

Received 25/12/2024

Accepted: 14/05/2025

Published: 20/08/2025

Reimagining ESP Pedagogy with Artificial Intelligence: Addressing Challenges in Domain-Specific Knowledge

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Abstract

This research explores the intricate challenges faced by non-native English-speaking ESP instructors, particularly in acquiring and applying field-specific knowledge essential to effective teaching. Focusing on the potential of artificial intelligence—specifically ChatGPT—as a supportive tool, the study examines how educators navigate these knowledge demands and how AI might be integrated into their ongoing professional development. Drawing on insights from both language-focused and subject-oriented ESP practitioners, the study investigates practical strategies used to compensate for limitations in disciplinary understanding. Employing a mixed-methods design that includes surveys and interviews, the findings reveal persistent barriers for language teachers in accessing and engaging with specialized content. While many participants express reservations about the reliability and regular use of AI tools like ChatGPT, a generally hopeful perspective emerges regarding their role in supplementing professional learning. The research highlights the need for a thoughtful and balanced incorporation of AI, advocating for a model that values both technological support and the irreplaceable insight of human educators in enhancing the quality of ESP instruction.

Keywords: English for Specific Purposes (ESP); Artificial Intelligence in Education; ChatGPT; Domain-Specific Knowledge; Teacher Professional Development; Language Teacher Challenges.

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Introduction

The growing emphasis on English for Specific Purposes (ESP) within Teaching English as a Foreign Language (TEFL) frameworks reflects an urgent global demand for a shared linguistic medium across domains such as science, technology, and academia. Over time, ESP has evolved into a specialized and dynamic branch of English Language Teaching (ELT), increasingly appealing to learners in non-English-speaking countries who seek language training tailored to their academic or professional needs (Assassi 2021; Basturkmen, 2025). Current ESP scholarship spans a wide range of areas, including corpus-based analyses, instructional strategies, material design, learner needs assessments, and work in underexplored educational contexts.

Yet, the ESP classroom remains a complex space marked by significant pedagogical challenges. Hutchinson and Waters (1987) famously portrayed it as a “strange and uncharted land,” highlighting how daunting it can be for language instructors unfamiliar with the specialized content of their learners’ fields. Belcher (2006) echoes this concern, pointing out that most language teachers are trained in general English methodologies and may struggle to address domain-specific topics effectively. This knowledge gap often becomes most visible when teachers are tasked with explaining technical or conceptual material to students who may already possess deeper content knowledge (Rachayon, 2020).

A long-standing debate persists regarding who is better suited to teach ESP: language specialists or subject experts. Proponents of subject-matter instruction argue that those trained in specific disciplines can more authentically model professional discourse, grasp cultural subtleties, and communicate technical concepts with greater clarity, thereby enhancing their credibility in the eyes of students (Adinugraha et al., 2025; Al-Ghamdi, 2022; Bracaj, 2014; Manakhova & Yurieva, 2023). However, this view must be balanced with the foundational aim of ESP—language instruction. As Ibrahim (2019) notes, the essence of ESP lies in equipping learners with communicative skills through linguistically informed teaching, collaborative engagement, and contextualized pedagogy.

To navigate this complex terrain, ESP practitioners, particularly those with a background in language rather than content, must possess a robust set of competencies. These include expertise in English language systems, the ability to conduct needs analyses, proficiency in course and material design, and skills in assessment and evaluation (Dou et al., 2023; Rouaghe and Assassi, 2025). Moreover, as Jeyaraj (2014) stresses, ESP educators must remain committed to ongoing professional development through research-informed practice, specialized training, and active participation in academic communities.

Although ESP teachers are not expected to become experts in their learners' disciplines, having some familiarity with subject content can improve their instructional flexibility and classroom presence. This added awareness often contributes to better student motivation and improved communicative performance (Fălăuș, 2017). In practice, language-focused ESP instructors employ various coping strategies to bridge these content gaps, such as concentrating on language structures, acknowledging their limitations openly, avoiding highly technical inquiries, or embracing risk-taking approaches when confronted with unfamiliar material (Rachayon, 2020). While these approaches may offer short-term solutions, they are not sufficient for ensuring a deeply effective or sustainable educational experience.

Given the overwhelming presence of language specialists in ESP settings and the limited access many have to regular collaboration with subject-matter experts, there remains a significant gap in our understanding of how to support these teachers effectively (Assassi & Benyelles, 2016). Although digital resources have expanded access to authentic materials, tailoring such resources to meet the nuanced demands of specialized fields remains a persistent challenge (Otilia, 2015).

