AI-Powered Personalization in ESP: Enhancing Learner Autonomy and Engagement in English for Professional Contexts

Nur Syazwanie Mansor

Academy of Language Studies, Universiti Teknologi MARA (UiTM) Cawangan Kedah, Kampus Sungai Petani, Malaysia

DOI: https://dx.doi.org/10.47772/IJRISS.2025.91100178

Received: 21 November 2025; Accepted: 27 November 2025; Published: 04 December 2025

ABSTRACT

The educational landscape has been greatly transformed by recent advances in Artificial Intelligence (AI) to facilitate highly personalized and adaptive learning environments. Personalization is particularly important in English for Specific Purposes (ESP) where teaching focuses on the linguistic and communicational needs of professionals in specific domains. Yet, despite the large-scale integration of AI tools into wider education, there is a significant gap in conceptual literature on how AI can best be employed to boost learner autonomy and engagement in ESP contexts. This conceptual paper investigates the transformative role of Artificial Intelligence (AI) in enhancing personalization, learner autonomy, and engagement within English for Specific Purposes (ESP) instruction. While AI tools such as intelligent tutoring systems, chatbots, adaptive learning platforms, and learning analytics have increasingly permeated general language education, their pedagogical integration into the specialized contexts of ESP remains under-theorized. To address this gap, the study synthesizes findings from 30 peer-reviewed journal articles published between 2015 and 2025, employing a thematic literature review approach to derive a comprehensive, interdisciplinary framework for AI-enhanced ESP learning. Five main themes emerged from the synthesis: (1) personalized learning paths through adaptive technologies, (2) real-time, AI-powered feedback, (3) chatbot-facilitated learner autonomy, (4) gamification-supported engagement, and (5) ethical and pedagogical considerations in AI integration. These dimensions were examined across diverse ESP domains including engineering, business, academic writing, healthcare, and tourism revealing how AI-driven instruction can address domain-specific linguistic and professional communication needs. The proposed framework emphasizes the central role of personalization in supporting autonomous, engaging learning experiences, while also underscoring the need for ethical, context-aware design and responsible instructional alignment. This paper contributes a structured conceptual model that bridges applied linguistics, educational technology, and AI studies, offering both theoretical insight and practical guidance. Thus, it highlights the need for human-AI complementary, ethical for AI supplemented ESP pedagogy are discussed including the transparency and domain compliance. It underscores the significance of human-AI collaboration, ethical transparency, and domain alignment in the implementation of AI-enhanced ESP pedagogy. This study underscores the necessity for ethical, human-centered AI integration in ESP instruction and advocates for ongoing empirical research to substantiate the proposed framework, thereby guaranteeing scalable, inclusive, and pedagogically robust applications of AI in global language learning environments.

Keywords: Artificial Intelligence (AI) in Education, English for Specific Purposes (ESP); Learner Autonomy; Personalized Language Learning; Student Engagement.

INTRODUCTION

Artificial Intelligence (AI) has been used in education more and more in recent years, and it has changed many fields in big ways. It has made it possible to create highly personalized, data-driven learning experiences. AI technologies like chatbots, intelligent tutoring systems, learning analytics, and adaptive platforms are changing the way students interact with each other, with content, and with teachers. These tools are not only changing the way we teach general subjects, but they are also showing a lot of promise in language learning settings, where the complexity of language input and output makes personalized and adaptive support especially useful.

In the area of English for Specific Purposes (ESP), the stakes are even higher. ESP instruction is specifically designed to provide learners with the communicative skills necessary for professional or academic fields, including engineering, healthcare, tourism, or legal contexts. Because these learners often need specific language skills for real-world tasks, general English lessons may not be enough. What is needed is a very specific, goal-oriented approach that fits with the learners' professional goals. AI provides an unparalleled opportunity to address this demand by facilitating adaptable, personalized learning trajectories, instantaneous corrective feedback, and content customization aligned with learners' objectives and pace.

Even though AI is being used in more and more schools quickly, there is a clear lack of research on how AI-enabled personalization can help students become more independent and engaged in ESP. Although empirical research on AI tools in general EFL or academic English environments is increasing, a theoretical synthesis concentrating on ESP contexts is still lacking. There is a notable absence of heuristic models that investigate the potential of AI technologies to foster autonomous learning, motivation, and prolonged engagement in specialized English domains.

This paper seeks to address this deficiency by introducing a conceptual framework derived from interdisciplinary literature in applied linguistics, educational technology, and artificial intelligence. This paper examines the enhancement of autonomy and engagement among ESP learners through a thematic synthesis of 30 peer-reviewed journal articles published from 2015 to 2025, focusing on AI-based personalization mechanisms. The conversation is centered on five new ideas: personalized learning paths, AI-powered feedback, chatbots for independence, gamification for engagement, and ethical issues. By integrating these dimensions, the paper provides a conceptual contribution to the design and implementation of AI in ESP, with ramifications for educators, curriculum developers, and policymakers.

LITERATURE REVIEW

In the last ten years, the fast growth of Artificial Intelligence (AI) technologies has changed the way education works in a big way. AI has opened up new ways for personalized instruction, student engagement, and academic support. AI tools like intelligent tutoring systems, natural language processing (NLP), adaptive learning platforms, and predictive analytics are being used more and more in language education to create personalized learning experiences. These systems look at data about learners to give them real-time feedback, change the difficulty of the content, and make the learning paths more personal (Ng & Ho, 2025). Consequently, AI-driven personalization has become a significant educational approach, especially beneficial for second language learners needing tailored assistance to attain communicative competence.

