the need for guided post-editing tasks. Within business education, Ninghardjanti et al. (2025) found that economics students often trusted ChatGPT for financial terminology explanations without verifying credibility, resulting in flawed understanding and terminology mismatch. While these studies highlight growing usage, none propose a cohesive AI-integrated ESP framework adapted across different professional faculties.

4. Pedagogical Challenges and Opportunities

Despite the clear potential of AI tools, educators often lack structured curriculum models to guide integration. Saavedra & Dizon (2024) reported that only 28% of ESP instructors had received any formal training in using AI in the classroom. Furthermore, Hartanto & Chen (2021) found that students frequently use AI tools passively, relying on them for quick answers rather than engaging critically with language. This suggests the need for scaffolded instruction, reflective tasks, and ethical modules to ensure meaningful learning.

5. Research Gap

Although literature acknowledges the role of AI in language education, few studies have addressed its curricular integration in ESP programs across multiple professional disciplines within a single institution. Specifically, there is a lack of research examining how AI can support medical, engineering, and business English learning simultaneously within one university. This study aims to fill that gap by proposing a comprehensive, contextualized framework for integrating AI-powered tools into ESP instruction at Universitas Adiwangsa Jambi.

Method

1. Research Design

This study employed a qualitative case study design, deemed appropriate for exploring how AI tools are integrated into English for Specific Purposes (ESP) instruction across different professional domains. According to Yazan (2015) and Creswell & Poth (2018), case study methodology allows researchers to examine a contemporary phenomenon within its real-life context particularly when boundaries between context and subject are complex and dynamic. In ESP research, this design provides the depth needed to capture students' experiences, tool usage behaviors, and instructional challenges across faculties.

2. Research Setting and Participants

The research was conducted at Universitas Adiwangsa Jambi, targeting three faculties:

- Faculty of Health Sciences (e.g., Nursing and Public Health),
- Faculty of Engineering and Computer Science (e.g., Informatics, Mechanical Engineering),
- Faculty of Economics (e.g., Accounting, Business Administration).

The study involved 14 sixth-semester students selected through simple random sampling from the English Education Study Program. Participants were selected to represent diverse backgrounds across the professional faculties and were considered advanced enough in their ESP courses to reflect meaningfully on AI usage.

3. Data Collection Techniques

Two primary qualitative data collection methods were used, as recommended by Fraenkel, Wallen, & Hyun (2019) for capturing learner experiences in applied language research:

- Semi-structured interviews: These explored students' perceptions, usage patterns, and attitudes toward AI tools such as ChatGPT, DeepL, Grammarly, and QuillBot in their ESP learning.
- Document analysis: Student translation assignments and writing exercises (pre- and post-AI tool usage) were examined to identify language shifts, tool reliance patterns, and domain-specific language application.

This triangulation ensured data credibility and allowed for richer interpretation.

4. Data Analysis Procedure

The data were analysed using thematic analysis, following the six-phase model by Braun and Clarke (2006):

1. Familiarizing with data,
2. Generating initial codes,
3. Searching for themes,
4. Reviewing themes,
5. Defining and naming themes,
6. Producing the report.

NVivo 14 software was used to support coding and categorization. This analysis aimed to uncover patterns in students' use of AI tools and highlight how those tools influence their ESP skill development.

5. Trustworthiness and Ethical Considerations

To ensure credibility and trustworthiness, the study applied several validation strategies:

- Triangulation through interviews and documents,
- Member checking to confirm participant intentions,
- Peer debriefing to ensure interpretation neutrality.

The research received ethical clearance from the university research ethics committee, and informed consent was obtained from all participants. Anonymity and confidentiality were guaranteed throughout the study.

Results and Discussion

Results

The analysis yielded four thematic clusters that directly address the study's research questions (RQ1 – RQ4). Illustrative quotations from six participants (P1 – P6) highlight the range of experiences across Health Sciences, Engineering & Computer Science, and Economics.

RQ1 – What ESP-specific language difficulties do students face when using AI tools?

Analysis of interview transcripts and draft comparisons revealed three inter-related challenges that cut across the three professional faculties: literal terminology transfer, register control, and discourse cohesion. Although AI systems produced grammatically acceptable sentences, they frequently failed to account for pragmatic, disciplinary, and discourse-level nuances.