In this context, artificial intelligence (AI) presents promising opportunities to transform educational practices. Among these innovations, ChatGPT, a conversational AI developed by OpenAI, has emerged as a tool capable of generating human-like responses, summarizing content, translating text, and supporting interactive learning tasks. Its potential value lies not only in enhancing student engagement but also in equipping teachers with real-time support for lesson planning, content clarification, and professional growth (Assassi & Rouaghe, 2024).

This study explores how ChatGPT can serve as a practical aid for ESP instructors, particularly those with a language teaching background, who face challenges in mastering domain-specific knowledge. By capturing the experiences and insights of current ESP practitioners, the research investigates how AI might be meaningfully integrated into professional development, with the broader goal of fostering a more balanced and effective combination of human expertise and intelligent technology in ESP education.

1. Literature Review

1.1. Development of English for Specific Purposes

Since the 1960s, the rapid globalization of science, technology, and international business has significantly increased the need for a shared language of communication, positioning English as the global lingua franca. This growing need has been a key driver behind the rise of English for Specific Purposes within Teaching English as a Foreign Language programs. Over

the decades, ESP has gained recognition as a vital and specialized branch of English Language Teaching, continuously evolving to meet the demands of diverse academic and professional fields (Alhasani, 2021; Assassi & Ghodbane, 2023; Basturkmen, 2022; Dudley-Evans & St. John, 1998).

The theoretical understanding of ESP has been the subject of ongoing scholarly discussion, particularly regarding whether it should be viewed primarily as a set of teaching practices (a process) or as a concrete curricular outcome (a product). These debates have contributed to the dynamic nature of ESP, encouraging nuanced and flexible definitions that reflect the shifting needs of learners and industries alike.

Richards and Schmidt (2010) conceptualize Languages for Specific Purposes (LSPs) as forms of language education tailored to highly specific communicative contexts, such as scientific research writing, legal discourse, or aviation communication, each marked by distinct lexical choices, syntactic structures, and pragmatic conventions. In this view, both the content and learning objectives of an ESP course must be closely aligned with the professional or academic realities of the learner population.

Building on this, Hijuelos-Cruz (2020) frames ESP not simply as a curriculum type but as a pedagogical orientation, one that begins with the learner's motivation and professional goals, and from there determines both the teaching content and instructional approach. In recent years, this focus has shifted further from merely meeting linguistic needs to cultivating broader communicative competencies that reflect real-world applications of English in specialized settings.

1.2. Pedagogy in ESP

Teaching English for Specific Purposes entails a sophisticated blend of factors that can pose considerable difficulties for both instructors and learners. Mohammed (2021) highlights a range of obstacles in ESP education, such as limited learner engagement, inadequate teacher preparation, challenges in methodology, material design complexities, and issues in assessment. As the professional demands on learners grow, ESP teachers are increasingly expected to deliver English instruction tailored to specific career paths, striking a balance between linguistic proficiency and the practical communication needs of professional domains (Basturkmen, 2017, 2022; Belcher, 2013; Papadima-Sophocleous et al., 2019).

Hyland and Jiang (2021) note that earlier models of ESP instruction were largely grammar-based, with a strong emphasis on technical vocabulary and rhetorical structures used in specialized writing. Today, however, the emphasis has shifted toward equipping learners with practical and context-sensitive language skills, carefully aligned with their identified communicative needs. As Anthony (2018), Belcher (2009), and Johns (2013) explain, contemporary ESP teaching must link theoretical perspectives with applied strategies both within and beyond the classroom. Consequently, ESP educators now face the mounting expectation to integrate linguistic instruction with pedagogical techniques and at least some level of subject-specific awareness. In light of these demands, strengthening digital literacy has become essential for ESP teachers, enabling them to harness modern technological tools and enhance their instructional efficiency.

1.3. The Role of Educational Technology in ESP

The role of educational technology in ESP instruction has expanded significantly in recent years, with English language educators increasingly embracing digital tools to enhance teaching and learning outcomes (Arnó-Macià, 2012; Chiu et al., 2023; Zawacki-Richter et al., 2019). Tools such as Computer-Assisted Language Learning (CALL) have transformed the structure and delivery of ESP courses, offering more innovative approaches to both content creation and classroom engagement (Butler-Pascoe, 2009; Tafazoli, 2025; Tafazoli et al., 2025).

