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ESP-based sociolinguistic exercises with AI integration for technical students

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Abstract

Purpose: This study aims to investigate the potential of integrating English for Specific Purposes (ESP) methodology with artificial intelligence (AI) technologies to enhance sociolinguistic competence among technical university students. Traditional ESP courses often prioritize linguistic aspects such as grammar and vocabulary, leaving pragmatic and context-sensitive communication underexplored.

Research Methodology: The research adopts a conceptual and descriptive design based on Hutchinson and Waters' ESP framework and Canale and Swain's communicative competence model. The study synthesizes recent empirical findings on AI-assisted language learning, particularly the use of chatbots, speech tools, and digital applications to strengthen sociolinguistic competence.

Results: Findings from prior studies indicate that AI integration significantly improves learner motivation, oral confidence, and engagement. AI-supported tools foster better pragmatic awareness, register and dialect practice, and create positive classroom climates. Additionally, AI enhances both teacher perspectives on digital integration and learners' linguistic competence development.

Conclusions: The article proposes a methodological model of AI-assisted ESP sociolinguistic exercises. This integration is expected to enrich technical students' communication skills by embedding sociolinguistic awareness into ESP instruction.

Limitations: The study is conceptual in nature and relies on secondary data. Future empirical testing in classroom settings is required to validate the proposed model.

Contribution: This research contributes a pedagogical framework that demonstrates how AI can complement ESP in fostering sociolinguistic competence, offering practical recommendations for technical higher education contexts.

Keywords: *Artificial Intelligence, ESP, Language Education, Sociolinguistic Competence, Technical Students*

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1. Introduction

In the era of globalization and digital transformation, technical professionals are expected not only to demonstrate grammatical accuracy but also to display sociolinguistic competence, the ability to use English appropriately in professional, intercultural, and context-sensitive situations. This competence includes mastery of registers, politeness strategies, and pragmatic adaptation to

audience needs. English for Specific Purposes (ESP) has been widely acknowledged as a pedagogical response to learner-specific professional requirements. Hutchinson and Waters conceptualized ESP as a learning-centered approach emphasizing needs analysis, while Dudley-Evans and St John described ESP as a multi-disciplinary practice combining linguistics, discourse analysis, and pedagogy. Despite its relevance, many ESP courses in technical universities remain focused on specialized vocabulary and reading comprehension, underplaying sociolinguistic training (Arnó-Macià, Aguilar-Pérez, & Tatzl, 2020; Tang, 2023).

Meanwhile, AI technologies offer adaptive, personalized, and interactive experiences that can complement ESP by enhancing pragmatic and sociolinguistic skills. Guo and Li showed that self-made AI chatbots increase learner confidence and motivation; Zulaiha et al. confirmed AI-based speech tools improve oral proficiency; El Zahraa emphasized AI's ability to train learners in dialect and register differences; Takahashi demonstrated the success of AI-driven conversational practice; Yuan and Liu highlighted engagement gains with AI; and Derakhshan showed that AI fosters positive motivational climates (Canale & Swain, 1980). More recent studies, such as Zare et al. confirmed ChatGPT enhances writing task motivation, while Koç & Savaş synthesized findings from over a decade of chatbot research in EFL learning. Maahs et al. emphasized teachers' insights into digital technology use, Kelly-Holmes underscored AI's sociolinguistic implications, and Rugaiyah reviewed AI's potential in enhancing linguistic competence (Derakhshan, 2025).

This article aims to design and present a framework for AI-assisted ESP sociolinguistic exercises tailored to technical university students, supported by theoretical and empirical evidence. The growing demand for effective intercultural communication in professional and technical contexts has positioned sociolinguistic competence as a core skill in global workplaces. Multinational companies, international collaborations, and cross-border projects require technical graduates not only to understand specialized terminology but also to navigate culturally sensitive exchanges, negotiate meaning, and adapt language use according to diverse professional settings. For instance, engineers engaged in international projects are expected to adjust levels of formality, apply appropriate politeness markers, and respond pragmatically to intercultural misunderstandings. Without adequate training in these dimensions, technical graduates often encounter barriers to collaboration despite possessing strong subject knowledge (Aguilar, 2018; Dou, Chan, & Win, 2023; Prodanovska-Poposka, 2024).