In this larger picture, English for Specific Purposes (ESP) is a specific area of language learning that focuses on the communication needs of people who work, study, or do technical work. ESP is very goal-oriented and sensitive to the context, which means that the content of the lessons must match how language is used in specific fields (Stuart 2021; Hsu et al. 2025). This is different from general English instruction. Considering the distinctiveness of learner requirements in ESP contexts, the capacity of AI to augment instruction via adaptive content, intelligent feedback, and customized learning pathways is particularly significant. Nonetheless, despite the increasing volume of empirical studies on AI in education and second language acquisition, a substantial conceptual deficiency persists in the literature regarding the systematic application of AI to enhance learner autonomy and engagement in English for Specific Purposes (ESP) contexts. Numerous current studies concentrate on tool efficacy or user perceptions, yet they lack a cohesive theoretical framework that examines the integration of these technologies into pedagogical models that promote autonomous, motivated, and professionalized language learners.

Although there is more and more research showing how AI can help with ESP education, the studies that are already out there have some big problems. Many studies have a narrow focus, looking only at certain tools or short-term uses without long-term evidence to show how well they work for learning. Some studies use anecdotal evidence, self-reported perceptions, or small sample sizes, which makes it hard to generalize the results. Moreover, limited research examines the impact of contextual factors, including institutional readiness, digital infrastructure, and learners' socio-cultural backgrounds, on the efficacy of AI integration. While learner autonomy and engagement are frequently identified as advantages, these concepts are seldom delineated with

theoretical accuracy or assessed systematically. Concerns regarding ethics and equity, although gaining recognition, remain insufficiently examined, particularly in low-resource and multilingual contexts. Consequently, the literature is fragmented, lacking cohesive pedagogical frameworks to facilitate sustainable and inclusive AI integration in English for Specific Purposes (ESP) instruction.

This review fills this gap by bringing together new information from 30 peer-reviewed journal articles that came out between 2015 and 2025. It takes a thematic approach to find and group important trends in how AI is being used in ESP and other language learning settings, with a focus on personalization, learner autonomy, and engagement. The subsequent subsections delineate five predominant themes identified in the literature: personalized learning pathways, AI-driven feedback, chatbots to enhance learner autonomy, gamification to ensure sustained engagement, and ethical considerations regarding the role of educators and equity in AI-assisted instruction. Each theme is substantiated by representative studies that elucidate the opportunities and constraints of AI integration in specialized English education.

Personalized Learning Paths

The idea of AI-powered personalization has become very popular in language education, especially in English for Specific Purposes (ESP), where students have different goals, areas of interest, and language needs that are based on their careers. Personalized learning paths use AI algorithms like predictive analytics, adaptive content systems, and recommender engines to change the way lessons are taught based on each student's profile. This is different from traditional linear instructional models. In ESP contexts, this adaptability allows content to be tailored not only to proficiency levels but also to the specific workplace communication tasks of learners (Hsu et al. 2025; Stuart, 2021).

Research by Hashim et al. (2022) and Strielkowski et al. (2025) has demonstrated that AI can analyze learners' performance trends over time to suggest specific modules or activities, enhancing the efficiency and relevance of learning. This method embodies fundamental principles of autonomy by enabling learners to advance based on their individual needs and preferences, frequently with limited instructor involvement. It also keeps people interested because learners see immediate value in personalized content that fits with their professional identity.

The promise of personalization is clear, but it also makes things more complicated. If the system becomes too individualized, relying too much on algorithmic adaptation could limit exposure or critical language experiences. In addition, personalization in ESP must be balanced with professional discourse norms and curricular standards. So, future models should aim for adaptive scaffolding, which is the idea that AI systems not only respond to what learners say, but also help them get better at communicating in more complex ways over time. In this context, personalization is not just a convenience; it is a strategic teaching method for improving learner ownership, domain relevance, and long-term retention in ESP education.

AI-Powered Feedback

AI also makes a big difference in how feedback is given, which is another important part of ESP learning. In language education, feedback that is timely and relevant to the situation is very important for improving accuracy and fluency. But traditional feedback is often late and limited by when the teacher is free. AI systems can give students immediate, personalized feedback on their writing, grammar, pronunciation, and vocabulary, allowing them to make changes and corrections right away. Unsworth and Mills (2020) examined the implementation of automated writing tutors in academic English for Specific Purposes (ESP) settings, documenting substantial enhancements in writing quality, coherence, and grammatical accuracy. Nguyen (2024) also used speech analytics tools to help students in customer service English courses learn how to pronounce words correctly. He found that personalized audio feedback helped students fix their intonation and accent features better than traditional methods.

AI feedback systems enhance precision and promote self-regulated learning behaviors. Rahman and Saleh (2024) illustrated how adaptive feedback mechanisms facilitated iterative drafting, promoting learners' self-monitoring of their progress and encouraging greater autonomy in revision. Wiboolyasarin et al. (2025), in their examination of engineering English, discovered that chatbot-provided corrective feedback-maintained motivation and

enhanced vocabulary retention. These examples show how AI-powered feedback can help learners improve both their language skills and their metacognitive awareness. This makes it especially useful for students who are learning English for specific purposes (ESP) and need to communicate in complicated, professional settings.