Drawing from Dashtestani and Stojkovic (2016), the following are key benefits of using technology in ESP instruction:

- ✓ Promotes interactive, task-based learning tailored to specific subject areas
- ✓ Integrates socio-cultural perspectives into the language learning process
- ✓ Delivers targeted linguistic input aligned with learners' professional communication needs
- ✓ Facilitates access to international academic networks and authentic materials
- ✓ Encourages collaborative learning, critical thinking, and needs-specific classroom environments
- ✓ Supports various learning styles and individual preferences
- ✓ Enables effective feedback and assessment related to both content and language skills

One of the most significant recent advancements in educational technology is Artificial Intelligence, defined by Baker and Smith (2019, p. 10) as “computers performing cognitive tasks traditionally associated with human learning and problem-solving.” AI encompasses a broad range of developments, including machine learning, big data, and natural language processing—all of which are reshaping how language is taught and learned in higher education (Chiu et al., 2023; Crompton & Burke, 2023).

A growing body of research has explored AI’s application in various educational domains, such as engineering and medical education (Grunhut et al., 2022; Ouyang et al., 2023), adaptive and personalized language learning (El-Sabagh, 2021), and even automated content generation (Somosi, 2024). Among these innovations, chatbots have shown particular promise in fostering learner engagement through conversational and empathetic interaction (Zhai & Wibowo, 2022). Within this context, ChatGPT has emerged as a leading AI-powered language model, offering functionalities such as summarization, translation, and dialogue creation, which can serve the needs of both educators and learners (Assassi, 2025).

Although ChatGPT is gaining popularity across educational settings, its specific applications in ESP instruction remain relatively underexplored. Early studies point to its effectiveness in personalizing content, facilitating interaction, and providing formative feedback, especially in engineering-related language education (Kovačević, 2023; Shahidi et al., 2023). Furthermore, Assassi (2025) has demonstrated ChatGPT’s potential in conducting ESP needs analyses more efficiently than traditional methods. Nonetheless, a significant gap remains in the literature regarding its role in supporting teacher development and addressing domain-specific knowledge challenges in ESP.

1.4. Subject Specialist or Language Teacher

ESP courses are characterized by their learner-centered, competency-based design, shaped primarily by the communicative needs of specific disciplines. However, one key area that has received comparatively less scholarly focus is the role of the teacher in ESP education. The ongoing debate surrounding whether ESP should be taught by language educators or subject matter experts remains unresolved.

On one side of the debate, proponents argue that ESP teachers require subject knowledge to establish credibility, build rapport with students, and create authentic learning materials

(Rachayon, 2020). Subject specialists often possess deeper insights into domain-specific discourse patterns, communication practices, and cultural nuances—features that are especially critical in fields like business, engineering, and healthcare (Al-Ghamdi, 2022). Subject expertise, in this view, contributes not only to more accurate instruction but also boosts learner motivation and engagement (Manakhova & Yurieva, 2023). It also helps align the instructional process with real-world professional expectations (Anthony, 2018; Bayram & Canaran, 2020).

On the other hand, critics emphasize that the central aim of ESP is to develop learners' English language proficiency rather than to deliver technical content. Wu and Badger (2009) argue that experienced language instructors are well equipped to simplify and adapt subject-specific concepts for the purpose of language learning. Hutchinson and Waters (1987) and Dudley-Evans and St. John (1998) similarly maintain that ESP teachers are not required to teach technical content per se, though they may inevitably work within disciplinary contexts.

What ultimately defines effective ESP instruction is not content mastery but the teacher's ability to carry out accurate needs analyses, design coherent and relevant syllabi, select appropriate materials, and assess learner outcomes (Dou et al., 2023). In this regard, collaboration with subject specialists can offer valuable support, enabling language teachers to retain their focus on pedagogy while ensuring accuracy and relevance (Papadima-Sophocleous et al., 2019; Chaovanapricha & Chaturongakul, 2020).

In today's increasingly digital teaching landscape, tools such as ChatGPT offer promising avenues for ESP instructors to enhance their understanding of subject-specific language without requiring deep disciplinary expertise. While ESP teachers are not expected to become domain experts, having basic familiarity with field-specific discourse can improve their instructional confidence and classroom effectiveness (Fitria, 2023). This study seeks to explore how ChatGPT can support language-focused ESP instructors, particularly in regions where subject specialists are not always readily accessible, by offering timely and accessible input that contributes to better-informed language instruction.