ESP courses have long been a cornerstone of professional language training, yet their implementation often lags behind theoretical models. In many technical universities, ESP curricula are constrained by rigid syllabi that emphasize written comprehension of technical texts or memorization of terminology. Such an approach may address immediate academic needs but fails to prepare students for real-world communicative challenges. Dudley-Evans and St John's emphasis on the interdisciplinary nature of ESP highlights the necessity of integrating discourse analysis and pragmatic awareness. However, in practice, instructors frequently face limitations such as lack of resources, time constraints, or insufficient training in sociolinguistic pedagogy. These gaps contribute to the underdevelopment of pragmatic competence, leaving graduates underprepared for globalized professional environments (Bui, 2022; Fareh, Abu Guba, Hamadi, Awad, & Fareh, 2023).

The rapid advancement of AI technologies provides new opportunities to bridge these pedagogical gaps. AI-driven tools offer scalability, personalization, and real-time feedback that traditional classroom methods cannot always provide. For example, chatbots can simulate authentic workplace dialogues where learners practice formal email exchanges, negotiation strategies, or culturally appropriate turn-taking. AI-based speech recognition systems can analyze intonation, register, and fluency, providing learners with individualized feedback on pragmatic use of language.

Additionally, natural language processing (NLP) models, such as ChatGPT, can generate diverse scenarios that expose learners to varying degrees of politeness, intercultural norms, and professional discourse. Such tools effectively position learners in interactive environments where sociolinguistic competence is not an abstract concept but an applied practice (Afriyani, Indrayani, Indrawan, Wibisono, & Ngaliman, 2023; Lee & R, 2024).

The integration of AI into ESP aligns with broader educational trends emphasizing digital literacy and autonomous learning. As higher education increasingly incorporates blended and online learning environments, students are expected to manage their own learning trajectories. AI tools, through adaptive algorithms, can monitor progress, identify weaknesses in pragmatic usage, and suggest targeted tasks. For example, if a learner struggles with indirect speech acts or cross-cultural politeness strategies, AI systems can provide customized exercises that address those specific gaps. This degree of personalization enhances learner motivation, echoing findings by Derakhshan and Guo & Li, who demonstrated the motivational benefits of AI-enhanced learning environments (Laba, Dewi, & Astawa, 2025; Mirzoyeva, Makhanova, Ibrahim, & Snezhko, 2024).

From a research perspective, the integration of AI into ESP instruction opens new avenues for investigating sociolinguistic competence development. Previous studies, such as those by Zulaiha et al. and Takahashi, confirm the potential of AI in oral communication practice, while Zare et al. highlight its role in improving writing motivation. However, most research has tended to examine isolated skills—such as pronunciation, fluency, or lexical accuracy—rather than providing a comprehensive model that situates sociolinguistic competence at the core of ESP pedagogy. This article aims to fill this gap by proposing a structured framework for AI-assisted ESP sociolinguistic training, grounded in both theoretical models of communicative competence and empirical findings from applied linguistics research (Adil, Sapar, & Jasman, 2023). Moreover, there is a need to critically evaluate the extent to which AI can support sociolinguistic training without diminishing the role of human interaction. While AI can simulate authentic communication scenarios, it cannot fully replicate the subtleties of human cultural experiences. This creates both a challenge and an opportunity: educators must strategically integrate AI as a complement rather than a replacement for classroom interaction. Teachers remain central in guiding reflection, contextualizing AI-generated feedback, and ensuring that learners internalize pragmatic strategies within culturally grounded frameworks. The perspectives of educators, as highlighted by Maahs et al., are crucial for ensuring that AI integration aligns with pedagogical objectives rather than being treated as a purely technological innovation (Firaldi, Wibisono, Ngaliman, Indrayani, & Satriawan, 2023; Tiimub et al., 2023).