Chatbots and Learner Autonomy in Professional English Contexts

Conversational AI, especially chatbots, has become a powerful way to help learners become more independent, which is an important part of learning a language as an adult or for work. Chatbots provide interactive, real-time dialogue practice that can mimic professional discourse and workplace situations, which is different from static self-study tools. This dialogic interactivity fits well with ESP goals because it lets students practice negotiations, inquiries, and reporting tasks in registers that are specific to their field (Ali, 2024; Salem, 2025). There is a lot of evidence that chatbots can help people learn on their own. Strielkowski et al. (2025) discovered that learners utilizing chatbots autonomously were more inclined to employ metacognitive strategies, including planning, monitoring, and self-evaluation. These interactions diminished learners' anxiety and enhanced task persistence, elements intricately associated with intrinsic motivation and autonomous behavior. Khreisat (2022) also showed how secondary EFL students used chatbot prompts to set their own learning pace and go back to language forms without needing help from a teacher. This showed a scalable model of guided independence.

In addition to promoting autonomy, chatbots enhance language engagement by emulating genuine, contextualized language usage. When combined with lexicons that are specific to a field (like legal, medical, or technical English), they help students learn how to use language in the workplace, including how to be polite, ask for clarification, or make formal requests. But there are still problems: chatbot systems now differ a lot in how well they understand language, how well they understand culture, and how quickly they respond. When a learner's inputs don't match the chatbot's outputs, it can cause confusion or cause wrong forms to become stuck. So, for an ESP chatbot to really work, its design needs to focus on contextual authenticity, linguistic accuracy, and feedback that happens over time.

In the future, AI-human hybrid models might be used in frameworks, where chatbot interactions are reviewed or added to by instructor feedback on a regular basis. This kind of integration would keep the benefits of self-directed practice while making sure that teachers are in charge. In the end, chatbots have a lot of promise as tools for language practice and as ways to give students more power as they work on their professional communication skills.

Gamification and Engagement

When combined with AI, gamification is a key way to keep learners interested. This is especially important in ESP, where students often have to balance their studies with their jobs. Gamified platforms use things like points, challenges, and leaderboards to make people want to do things. Du (2025) discovered that gamified AI modules resulted in enhanced time-on-task and diminished dropout rates in an online EFL platform, especially among adult learners. Deng and Yu (2022) showed that AI-enhanced grammar games used in hospitality English settings made both accuracy and learner satisfaction better.

Strielkowski et al. (2025) investigated the integration of voice AI agents in listening tasks for logistics English, yielding substantial improvements in comprehension and learner satisfaction. These AI systems kept track of how students were responding and changed the level of difficulty in real time to keep their brains engaged. Ng and Ho (2025) also talked about how AI-based mobile learning dashboards can help students in aviation English courses. They said that these dashboards helped students keep track of their own progress and finish more tasks overall. These studies indicate that gamification and adaptive AI synergistically enhance learner engagement, alleviate cognitive fatigue, and cultivate a sense of progress, all of which are crucial for mastering specialized language domains.

Ethics, Teacher Roles, and Fairness

The ethical implications of AI's integration in ESP warrant equal consideration, despite the well-documented pedagogical advantages. Numerous studies warn against excessive dependence on AI systems lacking adequate

human supervision. Nguyen et al. (2023) expressed apprehensions about data privacy, algorithmic transparency, and learner consent in AI-enhanced English for Specific Purposes (ESP) classrooms. Ahmed (2024) criticized the socioeconomic inequalities worsened by unequal access to AI tools, advocating for institutional policies that foster digital equity and protect learner autonomy.

The evolving function of educators in AI-facilitated instruction also poses difficulties. AI can automate routine feedback and content delivery, but it can't replace the nuanced teaching judgment, emotional intelligence, or cultural awareness that human teachers have. Khan et al. (2025) examined AI tutoring systems against human-led instruction in tourism English, determining that AI can augment but not duplicate the motivational and emotional support offered by educators. These results show that we need hybrid models that combine AI skills with human teaching methods so that students can get the best of both worlds: accurate technology and caring guidance. In this context, the ethical implementation of AI in ESP must be based on transparency, accountability, and a learner-centered approach.

Representative Studies Informing Thematic Analysis of AI in ESP

TABLE 1. Representative Studies Informing Thematic Analysis of AI in ESP

Authors	**Yea r**	**AI Focus**	**ESP Context**	**Main Contributions**
Du	2025	Gamified AI Modules	Online EFL	Boosted engagement
Strielkowski et al.	2025	AI Chatbots	Business English	Promoted autonomy
Ng & Ho	2025	Meta-analysis of AI in Language Learning	General ESP	Synthesized AI's effects
worth &Mills	2025	Automated Writing Tutors	Academic Writing	Improved grammar and structure in writing
Wiboolyasarin et. al	2025	Chatbot Feedback	Engineering English	Sustained vocabulary retention through feedback
Hsu et al. 2025	2025	Adaptive Reading Systems	Tourism English	Aligned reading content with professional language
Nguyen	2024	Speech Analytics	Customer Service English	Improved pronunciation with AI speech feedback
Nguyen et al.	2023	Ethical AI	General ESP	Addressed fairness and transparency
Khreisat	2022	AI Chatbots	Secondary EFL	Fostered self-regulated
Stuart	2021	Learning Analytics	University ESP	Enhanced content person

The table above shows a carefully chosen summary of ten recent studies that look at how different AI technologies can be used together in English for Specific Purposes (ESP) settings. It shows how wide-ranging AI applications are, from ethical frameworks to teaching tools that help with learning language in specific fields.