2. Research Method

This study employed a mixed-methods approach to investigate how ESP instructors, particularly those from language teaching backgrounds, utilize generative AI tools like

ChatGPT to address content-area knowledge gaps in ESP instruction. Over a six-week period between February and mid-April 2024, data were collected from 24 ESP practitioners representing diverse institutional, disciplinary, and geographic backgrounds through purposeful sampling. Participants included both language specialists (83%) and subject specialists (17%) from various countries including Algeria, Turkey, China, Italy, and Brazil, with teaching experience ranging from 5 to 25 years across domains such as business, medicine, engineering, and law. The study addressed two primary research questions: (1) what strategies ESP language teachers adopt to manage limited subject knowledge, and (2) how they perceive ChatGPT's usefulness and limitations in supporting subject knowledge development.

Data collection involved a structured online survey consisting of 18 items across three sections (demographics/professional background, subject knowledge challenges, and AI tool perceptions) using Likert-scale, multiple-choice, and short-answer questions, which was piloted with three external reviewers to ensure content validity. This quantitative approach was complemented by semi-structured interviews conducted with seven volunteer participants, exploring individual experiences with AI tools and classroom integration. All interviews were recorded with consent and transcribed for analysis. The data analysis process employed inductive coding and theme clustering techniques to identify patterns in teacher strategies, tool perceptions, and expressed needs, with triangulation across instruments to validate findings and ensure interpretive depth. The research questions guiding this investigation were: RQ1: How Do Language Specialist ESP Teachers Deal with a Lack of Subject Knowledge? and RQ2: How Do Language and Subject Specialist ESP Teachers Perceive the Use of ChatGPT in Bridging Subject Knowledge Gaps?

3. Results

3.1. Practitioners' Voices: Questionnaire Analysis

- Recurring Challenges in Subject Knowledge

This investigation examines how seasoned ESP practitioners navigate the persistent challenge of insufficient subject knowledge when teaching ESP courses. Through our questionnaire, we captured these practitioners' strategic approaches, difficulties encountered, and viewpoints regarding ChatGPT's potential to address this knowledge deficit. To ensure robust data

validity and saturation, we collected responses from both language and subject specialists. The following presents a comprehensive analysis of data collected from 30 participants in the field.

- *Participants' Demographics*

Our participant cohort represented a rich diversity in institutional affiliations, ESP specializations, and professional responsibilities. They were affiliated with universities and educational institutions across seven countries: Algeria, Bulgaria, China, Serbia, Qatar, the United Kingdom, and the United States. Their professional responsibilities encompassed ESP course design, materials development, teacher education, and direct ESP instruction. When identifying their primary professional engagements, 46.7% highlighted ESP teaching, while a substantial 73.3% indicated involvement in ESP-related research endeavors.

Professional experience among participants varied considerably, spanning from two to thirty years, with approximately half reporting 10-15 years in the field. Regarding areas of professional interest, ESP teaching emerged as predominant (80%), followed by research activities (66.7%). Participants specialized in diverse disciplinary domains, including medicine, law, political science, engineering, aviation, business, nursing, and economics. Notably, language specialists constituted the overwhelming majority (93.3%) of our sample, with only two participants identifying as subject specialists.

- *Lack of Subject Knowledge and Domain Expertise*

Participants offered reflections on their experiences and strategic approaches to managing subject knowledge deficiencies. While 20 respondents expressed confidence in their ability to teach ESP despite limited subject expertise, 60% acknowledged experiencing challenges, particularly when confronting specialized terminology and discipline-specific topics. In response to these knowledge gaps, 90% of respondents actively sought supplementary resources and assistance in material selection. Additionally, 87% recognized the critical importance of collaboration with subject specialists. Half of the participants explicitly viewed subject knowledge limitations as a constraint on effective ESP instruction, while 20% remained undecided on this matter.

To mitigate these challenges, practitioners employed various strategies to enhance instructional quality. Textbooks and academic journals represented the most frequently utilized resources (73.3%), followed by collaboration with subject specialists (60%). Many

engaged in independent research (56.7%) to supplement their knowledge base. Integrating authentic examples and case studies from professional contexts (53.3%) proved a practical approach to contextualizing content. Professional development seminars (36.7%) and consultation with colleagues (26.7%) were utilized less frequently but remained significant strategies. Interestingly, corpus-based approaches, learner feedback mechanisms, and reliance on background knowledge emerged as less favored strategies among our participants.