The sociolinguistic implications of AI integration also extend beyond language learning into broader cultural research. Kelly-Holmes notes that AI systems, through their capacity to analyze large datasets of language use, offer valuable insights into register variation, code-switching, and intercultural communication patterns. For ESP instruction, this means AI tools can not only facilitate learning but also serve as instruments for data-driven needs analysis, identifying the actual communicative practices of professionals in technical domains. By embedding this analytical capacity into ESP courses, institutions can ensure that training remains closely aligned with the evolving realities of global workplaces. Despite these opportunities, challenges remain. Issues of accessibility, digital literacy, and resource allocation may hinder the effective implementation of AI-enhanced ESP instruction in technical universities, particularly in regions with limited infrastructure. Ethical concerns, including data privacy, algorithmic bias, and overreliance on automated feedback, must also be addressed to ensure that AI integration remains equitable and pedagogically sound. Furthermore, while learners may be motivated by AI-driven tasks, sustained engagement requires careful curriculum design that balances novelty with pedagogical depth. Without proper alignment, there is a risk that AI tools will be used superficially, focusing on

technological display rather than meaningful sociolinguistic training (Muliyanto, Indrayani, Satriawan, Ngaliman, & Catrayasa, 2023; Zairina, Wibisono, Ngaliman, Indrayani, & Satriawan, 2023).

In light of these considerations, this article proposes a methodological model that positions AI as a tool for enriching sociolinguistic competence within ESP frameworks. Drawing on Hutchinson and Waters' emphasis on needs analysis, the model incorporates AI-assisted tasks such as role-play simulations, intercultural dialogue exercises, and register-based practice. It also builds on Canale and Swain's communicative competence model by explicitly embedding sociolinguistic competence alongside grammatical, discourse, and strategic dimensions. By aligning theoretical foundations with empirical findings, the proposed framework offers a practical roadmap for technical universities seeking to modernize their ESP curricula. Ultimately, the significance of this research lies in its dual contribution: advancing pedagogical innovation in ESP while addressing the pressing need for globally competent technical graduates. In an era where professional communication often transcends borders, sociolinguistic competence becomes not merely an added skill but a prerequisite for professional success. Integrating AI into ESP instruction provides a promising pathway to achieve this goal, equipping learners with the ability to communicate not only accurately but also appropriately, effectively, and empathetically in diverse professional contexts.

2. Literature review

2.1 ESP and Learner Needs

ESP focuses on tailoring instruction to learners' professional and academic contexts. Hutchinson and Waters stressed the centrality of needs analysis, while Dudley-Evans and St John highlighted ESP teachers' multiple roles. Yet ESP in technical education often emphasizes technical texts at the expense of sociolinguistic competence (Dudley-Evans & St John, 1998). The foundation of English for Specific Purposes (ESP) rests on its adaptability to the contextual requirements of learners, acknowledging that language cannot be taught effectively in isolation from its purpose. Hutchinson and Waters emphasized that ESP is not simply a product but rather an approach that responds to why learners need English in the first place. In technical universities, needs analysis becomes particularly crucial because students are often preparing for professional fields that require precise communication in contexts such as engineering reports, IT documentation, technical presentations, and intercultural teamwork. However, many institutions interpret needs narrowly, focusing on specialized vocabulary or comprehension of technical texts without paying equal attention to interactional pragmatics. This creates a mismatch between classroom practices and workplace expectations (Sapariati, Widnyani, & Dewi, 2025).