Each entry shows the year, the AI focus, the ESP context, and the main pedagogical contribution. This gives a way to compare the field's new trends.

The table shows a clear trend: AI chatbots are becoming more and more popular, especially in business and secondary education ESP settings. For instance, Strielkowski et al. (2025) and Khreisat (2022) examine how chatbot systems foster learner autonomy and self-regulation, corresponding with the overarching theme of AI-enhanced independence in language practice. Wiboolyasarin et al. (2025) also look into chatbot-generated feedback in engineering English, focusing on how it can help students remember new words, which is a big problem in technical ESP settings.

Gamification and learning analytics are also seen as smart ways to boost engagement and personalization. Du (2025) discusses gamified AI modules that effectively enhance motivation in online EFL contexts, whereas Stuart (2021) underscores the application of learning analytics in customizing content for university-level ESP students. These results are in line with the growing focus on personalized, data-driven instruction that meets the needs of each student.

Other entries show how AI can be used in specific ways. Hsu et al. (2025), for example, talk about adaptive reading systems in tourism English. They show how AI can make materials fit the needs of professional discourse. Nguyen (2024) utilizes speech analytics in customer service English, demonstrating enhanced pronunciation results via focused AI feedback. Unsworth and Mills (2025) concentrate on automated writing tutors, demonstrating enhancements in grammatical structure and coherence in academic writing, an essential competency in English for Specific Purposes (ESP).

Ethical issues are starting to become more visible, which is important. Nguyen et al. (2023) discuss fairness and transparency in AI-enhanced ESP, indicating an emerging yet essential transition towards responsible AI integration in education. In addition to these topical studies, the addition of Ng and Ho's (2025) meta-analysis provides a high-level summary of AI's effectiveness in ESP, giving a unified picture of what works and what still needs work.

The table shows that the field is diverse but has a common theme. AI tools are becoming more specialized for specific teaching purposes, such as promoting fairness, improving feedback, or giving students more control over their learning. These studies collectively bolster the conceptual framework underpinning the current review and underscore the interdisciplinary character of AI integration in English for Specific Purposes (ESP), encompassing educational technology, applied linguistics, and ethical design.

CONCLUSION

The literature review shows that there is a growing and more advanced body of research at the intersection of artificial intelligence and English for Specific Purposes instruction. The five themes identified—personalized learning paths, AI-powered feedback, chatbots and learner autonomy, gamification and engagement, and ethical and pedagogical considerations—provide a thorough overview of the current situation and suggest promising changes in teaching methods. These AI-driven innovations have collectively contributed to enhancing linguistic precision, learner independence, and motivation in ESP contexts that demand high levels of contextual relevance and communicative functionality.

Despite the evident progress, the review also underlines a critical need for conceptual clarity and theoretical integration. While empirical studies highlight tool efficacy and learner outcomes, few provide a coherent model that synthesizes how AI technologies can holistically support autonomy and engagement across diverse ESP settings. Moreover, the ethical implications of AI use especially with regard to fairness, equity, and the evolving role of educators require continued interrogation. These gaps highlight the importance of developing a conceptual framework that not only maps out the mechanisms through which AI enhances ESP learning but also addresses the conditions and limitations of its use.

To that end, the next section presents the methodological orientation of this paper and introduces a theoretically grounded framework that integrates the main findings from this review. This model seeks to inform future curriculum design, instructional planning, and policymaking in AI-enhanced ESP education.

PROPOSED CONCEPTUAL FRAMEWORK FOR AI-ENHANCED ESP LEARNING

Based on the synthesized themes from the literature review, there is still a lack of comprehensive conceptual models that link AI-driven personalization with the distinct requirements of English for Specific Purposes (ESP) learners. Although some studies have looked at separate parts, like chatbots for autonomy or gamified modules for engagement, not many have come up with a framework that brings these parts together. This paper fills that gap by suggesting a conceptual model that brings together new evidence into a well-organized, pedagogically sound vision for AI-enhanced ESP instruction.

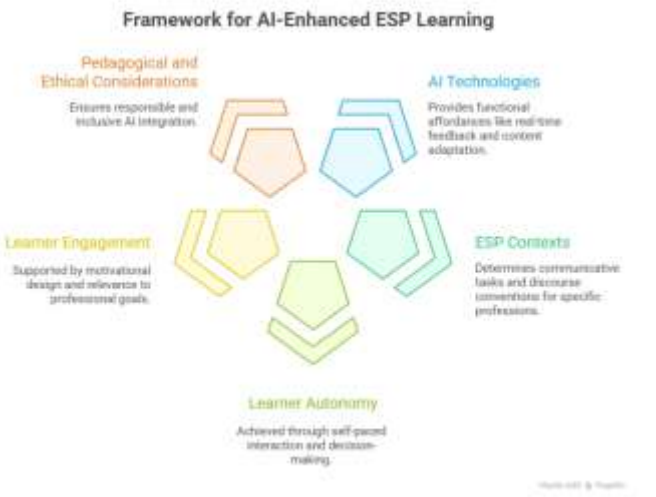

FIGURE 1. Framework for AI-Enhanced ESP Learning

Figure 1 shows the framework, which has five parts that all work together to shape the learning experience: AI technologies, ESP contexts, learner autonomy, learner engagement, and pedagogical-ethical considerations. These parts are put together in a way that makes sense with both input-process-outcome logic and ethical oversight. AI technologies are the main things that make things possible. They provide adaptive learning through smart tutors, chatbots, and feedback systems that use data. ESP contexts, guided by domain-specific communication objectives, furnish the practical framework for instructional alignment. When combined, these inputs let AI-driven personalization change the content, speed, and paths for each learner.