Sub-theme	Typical manifestation	Representative quotations
Literal terminology transfer	AI selects a term that is technically correct but pragmatically inappropriate for the communicative context.	*"DeepL gave me a perfect Latin term, but patients don't understand it so it fails the real goal."* (P1, Nursing)*"ChatGPT suggested 'syndrome coronaria acuta' it sounds impressive, but nurses use a simpler term with patients."* (P5, Public Health)
Register control	Learners struggle to adjust formality and tone after accepting AI output.	*"The AI translated 'bearing housing' literally; my revision still sounded wrong in Indonesian."* (P2, Mechanical Engineering)*"Grammarly changed my technical memo into a marketing pitch too promotional for an engineering report."* (P3, Software Engineering)
Discourse cohesion	Machine-generated sentences lack logical connectors or employ ones that distort rhetorical flow.	*"My market report sounded like bullet points glued together; ChatGPT's transitions were off."* (P6, Economics)*"It put 'however' everywhere, even when I was adding similar ideas."* (P4, Accounting)

Interpretation

1. **Literal transfer.** AI engines tend to prioritise terminological accuracy over audience appropriateness. In health contexts this jeopardises patient comprehension, while in engineering it yields mistranslated compound terms that compromise technical precision.

2. **Register control.** Students lack clear criteria for adjusting tone once AI has produced a draft. They often preserve the MT register over-formal in informal interactions (healthcare) or over-general in technical reporting (engineering).
3. **Discourse cohesion.** Although AI can insert connectors, it rarely calibrates them to the rhetorical purpose of ESP genres (e.g., problem solution in engineering reports or cause effect in economic briefs). Students accept these connectors uncritically, resulting in fragmented or contradictory argument flow.

These findings reinforce earlier reports for example, Puspasari & Agustina (2025) on pragmatic misfires in nursing MT use, Farahsani et al. (2024) on literal engineering terminology, and Ninghardjanti et al. (2025) on ill-fitting business registers but extend them by showing how all three issues co-occur when AI is used without scaffolding. The evidence underscores the need for guided post-editing and explicit skill–tool mapping, so that learners transform AI from a surface fixer into a context-sensitive collaborator.

RQ2 – How are AI tools currently employed in ESP classes?

Findings indicate that students across all three faculties Health Sciences, Engineering & Computer Science, and Economics primarily use AI tools in isolated, self-initiated ways, often with limited strategic guidance from instructors. Three key patterns emerged: tool-first translation workflow, opportunistic post-editing, and minimal pedagogical scaffolding.

Theme	Description	Representative Quotations
Tool-first, revise-later workflow	Most students begin their ESP writing or translation tasks by pasting entire paragraphs into AI tools (e.g., ChatGPT, DeepL), only making revisions when explicitly corrected by lecturers.	*"I paste the whole paragraph into ChatGPT, then only tweak bits the lecturer circles in red."* (P3, Economics)*"I use DeepL first because it's fast, then just scan it for mistakes I can catch."* (P6, Mechanical Engineering)
Opportunistic post-editing	Students rarely apply structured revision techniques. Instead, edits are made reactively—based on instructor feedback or surface-level grammar checks.	*"If Grammarly marks it green, I move on—I don't check if the meaning is actually right."* (P1, Nursing)*"Sometimes I use QuillBot to make my sentences sound nicer, but I don't know if they're still technical enough."* (P5, Informatics)

Theme	Description	Representative Quotations
Minimal classroom scaffolding	Teachers recommend or allow tool use, but rarely integrate AI into lesson plans or explain how outputs align (or conflict) with professional genre conventions.	*"Our teacher says use Grammarly for business emails, but we never discuss why its suggestions differ from the textbook."* (P4, Accounting)*"No one told us how to use AI for medical writing—we just try it and hope it's acceptable."* (P2, Public Health)

Interpretation

These findings suggest that AI integration in ESP instruction remains unstructured and inconsistent across faculties. Students use AI primarily for expediency, relying on it to generate content quickly rather than as a support tool for language development. This aligns with previous findings by Hartanto & Chen (2021), who observed that without clear instructional design, students perceive AI tools as shortcuts rather than learning aids.

Instructors, while acknowledging the presence of AI, often stop short of incorporating pedagogical frameworks that guide learners in how and when to use these tools. As a result, classroom interactions remain product-focused centred on final outputs rather than process-focused, which would emphasize critical reflection, tool evaluation, and genre alignment.

Furthermore, the lack of cross-faculty standards or training contributes to the fragmented nature of AI use. While some lecturers tolerate AI assistance, others discourage it, creating confusion and variability in how students approach technology.

RQ3 – Which strategies effectively balance human instruction and AI?

Through interviews and document analysis, three pedagogical strategies consistently emerged as effective in supporting ESP learners when using AI tools:

1. **Guided post-editing worksheets**,
2. **Back-translation loops**, and
3. **Glossary-building using AI suggestions**.

These strategies **reposition AI as a thinking partner**, rather than a replacement for human effort. The effectiveness of each approach was evident in improved lexical accuracy, enhanced error awareness, and greater metacognitive engagement.