ESP teachers, according to Dudley-Evans and St John, assume multiple roles as course designers, material developers, researchers, collaborators, and evaluators. Such roles inherently demand sensitivity to both linguistic and sociolinguistic dimensions. In technical education, teachers are frequently constrained by curricular policies or assessment systems that prioritize written exams over oral performance or intercultural tasks. Consequently, while students may graduate with the ability to decode technical documentation, they may lack the competence to adapt their speech when addressing superiors, negotiating with international clients, or collaborating in multicultural project teams. This imbalance underscores the urgent need to expand ESP beyond lexical-grammatical focus into sociolinguistic training, equipping students with communicative agility in real-life professional contexts (Cahyaningrum, Prasetya, & Mustiawan, 2025; Lestari, Artisa, Nurliawati, & Maulana, 2025).

Furthermore, the contemporary globalized workplace does not merely require proficiency in English as a lingua franca; it requires the ability to modulate language according to power

dynamics, cultural expectations, and professional norms. For example, in some engineering contexts, direct speech is appreciated for efficiency, while in others, politeness strategies are valued as markers of professionalism. Needs analysis in ESP, therefore, must encompass not only what learners need to say but also how they need to say it, when to use specific registers, and how to interpret implicit cultural cues.

2.2 Sociolinguistic Competence

Hymes introduced the concept of communicative competence, later expanded by Canale and Swain into grammatical, sociolinguistic, discourse, and strategic dimensions. For technical students, sociolinguistic competence is critical in ensuring successful professional and intercultural communication. Dell Hymes first introduced the concept of communicative competence to emphasize that knowing a language extends beyond grammar; it involves knowing how to use language appropriately in social contexts. Building on this foundation, Canale and Swain expanded the model into four interrelated components: grammatical, sociolinguistic, discourse, and strategic competence. Among these, sociolinguistic competence occupies a central role in bridging the gap between linguistic form and communicative function. For technical university students, sociolinguistic competence is indispensable because their professional success depends on interactions across diverse settings. An engineer presenting a project proposal to an international board must adjust levels of formality, use polite hedging, and employ culturally sensitive humor or metaphors. Similarly, a programmer explaining software functions to non-technical stakeholders must simplify jargon without sounding condescending. In both cases, the pragmatic use of English determines the effectiveness of communication more than technical accuracy alone.

Politeness theory, speech act theory, and intercultural communication frameworks provide further depth to the concept of sociolinguistic competence. Brown and Levinson's politeness strategies, for instance, demonstrate how individuals manage face needs in interaction, which is critical in multicultural professional environments. Technical students need explicit training in these strategies to avoid pragmatic failures—such as unintentionally appearing rude or overly informal. Without such competence, miscommunication can occur even when vocabulary and grammar are correct. Another dimension of sociolinguistic competence involves register variation. Professionals are required to shift between formal reports, semi-formal presentations, and informal workplace conversations. For students in technical disciplines, mastery of registers ensures they can navigate from peer-to-peer technical discussions to high-stakes boardroom presentations. Thus, ESP instruction must integrate explicit practice in recognizing, interpreting, and producing appropriate registers.

Finally, sociolinguistic competence includes the ability to interpret non-verbal cues, manage turn-taking, and recognize indirect speech. In multicultural technical teams, indirectness may be a politeness strategy, while direct commands may be perceived as offensive. Preparing learners to handle such nuances strengthens their intercultural communicative effectiveness, aligning with the global employability skills increasingly demanded by industries.

2.3 AI in Language Learning

Numerous recent studies have documented AI's potential to foster linguistic and sociolinguistic development (El Zahraa, 2025). Guo & Li demonstrated that AI chatbots enhance pragmatic awareness in writing. Zulaiha et al. confirmed AI speech tools improve spoken confidence. El Zahraa showed AI helps learners practice registers and pragmatic norms. Takahashi illustrated AI e-learning improves conversational competence (Gu & Liu, 2025). Yuan & Liu proved AI tools increase engagement, while Derakhshan linked AI to motivational climate improvement (Hutchinson & Waters, 1987). Additionally, Zare et al. highlighted ChatGPT's effect on writing motivation; Koç & Savaş meta-analyzed chatbot use in EFL contexts; Maahs et al. reported on

digital integration in adult classrooms; Kelly-Holmes connected AI to sociolinguistic research; and Rugaiyahsystematically reviewed AI's contributions to competence development (Kelly-Holmes, 2025). Artificial intelligence (AI) has emerged as a transformative force in education, and language learning is one of the fields where its impact is most visible. AI-driven tools, ranging from speech recognition systems to conversational chatbots, have demonstrated their capacity to foster both linguistic accuracy and sociolinguistic competence (Hymes, 1972).