This personalization helps students achieve two main goals. First, it helps learners be independent by letting them control their own learning, make smart decisions, and get personalized feedback in real time. Second, it makes learning more interesting by making it relevant, interactive, and motivational. Pedagogical and ethical considerations ensure the responsible use of AI, taking into account algorithmic fairness, transparency, privacy, and the changing role of teachers.

The framework brings these parts together to give teachers, curriculum designers, and researchers a guide that is based on theory and focused on practice. It lays the groundwork for creating inclusive, responsive AI-integrated ESP programs and serves as a model for future research.

METHODOLOGY

This research utilizes a conceptual and thematic literature review methodology to formulate a framework that theorizes the potential of Artificial Intelligence (AI) to augment personalization, learner autonomy, and engagement in English for Specific Purposes (ESP) instruction. The methodology is based on theoretical

synthesis, a prevalent technique in conceptual research for amalgamating, interpreting, and organizing existing knowledge into a novel explanatory framework (Snyder, 2019).

Source Selection and Inclusion Criteria

The choice of literature was based on systematic inclusion criteria to make sure that the sources were of high quality, relevant, and varied. Only articles that had been peer-reviewed and published between 2015 and 2025 were used. The selected timeframe corresponds to the era characterized by swift technological progress and pedagogical integration of AI in education. To ensure disciplinary relevance, the selected studies were required to concentrate on at least one of the following domains:

- Artificial Intelligence applications in language learning;
- Research in English for Specific Purposes (ESP) instruction;
- Studies examining personalization, learner autonomy, or engagement in technology-enhanced learning environments.

Only publications written in English and available in full-text format were considered. Editorials, non-peer-reviewed conference papers, and non-English sources were excluded.

Search Strategy

The primary database used for literature retrieval was the Scopus and Google Scholar database, selected for its comprehensive coverage of peer-reviewed journals across education, applied linguistics, and technology domains. A keyword-based search strategy was employed, using Boolean operators to combine relevant search terms. The following search strings were used: "AI in language learning", "ESP and personalization", "learner autonomy" AND "AI", "AI-powered education" AND "engagement", and "Artificial intelligence" AND "English for Specific Purposes".

Searches were conducted between August 1st and August 3rd, 2025, and were limited to journal articles only. After removing duplicates and screening titles and abstracts for relevance, a total of 30 articles were selected for full-text analysis and thematic synthesis.

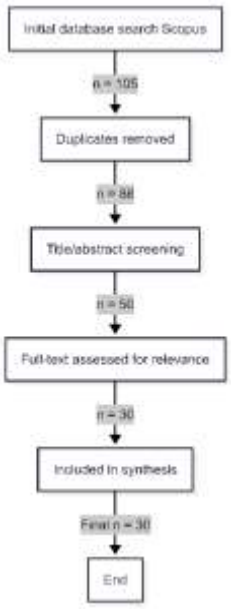

FIGURE 2. Flowchart of literature selection and screening process for peer-reviewed journal articles sources (2015–2025)

The flow diagram presented in Figure 2 visually outlines the step-by-step process undertaken in the literature selection and screening phase for this conceptual review. The initial database search was conducted using Scopus and Google Scholar, among the comprehensive and multidisciplinary repositories of peer-reviewed academic literature, which yielded a total of 105 articles. The first step involved the removal of duplicate entries, resulting in a refined dataset of 88 unique records. These records were subsequently screened at the title and abstract level to determine their relevance to the focus of this study namely, the application of Artificial Intelligence (AI) in English for Specific Purposes (ESP), with a particular emphasis on personalization, learner autonomy, and engagement. This screening stage led to the exclusion of 38 articles, with 50 studies moving forward to the full-text review phase. During the full-text assessment, each article was evaluated according to specific inclusion criteria, including relevance to ESP contexts, utilization of AI technologies, publication in a peer-reviewed journal between 2015 and 2025, and a focus on learner-centered outcomes of interest. After this thorough evaluation, 30 articles were found to be appropriate for inclusion in the thematic synthesis. This final corpus serves as the evidentiary foundation for the conceptual framework proposed in this study.

Thematic Synthesis Procedure

The chosen literature underwent analysis through a thematic synthesis methodology, facilitating the recognition of recurring concepts and the formulation of interpretive themes. We looked at each article and coded it based on its AI use (like chatbots, learning analytics, and automated feedback), its pedagogical focus (like autonomy and engagement), and its ESP domain (like business, engineering, and tourism). Through iterative comparison, five cross-cutting themes were identified: personalized learning paths, AI-powered feedback, chatbots and learner autonomy, gamification and engagement, and ethical-pedagogical considerations.

These themes were used to organize the literature review and served as the foundation for the conceptual framework proposed in the next section. The framework reflects an inductive synthesis process grounded in current literature, offering a model for how AI can be pedagogically and ethically integrated into ESP instruction.