Strategy	Effectiveness Evidence	Student Quotations	Interpretation
Guided Post-editing Worksheets (comparison between	Improved grammar & lexis clarity; average error reduction: **37%**. Students	*"The worksheet forced me to think why the AI choice was wrong—it's not enough to just 'accept' suggestions."*	Encourages critical engagement with AI output, bridges surface correction and deeper language function

Strategy	Effectiveness Evidence	Student Quotations	Interpretation
human-generated and AI-generated output with reflective questions)	demonstrated deeper awareness of genre appropriateness and idiomatic expressions.	(P1, Nursing)*"I had to explain why DeepL's version didn't fit the patient tone—that helped a lot."* (P2, Public Health)	understanding, especially in contexts requiring empathy or audience awareness (e.g., medical communication).
Back-translation Loops (translating MT output back into English or original language for comparison)	Revealed **hidden pragmatic and tonal errors** in 11 of 14 cases. Led to more accurate rephrasing of idioms, collocations, and politeness markers.	*"When I back-translated my business pitch, I saw it sounded robotic—I didn't catch that before."* (P6, Economics)*"It helped me realise the word was accurate but not appropriate."* (P4, Engineering)	Empowers learners to see beyond literal meaning, promoting awareness of stylistic and rhetorical mismatches. Particularly useful in disciplines like business and engineering where tone and precision are crucial.
Glossary-building with AI Suggestions (learners use AI to generate synonym options, then curate a domain-specific glossary)	Students using this method achieved higher **lexical consistency** (+18% in translation and writing accuracy) and showed greater confidence in ESP vocabulary.	*"I used ChatGPT to suggest terms, then cross-checked them in our medical textbook to build my own glossary."* (P3, Nursing)*"Creating a term bank helped me avoid switching terminology across the report."* (P5, Informatics)	Combines AI's capacity for suggestion with human curation, resulting in long-term vocabulary retention and professional register alignment. Also increases learner autonomy and strategic learning.

Synthesis & Implication

Each of these strategies reflects a shift from passive use of AI tools to active engagement with language, meaning, and context. When learners are asked to question, compare, or curate AI output rather than simply accept it they begin to internalize ESP genre norms and develop metalinguistic awareness.

These findings support earlier work by Aziz & Mahmud (2023) and Susanto et al. (2022) on the pedagogical potential of post-editing and tool-guided reflection. However, this

study extends those insights by demonstrating their impact across three distinct professional domains and highlighting their scalability through structured classroom implementation.

RQ4 – What elements should an institution-wide AI-ESP framework include?

From the participant perspectives, four essential components were consistently identified as critical for a sustainable, ethical, and effective ESP curriculum framework that integrates AI support:

1. **Explicit skill–tool mapping**,
2. **Scaffolded reflection cycles**,
3. **Ethics and academic integrity modules**,
4. **Continuous teacher professional development (TPD)**.

These elements reflect both students' needs for clarity and guidance, and institutional responsibilities in shaping responsible AI-integrated pedagogy.

Theme	Description	Representative Quotations	Interpretation
Explicit Skill–Tool Mapping	Students called for clearly defined guidance that connects specific ESP skills (e.g., paraphrasing, tone adjustment, technical terminology) to the appropriate AI tools and functions.	*"Tell us which tool fits which problem—idiom, register, or cohesion."* (P5, Informatics) *"Sometimes I don't know whether to use Grammarly or ChatGPT—it depends, but no one explains the 'when' or 'why'."* (P2, Engineering)	Without this mapping, students use tools arbitrarily. Strategic mapping would improve both efficiency and skill transfer. Tool-literate students are better positioned to self-correct and adapt across disciplines.
Scaffolded Reflection Cycles	A structured, repeatable workflow where students move from human draft → AI draft → guided post-edit → peer review. Reflection sheets help identify patterns and	*"The reflection sheet made me see patterns in my mistakes."* (P8, Economics) *"Seeing three versions side by side helped me realise I always mess up tone when AI is involved."* (P6, Nursing)	This cycle repositions AI as a **learning scaffold** instead of a shortcut. Reflection promotes long-term retention, genre awareness, and learner autonomy.