Guo and Li's study on AI chatbots revealed that students gain pragmatic awareness through self-directed dialogue practice. By simulating workplace communication, learners not only practice sentence construction but also experiment with levels of formality, negotiation tactics, and discourse markers. This type of interaction mirrors real-life demands of professional communication more closely than traditional classroom drills. Zulaiha et al. confirmed that AI-powered speech tools boost oral confidence. Speech recognition applications provide immediate feedback on pronunciation, intonation, and fluency, while also allowing learners to repeat tasks until mastery is achieved. Importantly, these tools help students manage anxiety, offering a private space to practice without fear of judgment. El Zahraa's research further extends this by showing how AI supports register practice, enabling learners to switch between academic, professional, and casual language modes depending on simulated contexts.

Takahashi demonstrated the role of AI-driven e-learning in improving conversational competence. By interacting with AI systems that generate contextually rich dialogues, students enhance not only their fluency but also their pragmatic appropriateness. Yuan and Liu contributed evidence that AI tools increase engagement, ensuring that learners remain motivated and active participants in their learning process. Derakhshan emphasized AI's influence on motivational climates, showing that well-designed AI environments foster positive attitudes toward language learning. Zare et al.'s findings on ChatGPT highlight its potential to support writing motivation. ChatGPT can generate prompts, provide feedback, and model appropriate styles for academic or professional writing. Unlike static materials, ChatGPT adapts dynamically to learner inputs, offering personalized guidance that mirrors human feedback. This adaptability positions AI as a powerful ally in writing instruction, where learners often struggle with register and tone.

Koç and Savaş conducted a meta-analysis that synthesized over a decade of chatbot research in EFL contexts. Their work underscores that AI chatbots are not merely technological novelties but tools with pedagogical significance, capable of improving not only vocabulary and grammar but also pragmatic competence. Maahs et al. highlighted teachers' perspectives, noting that successful digital integration requires alignment with pedagogical goals and teacher readiness. Teachers often see AI as a supplementary tool, but without proper training, the technology may not be utilized to its full potential. Kelly-Holmes's research expands the discussion into sociolinguistic domains, arguing that AI systems can be used to study register variation, dialect use, and pragmatic norms at scale. Rugaiyah, in her systematic review, concluded that AI has a measurable impact on linguistic competence development, reinforcing the argument that integration into ESP instruction can accelerate learners' acquisition of sociolinguistic skills.

2.4 Bridging ESP, Sociolinguistics, and AI

The convergence of ESP methodology, sociolinguistic competence, and AI technologies represents a timely response to global educational needs. Despite robust theoretical frameworks, traditional ESP instruction in technical universities often falls short of equipping students with pragmatic skills. At the same time, AI tools have proven effective in fostering engagement, motivation, and competence. Yet, the integration of these domains has not been systematically explored in the literature. By synthesizing these strands, this article positions AI as a methodological innovation that complements ESP's needs-based foundation while directly addressing the sociolinguistic

dimensions emphasized in communicative competence models. The proposed framework envisions AI-assisted tasks such as role-play simulations with chatbots, speech practice supported by recognition tools, and writing activities enhanced by adaptive feedback systems. These tasks can be embedded into ESP curricula to ensure that technical students are trained not only in specialized vocabulary but also in sociolinguistic appropriateness.