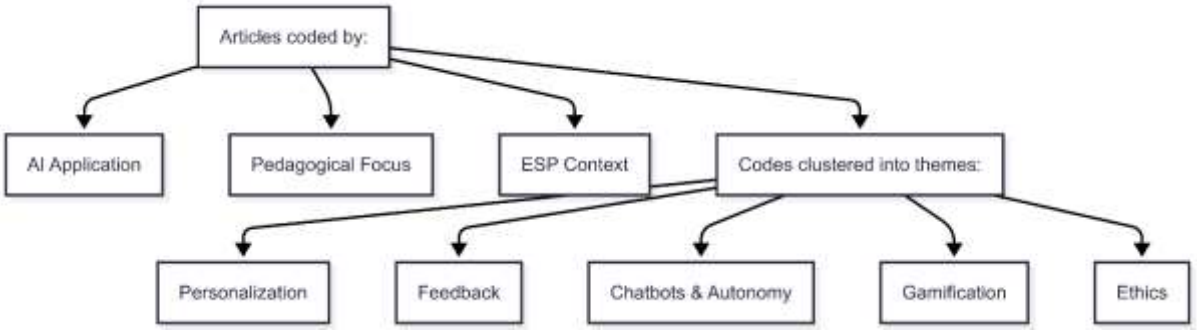

FIGURE 3. Thematic Coding and Synthesis Map

The diagram above visually represents the thematic synthesis process applied in this conceptual review. It begins with the coding of the 30 selected articles based on three primary dimensions: AI Application, Pedagogical Focus, and ESP Context. These categories served as the foundational coding structure during the literature analysis phase. Each article was systematically reviewed to determine how it employed AI technologies (e.g., chatbots, learning analytics, speech tools), its primary pedagogical intent (e.g., enhancing personalization, promoting learner autonomy, increasing engagement), and the specific English for Specific Purposes (ESP) domain it addressed (e.g., academic writing, business communication, tourism English).

The second level of the diagram shows how these initial codes were further synthesized into five emergent themes:

1. **Personalization**: studies focusing on AI-driven adaptive learning tailored to individual learner needs;

2. **Feedback:** work that emphasizes automated or intelligent feedback systems that scaffold learning;

3. **Chatbots & Autonomy:** research highlighting how conversational AI supports self-directed learning and independence;

4. **Gamification**: studies utilizing game-based AI elements to enhance motivation and learner engagement;

5. **Ethics**: literature addressing responsible AI use, including data privacy, algorithmic fairness, and the evolving role of educators.

The flow diagram illustrates the process of interpretive synthesis used in this study, showing how initial descriptive coding of articles based on AI application, pedagogical focus, and ESP context led to the development of broader thematic categories. This structured approach follows established procedures in conceptual and thematic literature analysis, offering a clear account of how data from the selected studies were organized and interpreted. It also serves as a reference for researchers interested in conducting similar literature-based investigations within the context of AI applications in language education.

DISCUSSION

TABLE 2. Complete List of Reviewed Studies

Authors	Year	AI Tool	ESP Domain	Pedagogical Focus
Nguyen et al.	2023	Ethical AI	General ESP	Ethics
Du	2025	Gamified AI Modules	Online EFL	Engagement
Jiang & Zhao	2023	Grammar Bots	Grammar Training	Grammar
Fernandez & Ruiz	2023	Fair AI Design	Ethics in ESP	Fairness
Khreisat	2022	AI Chatbots	Secondary EFL	Autonomy
Stuart	2021	Learning Analytics	University ESP	Personalization
Strielkowski et al.	2025	AI Chatbots	Business English	Autonomy
Ng & Ho	2021	Meta-analysis	General ESP	Synthesis
Omar & Rahman	2021	Gamified ESP	Business English	Engagement
Unsworth & Mills	2020	Automated Writing Tutors	Academic Writing	Accuracy
Wiboolyasarin et. al (2025)	2025	Chatbot Feedback	Engineering English	Vocabulary Retention
Hsu et al.	2025	Adaptive Reading	Tourism English	Content Alignment
Zawacki-Richter et al	2019	Various AI Applications	General ESP/Higher Education	Foundational understanding of AI's educational uses
Nazari & Atai	2022	Not AI-specific	EAP (English for Academic Purposes)	Academic Progress / Coping mecha

Hyland & Jiang	2021	Not Applicable	General ESP	Disciplinary development of ESP
Eshbayev, Maxmudov & Rozikov	2022	NLP (Natural Language Processing), Data Analysis, Fuzzy Logic, Intelligent Systems	Engineering English	Corpus-based pedagogy, ethical design
Khellab et al.	2022	Strategy-based Pedagogy, CALLA model	English for Science and Technology (EST)	Metacognitive reading strategies, Reading comprehension, Strategy instruction
Wang et al.	2015	None (Blended Learning Framework using Complex Adaptive Systems)	General Higher Education	Blended learning models, Systems thinking, Framework development, Scaling in tertiary education
Luckin & Holmes	2016	AIEd (General AI in Education)	General (Applicable to ESP & beyond)	Personalized learning, lifelong learning, teacher augmentation, system-level transformation
Holmes et al.	2019	General AI applications in education	General ESP	Curriculum reform, teacher enhancement, social impact
Lin & Hwang	2025	AI-based Procedural Scaffolding Peer Assessment (AI-PSPA)	Academic English Writing (EFL context)	Personalized writing development, critical thinking, peer assessment in flipped classrooms
Zhao	2025	AI-enhanced Instructional Systems	General English/ English Language Teaching (ELT)	Personalized learning, increased engagement, improved learning outcomes through AI integration
Dewantara et al.	2025	AI-powered language learning tools	Vocational English (ESP)	Personalization, learner autonomy, speaking, engagement
Xayitmuradova, S. M	2025	Chatbots, adaptive learning, speech recognition, virtual simulations	General ESP	Personalized learning, automated assessment, professional communication, engagement