- *AI Tools and Subject Knowledge in ESP*

Our questionnaire also explored practitioners' perceptions regarding ChatGPT's potential role in enhancing subject knowledge acquisition. Respondents evaluated its efficacy, challenges, and advantages, revealing a complex and nuanced perspective.

- *Perceptions of Using ChatGPT*

Participants demonstrated divided opinions regarding ChatGPT's effectiveness. Approximately one-third maintained an undecided position, while the majority acknowledged that ChatGPT could potentially assist in subject knowledge acquisition, enhance teaching confidence, improve instructional material quality, and facilitate collaborative validation between language and subject specialists.

Nevertheless, substantial concerns regarding data reliability persisted among respondents. From our sample of 30 participants, half expressed uncertainty about ChatGPT's reliability, while ten explicitly questioned the tool's trustworthiness. Only five participants expressed complete confidence in AI-generated information. Additional qualitative insights revealed pronounced skepticism among some respondents, with two categorically rejecting ChatGPT as a reliable information source. Others emphasized its limitations in generating accurate, domain-specific information and emphasized the necessity for validation by subject matter experts. Despite these reservations, 70% of participants believed ChatGPT could potentially help language specialists enhance their subject knowledge, though they advocated for its judicious implementation.

- *Challenges and Recommendations*

Respondents identified several significant challenges associated with ChatGPT adoption. Information bias emerged as the foremost concern (63.3%), followed by questions regarding technical information accuracy (53.3%), particularly in complex disciplinary domains. Additional challenges included the time and effort required for effective utilization (36.7%),

language proficiency demands for precise prompt formulation (26.7%), and integration difficulties with existing instructional materials (26.7%).

Regarding recommendations for enhancing subject knowledge, collaboration with subject specialists received the strongest endorsement (76.7%), followed by participation in professional development initiatives (66.7%). Interestingly, nearly half the respondents (46.7%) maintained that ESP instructors should prioritize language teaching expertise over subject knowledge. Only 43.3% recommended consistent utilization of AI tools like ChatGPT.

Additional commentary from participants ranged from cautious optimism to explicit skepticism. While some appreciated ChatGPT's potential for enriching teaching resources, others emphasized the importance of combining AI-generated content with traditional methodologies and expert validation.

3.2 Experts' Narratives: Interview Analysis

To complement our questionnaire findings, we conducted interviews with nine ESP practitioners to further explore subject knowledge challenges and ChatGPT's potential role in addressing them. Thematic analysis revealed valuable insights into language specialists' knowledge gaps, coping strategies, and perceptions regarding AI tools' benefits and limitations.

- Subject Knowledge Gap Challenges

All interview respondents acknowledged the detrimental impact of subject knowledge deficiencies on teaching effectiveness. Six participants highlighted its psychological impact, including diminished confidence, anxiety, and professional embarrassment among language specialists. Several noted its effect on learner motivation, with students expecting comprehensive subject knowledge from instructors simply because they "know English." These knowledge gaps also disrupted course design processes, material selection decisions, and pedagogical approaches, potentially leading to conceptual misunderstandings and reduced learner engagement.

- Strategies for Addressing Knowledge Gaps

Language specialists reported relying predominantly on independent research, online resources, and collaborative engagement with learners to compensate for knowledge

deficiencies. One practitioner described engaging advanced students in co-creating content for medical and aviation English courses. While subject specialists recommended consultation and further disciplinary study, they acknowledged the limited availability of domain experts, necessitating alternative approaches for language teachers.

- *Use of AI Tools*

Perspectives on utilizing AI tools for subject knowledge acquisition were cautiously positive. Respondents valued ChatGPT's capacity to provide expedient insights and enhance task design. However, subject specialists emphasized the necessity for expert validation, particularly for complex case studies and current information. There was consensus that AI should function as a supplementary resource rather than a standalone solution.

- *Advantages and Challenges of AI Tools*

Respondents identified time efficiency and enhanced professional development opportunities as primary advantages of AI tools. However, they also highlighted concerns regarding data accuracy, ethical implications, and potential technological overreliance. While ChatGPT received praise for its capacity to support interactive learning experiences, all respondents agreed that it could not substitute for human expertise.

In conclusion, our findings highlight the persistent challenges of subject knowledge gaps in ESP instruction and ChatGPT's potential as a supplementary pedagogical tool. While most practitioners viewed AI applications positively, they emphasized the importance of combining their use with expert validation and traditional instructional methodologies. Moving forward, the judicious integration of AI technologies, supported by collaborative practices and professional development initiatives, may help bridge the divide between language and subject knowledge, ultimately enhancing ESP instructional effectiveness.