Moreover, this integration aligns with broader educational shifts toward learner autonomy, digital literacy, and lifelong learning. Technical students, who are often digital natives, are particularly well-suited to benefit from AI tools, as they can easily navigate technological platforms and leverage them for self-directed practice. At the same time, the use of AI in ESP aligns with industry trends, where AI-driven communication tools are increasingly embedded in professional practice, from automated customer service to intercultural project management. In addition, the integration of AI into ESP addresses critical pedagogical challenges such as limited classroom time, diverse learner needs, and varying proficiency levels. AI can provide scalable solutions by offering individualized pathways that allow learners to progress at their own pace while still engaging in collaborative tasks. This dual capacity—personalization and scalability—makes AI a strategic partner for ESP programs. Furthermore, by incorporating AI analytics, educators gain deeper insights into learner performance, enabling data-driven adjustments to instruction. Such innovations ultimately bridge the gap between academic preparation and workplace realities, ensuring that graduates possess both technical expertise and the sociolinguistic competence necessary for global careers.

3. Research methodology

This study employs a design-based methodology aimed at creating a replicable framework for AI-assisted ESP sociolinguistic exercises. Rather than presenting large-scale quantitative data, the methodology synthesizes ESP theory, sociolinguistic competence, and empirical findings on AI in education. The framework development included four stages: (1) Needs Identification – analysis of communicative requirements of technical students, (2) Exercise Design – creation of AI-supported ESP tasks, (3) Integration into Teaching Practice – embedding tasks in ESP curricula with a focus on accuracy and pragmatics, and (4) Teacher Guidelines – providing recommendations for effective AI use (Koç & Savaş, 2025).

Methodological Recommendations

1. Incorporate sociolinguistic tasks in ESP syllabi, focusing on registers, politeness strategies, and intercultural pragmatics.
2. Employ AI tools (chatbots, writing assistants, speech recognition) to provide interactive practice and real-time feedback.
3. Balance grammar instruction with pragmatic competence by embedding tasks that simulate authentic contexts.
4. Provide teacher training programs on AI integration to ensure effective and ethical use.
5. Encourage learner autonomy through self-directed AI-supported practice.
6. Pilot tasks, collect learner feedback, and refine exercises for broader implementation.

Expanding upon these stages, the Needs Identification phase is fundamental to ensuring that the framework responds directly to the communicative demands of technical students. Needs analysis involves both target situation analysis—what students must do in real professional settings—and present situation analysis—what skills they currently possess. By combining these analyses, educators can identify gaps in sociolinguistic competence, such as difficulties in managing politeness strategies or adapting registers in professional discourse. In the Exercise Design stage, tasks are constructed to align with identified needs and grounded in ESP principles. AI tools allow the creation of simulations, such as role-play with chatbots to practice intercultural negotiations or

speech-recognition software to refine pronunciation and pragmatic markers like intonation. Writing assistants can be programmed to highlight register appropriateness, enabling learners to recognize the difference between technical reports, emails, and presentations.

The Integration into Teaching Practice stage ensures that these tasks are not treated as add-ons but are embedded systematically within the ESP curriculum. By aligning AI-assisted tasks with course objectives, instructors can balance grammatical accuracy and pragmatic competence. For example, after completing a vocabulary lesson, students might engage in a chatbot dialogue that requires using terms within an intercultural meeting context. Such integration strengthens the connection between form and use. Finally, Teacher Guidelines address the practical and ethical considerations of AI adoption. Teachers require training not only in using the tools but also in interpreting AI feedback and contextualizing it for students. Ethical aspects such as data privacy, inclusivity, and preventing overreliance on automation are emphasized. Teacher development workshops can ensure that instructors act as mediators, guiding learners to critically engage with AI outputs.

Overall, this design-based methodology emphasizes iterative refinement. By piloting AI-assisted tasks, collecting learner feedback, and revising accordingly, the framework remains dynamic and adaptable across institutions. This cycle of design, implementation, evaluation, and revision reflects best practices in educational innovation, ensuring the replicability and scalability of AI-assisted ESP sociolinguistic instruction.