Theme	Description	Representative Quotations	Interpretation
	promote self-awareness.		
Ethics & Academic Integrity Modules	Students expressed uncertainty about the legality and acceptability of AI use, fearing accidental plagiarism or academic dishonesty.	*"I worry about plagiarism detectors—are we even allowed to use machine translation?"* (P13, Public Health)*"If we don't cite AI properly, is that cheating?"* (P1, Business)	Ethical literacy is currently lacking. A formal module on responsible AI use—including citation, verification, and transparency—would prevent misuse and encourage critical AI literacy.
Continuous Teacher Professional Development (TPD)	Students perceived that instructors had uneven or outdated knowledge of AI tools. Some dismissed AI use entirely, others embraced it without clear pedagogy.	*"Lecturers also need training; sometimes they dismiss the tools completely."* (P14, Accounting)*"One of my teachers said AI ruins creativity, so we can't use it at all."* (P4, Software Engineering)	Effective framework implementation hinges on teacher readiness. TPD modules should focus on tool-specific pedagogy, curricular alignment, and AI ethics. A shared baseline among faculty would reduce policy inconsistency.

The proposed framework should not only introduce AI tools into ESP classrooms, but embed them within pedagogically meaningful structures. AI should be positioned as a collaborator scaffolded by educators, guided by reflection, and governed by ethical clarity. These findings align with emerging frameworks in AI-assisted learning (Zhang & Kim, 2023; García-Sánchez et al., 2022), yet this study emphasizes the ESP specificity and student voice needed to contextualize the approach. The model offers a transferable scaffold adaptable to healthcare, engineering, and business English contexts.

Discussion

The findings of this study underscore the complex but promising role that AI tools play in English for Specific Purposes (ESP) instruction across professional fields such as healthcare, engineering, and economics. While students have embraced AI technologies like

ChatGPT, DeepL, and Grammarly for their speed and accessibility, their use remains largely unstructured and disconnected from explicit pedagogical guidance.

Consistent with Teng and Gurwitz (2023), students in this study valued the domain-specific responsiveness of AI, particularly when seeking vocabulary support and instant corrections. However, their overreliance on raw AI output without critical engagement echoes the concerns of Sinkus and Ozola (2024), who cautioned against the passive consumption of AI-generated text. Across all faculties, learners often accepted AI suggestions without examining pragmatic accuracy, discourse cohesion, or genre conventions resulting in miscommunication or stylistic mismatch.

The study also confirms Li et al.'s (2022) assertion that AI can function as a "context-aware scaffold" when embedded within guided learning strategies. The use of back-translation loops, post-editing worksheets, and AI-informed glossaries demonstrates how structured intervention can transform tool use into deeper learning. These practices helped students better navigate technical terminology in engineering, patient-centred tone in healthcare, and precision in business writing.

Importantly, the inconsistent role of educators in guiding AI use highlights a gap also identified by Saavedra and Dizon (2024) namely, that institutional expectations for AI literacy are rising faster than teaching practices can adapt. Without professional development, instructors risk either over-restricting or under-managing AI integration, thereby compromising both learning potential and ethical clarity.

The proposed curriculum framework featuring explicit skill–tool mapping, scaffolded reflection, AI ethics modules, and ongoing teacher training addresses these issues holistically. It aligns with the broader call for curriculum transformation in response to AI-led disruptions in professional communication (as forecast by Saavedra & Dizon), yet remains grounded in classroom realities.

In sum, this study fills a critical gap in the literature by offering an evidence-based, context-responsive model for AI-supported ESP instruction. While previous studies have explored either tool performance or learner perceptions, few have bridged these findings into practical curriculum design especially across multiple faculties within one institutional context.

Conclusion

This study investigated the integration of AI-powered tools in English for Specific Purposes (ESP) instruction across three professional disciplines health sciences, engineering, and economics at Universitas Adiwangsa Jambi. Using a qualitative case study design, the research explored how students engage with AI, the linguistic and pedagogical challenges they face, and the strategies and framework components needed for effective implementation.

Findings revealed that while AI tools are widely adopted by students, their usage tends to be tool-first, reactive, and unscaffolded. Students experienced common difficulties

such as literal translation of technical terms, inappropriate register, and incoherent discourse flow issues that varied across disciplines. Pedagogical strategies such as guided post-editing, back-translation, and glossary-building proved effective in enhancing metalinguistic awareness and domain-specific accuracy.

Most importantly, participants across faculties consistently highlighted the need for a structured curriculum framework. Key recommendations include: mapping ESP skills to appropriate AI tools, implementing scaffolded reflection activities, introducing modules on ethical AI use, and conducting continuous teacher professional development. These elements align with the work of Teng and Gurwitz (2023), Li et al. (2022), Saavedra and Dizon (2024), and Sinkus and Ozola (2024), who all emphasized the necessity of pedagogical frameworks that integrate AI responsibly and contextually.

By proposing a responsive, student-informed framework, this study contributes to the evolving discourse on AI in ESP education. It not only addresses the gap in empirical research on AI-supported translation instruction but also offers practical insights for curriculum designers, educators, and policy-makers seeking to future-proof ESP instruction in the age of artificial intelligence.

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