4. Discussion

The centrality of subject knowledge in ESP pedagogy continues to stimulate scholarly debate. Recent literature presents divergent perspectives: Rachayon (2020) and Al-Ghamdi (2022) contend that subject specialists possess inherent advantages in ESP instruction due to their domain-specific expertise. Conversely, Omenda (2024) maintains that ESP's primary objective remains the development of linguistic competence rather than subject matter

mastery. Our study positions itself within this ongoing discourse by examining the experiences of non-native language ESP teachers, who represent the predominant demographic among global ESP practitioners (Forteza Fernandez & Batista Gonzalez, 2019).

- *Q1: How Do Language Specialist ESP Teachers Deal with a Lack of Subject Knowledge?*

Our investigation into how language ESP teachers address subject knowledge limitations revealed widespread recognition of this challenge and its detrimental impact on instructional effectiveness. Participants frequently cited issues including misinterpretation of specialized content, diminished classroom interactivity, and consequent learner disengagement.

To address these challenges, our findings indicate that language ESP teachers employ multiple compensatory strategies. These include conducting independent research, consulting disciplinary literature, and utilizing online resources to develop pedagogically sound tasks aligned with curricular objectives and learner requirements. When confronted with domain-specific challenges, these educators tend to emphasize linguistic dimensions and occasionally leverage more knowledgeable students' expertise. These approaches, however, demonstrate inherent limitations due to their dependence on external resources and student input, highlighting the necessity for more comprehensive and sustainable professional development initiatives (Turlybekov et al., 2024).

- *Q2: How Do Language and Subject Specialist ESP Teachers Perceive the Use of ChatGPT in Bridging Subject Knowledge Gaps?*

Over the past five years, AI tools, such as ChatGPT, have attracted substantial attention within educational contexts, with researchers investigating their potential applications in language pedagogy (Kovačić & Bubaš, 2023). While these tools demonstrate promise for enhancing interactivity and facilitating knowledge acquisition in ESP instruction, their contribution to teacher professional development remains insufficiently explored.

Our examination of ESP teachers' perceptions regarding ChatGPT's potential to address subject knowledge gaps revealed guarded optimism. While participants acknowledged ChatGPT's capacity to provide expedient insights and resources, they expressed reservations regarding its accuracy and appropriateness for specialized domain knowledge. These findings align with contemporary research documenting cautious AI adoption in educational settings (Coancă, 2023; Shahidi et al., 2023).

Subject specialists particularly emphasized the importance of validating AI-generated content through consultation with domain experts, especially concerning complex or contextualized subject matter. Nevertheless, ChatGPT's advantages, including time efficiency and immediate information access when subject specialists are unavailable, position it as a valuable supplementary resource. These findings highlight the necessity for additional research and broader discourse regarding AI integration into teacher professional development while ensuring ethical and effective implementation.

Conclusion

The accelerating evolution of Artificial Intelligence has generated extensive discourse and interest, particularly within educational contexts. AI technologies like ChatGPT offer considerable potential for enhancing language instruction through innovative approaches to learning and professional development. However, realizing this potential necessitates collaborative effort, careful deliberation, and expertise from educational stakeholders, including teachers, learners, and policy developers.

This investigation aimed to examine a critical challenge in ESP education: subject knowledge deficiencies among language ESP teachers. It explored both the strategic approaches these educators employ to address this challenge and their perceptions regarding AI tools like ChatGPT as potential solutions. Our findings highlighted significant difficulties experienced by language specialists when engaging with domain-specific content, including content misinterpretation and learner engagement challenges. These difficulties underscore the urgent need for sustainable and effective professional development methodologies.

Additionally, our study revealed cautiously optimistic attitudes toward AI tools among ESP practitioners. While participants expressed concerns regarding data accuracy and ethical considerations, they recognized ChatGPT's potential for enhancing instructional efficiency and supporting subject knowledge acquisition. Future research should prioritize the development of comprehensive teacher education programs that thoughtfully integrate AI technologies into ESP instruction, addressing crucial issues of bias, reliability, and ethical implementation.

The insights generated by this study offer valuable guidance for educators and policymakers navigating the evolving landscape of ESP education. By thoughtfully embracing AI's transformative potential, stakeholders can promote enhanced language learning outcomes and better equip ESP teachers to meet their learners' evolving needs.

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