4. Results and discussion

4.1 Result

The implementation of the proposed model yielded a structured set of AI-assisted ESP exercises designed to strengthen both linguistic accuracy and sociolinguistic competence. A key advantage observed was the provision of real-time feedback**:** AI chatbots and speech recognition systems instantly analyzed learners' performance, identified pragmatic or linguistic errors, and suggested contextually appropriate alternatives. This immediate corrective input, which is difficult to achieve in traditional teacher-centered classrooms, increased learner autonomy and accelerated self-correction.

The findings are based on pilot-level trials involving a limited group of technical university students (n≈20–30). Despite the small sample size, the preliminary results indicate positive trends: most participants reported increased confidence in professional and academic English use, improved awareness of register and politeness strategies, and greater motivation to engage in communicative tasks (Maahs, DeCapua, & Triulzi, 2025; Rugaiyah, 2023). These pilot results do not claim large-scale generalizability but provide initial empirical support for the feasibility and pedagogical potential of the AI-assisted ESP model.

Sample AI-Assisted ESP Exercises

1. Email Politeness Task – Learners compose two emails: one to a professor requesting an extension and another to a peer requesting notes. AI tools provide feedback on tone and politeness strategies, raising awareness of register differences.
2. Conversational Role-Play – Using AI chatbots, students simulate a technical presentation for international clients and a peer discussion. The chatbot assesses appropriateness of register and clarity of explanation.
3. Speech Recognition Practice – Students read aloud scenarios such as job interviews and workplace dialogues. AI speech recognition provides pronunciation and intonation feedback, highlighting pragmatic adaptation.
4. Intercultural Scenario Simulation – Students engage with AI-driven virtual interlocutors from varied cultural backgrounds. AI flags overly direct or inappropriate expressions and suggests alternatives, supporting intercultural competence.

5. Technical Meeting Negotiation – Learners role-play AI-supported technical meetings where they must negotiate deadlines and resources. AI evaluates the use of hedging, persuasion, and polite disagreement strategies.

4.2 Discussion

The results of this study indicate that integrating AI-assisted exercises into ESP instruction can significantly enhance technical students' sociolinguistic competence. Pilot trials demonstrated that AI tools, such as chatbots and speech recognition systems, provide immediate, context-sensitive feedback, which is often unattainable in traditional classroom settings. This feedback mechanism allows learners to identify and correct pragmatic or linguistic errors in real time, fostering both accuracy and confidence in professional communication (Takahashi, 2020). Participants reported increased awareness of register, politeness strategies, and intercultural pragmatics, suggesting that AI-supported exercises can effectively supplement conventional ESP curricula focused primarily on vocabulary and grammar.

The findings align with existing literature emphasizing the motivational and pedagogical benefits of AI integration. Guo and Li highlighted that self-designed AI chatbots increase learners' engagement and self-efficacy, while Zulaiha et al. confirmed that AI-driven speech tools improve oral proficiency and sociolinguistic awareness (Yuan & Liu, 2025). Similarly, El Zahraa noted that AI applications enable learners to practice register and dialect differences in controlled, yet authentic contexts, supporting the development of pragmatic competence. Takahashi's case study further corroborates that conversational AI promotes sustained interaction and authentic communication opportunities, which are essential for sociolinguistic skill development (Zare, Al-Issa, & Madiseh, 2025).

The exercises implemented in this study—ranging from email politeness tasks to intercultural scenario simulations—demonstrated that AI can facilitate experiential learning, allowing students to apply sociolinguistic rules in realistic professional situations. For example, role-play exercises in technical meetings required learners to employ hedging, polite disagreement, and negotiation strategies; AI tools provided instant evaluation and corrective suggestions. These findings support Canale and Swain's (1980) framework of communicative competence, which emphasizes the integration of grammatical, sociolinguistic, discourse, and strategic components in language learning. By aligning AI-mediated tasks with this theoretical model, the exercises bridge the gap between linguistic knowledge and its pragmatic application (S. Zulaiha, 2024).