26Kalimbetova, Xurliman	2025	AI-driven programs (personalized learning, intelligent tutoring, automated assessment, real-time feedback)	General ESP	Personalized learning, intelligent tutoring, automated assessment, learner engagement, instructional efficiency
Le Quang	2021	AI-powered tools, LMS	General ESP (Vietnamese university context)	Personalized learning, motivation, adaptive instruction
Liashenko et al.	2025	Personalized learning, automated assessment, virtual tutors	STEM ESP	Tailored instruction, academic outcomes, self-directed learning, soft skills development
Rudneva, M	2025	AI-assisted Task Design Tools	General ESP (cross-domain)	Pedagogic material development, authenticity of AI-generated content, learner engagement, and design efficiency
T. V. Pitirimova	2025	AI Chatbots, Virtual Assistants, Adaptive Learning Platforms	General ESP / Professional English	Personalized learning, real-time feedback, domain-specific adaptation, and engagement

The corpus of 30 studies analyzed in this literature review reveals a dynamic and rapidly evolving landscape in the application of Artificial Intelligence (AI) within English for Specific Purposes (ESP) education. Spanning diverse domains such as engineering, tourism, STEM, vocational training, and academic writing, these studies collectively demonstrate that AI is not merely enhancing existing pedagogical practices but is actively transforming the foundations of ESP instruction. A prevailing trend in the literature is the adoption of AI-driven personalized learning, as evidenced by the studies of Liashenko et al. (2025), Lin and Hwang (2025), and Pitirimova (2025). These studies demonstrate the utilization of technologies, including adaptive learning platforms, intelligent tutoring systems, and chatbots, to provide instruction customized to learners' professional objectives, skill levels, and personal learning preferences, thereby enhancing learner autonomy, motivation, and content mastery.

AI's ability to give feedback in real time and at scale is just as important. Rudneva (2025) and Unsworth and Mills (2020) both write about the problems of giving quick, useful feedback in large-scale ESP writing and grammar classes. This theme comes up a lot in their work. Stuart (2021) and Dewantara et al. (2025) show that learning analytics and AI-powered platforms can also help students learn on their own and improve their vocabulary in technical fields. These results underscore AI's expanding role in promoting autonomous learning and effective content acquisition in specialized settings.

Ethical considerations and responsible AI design are also important topics in the literature. Nguyen et al. (2023) and Fernandez and Ruiz (2023) examine the ramifications of algorithmic fairness, data privacy, and bias, underscoring the essential necessity of designing AI systems in language education with transparency and inclusivity as priorities. At the same time, using AI chatbots in the classroom is becoming more popular as a way to encourage students to interact and be independent in professional English settings. Khreisat (2022) and Strielkowski et al. (2025) found that conversational AI can mimic real-life business and school situations, which can help people practice their language skills in a more interactive and self-paced way. Likewise, Xayitmuradova

(2025) and Pitirimova (2025) amalgamate chatbots and virtual simulations to deliver domain-specific language exposure and promote ongoing language utilization outside the classroom.

Another prominent trend in the examined literature is the gamification of English for Specific Purposes (ESP) instruction. Du (2025) and Omar and Rahman (2021) discuss the effects of gamified AI systems on motivation and engagement in Business English and online EFL settings. These tools use things like point systems, badges, and performance levels to make learning environments that are fun and encourage people to learn. Lin and Hwang (2025) enhance this narrative by demonstrating that gamification in AI-driven peer assessment promotes higher-order thinking and writing development in flipped classrooms. Zhao (2025) further illustrates that gamified AI instruction enhances engagement and retention by integrating game mechanics with individualized learning pathways.

In the meantime, the intersection of AI with teacher roles and educational ethics is becoming an important area of research. Research conducted by Zawacki-Richter et al. (2019), Hyland and Jiang (2021), and Nazari and Atai (2022) elucidates the changing roles of educators in AI-integrated contexts. Teachers are increasingly functioning not merely as purveyors of content but also as curators, facilitators, and ethical guardians of AI-enhanced education. These changing roles require more flexibility in teaching, more digital literacy, and more moral reflexivity. Nguyen et al. (2023) and Fernandez and Ruiz (2023) warn against relying too much on AI. They stress the importance of having clear systems and human oversight to keep AI-mediated learning fair and accountable.
When used carefully, these thematic insights show that AI has the potential to spark big changes in the way ESP education is taught. The studies that were looked at all agree that AI can help create personalized, interesting, and domain-specific learning experiences. They also agree that human teachers are still needed to guide and put AI use in context.

This review significantly enhances the field by integrating a diverse range of empirical and theoretical studies and thematically synthesizing their results. It enhances our comprehension of AI's educational contributions to ESP education in three significant aspects: by demonstrating its instructional advantages, clarifying context-sensitive tool-ESP alignment, and pinpointing essential research deficiencies.