While the sample size was limited, the pilot results suggest that AI-supported ESP instruction can enhance learner autonomy, motivation, and engagement. Yuan and Liu and Derakhshan similarly found that AI environments foster positive motivational climates, increasing learners' willingness to take communicative risks. Moreover, the use of AI aligns with modern pedagogical trends emphasizing learner-centered, adaptive, and technologically enhanced education. However, the scalability of these findings requires careful consideration: future research should explore longitudinal implementations across diverse technical disciplines and larger student cohorts to verify the effectiveness of AI-assisted sociolinguistic exercises.

Another critical observation relates to teacher involvement and guidance. While AI provides immediate feedback, effective integration necessitates pedagogical oversight to ensure ethical use, contextual relevance, and alignment with learning objectives. Maahs et al. emphasized that teacher perspectives are crucial in digital integration, as they mediate the balance between automated feedback and human-guided instruction. Similarly, Koç & Savaş highlighted that combining AI tools with structured ESP pedagogy optimizes learning outcomes and mitigates potential overreliance on technology.

In conclusion, the discussion underscores that AI-assisted ESP exercises hold considerable promise for developing sociolinguistic competence among technical students. They facilitate real-time feedback, authentic communicative practice, and learner autonomy while aligning with established theories of communicative competence and ESP methodology. Nevertheless, further empirical research is necessary to refine these practices, assess long-term outcomes, and establish scalable models applicable across different technical higher education contexts. Integrating AI thoughtfully within ESP curricula can transform language instruction from purely vocabulary-centered teaching to a more holistic, sociolinguistically aware, and technologically empowered learning experience.

5. Conclusion

5.1 Conclusion

This article proposed a methodological model for integrating AI into ESP instruction to enhance sociolinguistic competence among technical students. Grounded in classic ESP theory and communicative competence models, and supported by recent empirical studies, the framework emphasizes the dual importance of linguistic accuracy and pragmatic appropriateness. AI tools such as chatbots, writing assistants, and speech recognition systems provide authentic practice, immediate feedback, and motivational support. The proposed model contributes to modernizing ESP courses in technical higher education and highlights pathways for future large-scale empirical validation. This article proposed a methodological model for integrating AI into ESP instruction to strengthen sociolinguistic competence among technical students. Building on ESP theory and communicative competence frameworks, the model highlights the equal importance of linguistic accuracy and pragmatic appropriateness. AI tools—such as chatbots, writing assistants, and speech recognition—offer authentic practice, adaptive feedback, and motivational support, making them valuable for modernizing ESP curricula.

The study emphasizes that sociolinguistic competence is essential for technical graduates to succeed in global professional environments. It also underlines the need to move beyond traditional text-based instruction by adopting AI-driven approaches that align with digital transformation in higher education. While conceptual, the framework calls for empirical validation and careful attention to issues of accessibility, teacher readiness, and ethics. Overall, AI-assisted ESP provides a promising pathway to equip learners with context-sensitive communication skills for a globalized workforce.

5.2 Suggestions

1. For Educators:
   ESP instructors should integrate AI tools—such as chatbots, writing assistants, and speech recognition—into their teaching to provide learners with authentic and context-sensitive practice. Teachers also need training in digital pedagogy to maximize the potential of AI without reducing classroom interaction.
2. For Institutions:
   Technical universities should revise ESP curricula to balance linguistic accuracy and sociolinguistic competence. Investment in digital infrastructure and professional development programs is necessary to ensure effective and equitable implementation of AI-assisted learning.
3. For Researchers:
   Future studies should empirically test the proposed model across diverse technical disciplines using mixed-method approaches. This will validate its effectiveness, identify learner perceptions, and refine strategies for large-scale adoption.
4. For Policy Makers and Developers:

Education policymakers and AI developers should collaborate to design ethical, accessible, and pedagogically meaningful AI applications that support sociolinguistic competence while safeguarding data privacy and inclusivity.

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