First, there is strong proof that AI has educational benefits, especially when it comes to personalized learning, learner autonomy, and real-time feedback. Research conducted by Lin and Hwang (2025), Kalimbetova (2025), and Dewantara et al. (2025) demonstrates how tools such as AI-PSPA systems, intelligent tutors, and adaptive platforms empower educators to tailor instruction, thereby enhancing learner engagement and outcomes. Studies by Khreisat (2022), Strielkowski et al. (2025), and Pitirimova (2025) show that chatbots and virtual tutors can help people learn languages in a more self-directed and context-aware way.

Second, the review shows how well AI tools fit with ESP areas. Strielkowski et al. (2025) utilize chatbots in business communication training, whereas Pitirimova (2025) modifies virtual simulations for psychology students. Liashenko et al. (2025) also talk about how AI-enhanced ESP instruction in STEM education helps students learn both language and technical skills. These examples show how important it is for teachers to match AI's abilities with the language and professional needs of different fields.

Finally, this synthesis reveals substantial research deficiencies, especially in low-resource environments and areas where English is not the primary language. Most studies come from well-funded schools in cities or places where people speak English well. Fewer studies look at how AI can help ESP learners in rural or underfunded areas. Le Quang (2021) and Dewantara et al. (2025) examine this disparity by investigating personalized learning within Vietnamese and vocational education settings, respectively. However, their work also emphasizes the urgent necessity for AI applications that address infrastructural limitations and linguistic diversity.

This review not only shows how AI is currently being used in ESP education, but it also gives a more nuanced view of how pedagogy, technology, and equity all work together. It urges teachers, developers, and policymakers to see AI as more than just a tool. It can also be a strategic teaching partner that can help make ESP instruction more inclusive, adaptable, and effective.

CONCLUSION AND IMPLICATIONS

This conceptual paper aimed to investigate the potential of Artificial Intelligence (AI) to improve personalization, learner autonomy, and engagement in English for Specific Purposes (ESP) instruction. By integrating recent academic literature and proposing a theoretically informed framework, the study tackles a significant deficiency in conceptual research that connects AI technologies to fundamental pedagogical constructs within ESP. Utilizing interdisciplinary perspectives from applied linguistics, educational technology, and artificial intelligence studies, the paper formulates a comprehensive model designed to enhance both theoretical understanding and practical application.

Through a thematic analysis of thirty peer-reviewed journal articles published between 2015 and 2025, five interrelated themes emerged: personalized learning paths, AI-powered feedback, chatbot-facilitated autonomy, gamification-driven engagement, and ethical-pedagogical considerations. These themes were critically examined across diverse ESP contexts—including business, engineering, academic writing, and medical English—revealing the ways in which AI tools have been employed to address specialized linguistic and professional demands. Based on these insights, the proposed framework accentuates the role of personalization as a central mechanism that supports both learner autonomy and engagement, while simultaneously emphasizing the importance of ethical AI design and context-aware instructional alignment.

Theoretically, this framework contributes to the growing discourse on AI in language education by offering a structured lens through which the pedagogical affordances of AI can be interpreted in ESP environments. It bridges disciplinary silos and synthesizes fragmented research into a coherent conceptual model, offering new ways to understand the dynamic interplay between technology, pedagogy, and domain-specific language learning. Practically, it provides actionable guidance for educators, instructional designers, and policymakers seeking to implement AI-enhanced learning environments that are not only effective but also learner-centered and ethically responsible. The integration of tools such as chatbots, analytics systems, and gamified platforms—when aligned with clear pedagogical goals—can foster adaptive and engaging learning experiences that promote learner independence and professional readiness.

However, the review also identified notable gaps that demand further exploration. Ethical concerns such as data privacy, algorithmic transparency, and equitable access remain insufficiently addressed in much of the existing literature. There is also a pressing need to examine the role of human educators in AI-enhanced ESP instruction, particularly how AI can complement rather than replace human pedagogy. Moreover, the predominance of small-scale, context-specific implementations in current studies limits the generalizability of findings, highlighting the need for longitudinal, cross-contextual, and large-scale empirical research to evaluate the sustained impact of AI on language learning outcomes.

In conclusion, this study advances a robust conceptual foundation for understanding the integration of AI in ESP education. By aligning AI's technological capabilities with core pedagogical aims, the proposed framework serves as a pathway toward more responsive, ethical, and effective language instruction. Future research should seek to empirically validate and refine this framework through interdisciplinary collaboration, participatory design, and inclusive approaches that ensure AI technologies contribute meaningfully to equitable and high-quality language education worldwide.

ACKNOWLEDGEMENTS

The author would like to express her sincere gratitude to the Kedah State Research Committee, UiTM Kedah Branch, for the generous funding provided under the Tabung Penyelidikan Am. This support was crucial in facilitating the research and ensuring the successful publication of this article.

REFERENCES

1. Ahmed, F. (2024). The digital divide and AI in education: Addressing equity and accessibility. AI EDIFY Journal, 1(2), 12-23.

2. Ali, R., AbdAlgane, M., Youssif, E., Elkot, M. A., & Abbass, D. (2024). Elevating English reading comprehension: The synergy of dialogic teaching and technology integration in ESP learning environments. International Journal of Information and Education Technology, 14(8), 1109-1118.
3. Deng, X., & Yu, Z. (2022). A systematic review of machine-translation-assisted language learning for sustainable education. Sustainability, 14(13), 7598.
4. Dewantara, K. A. K., Laksana, I. P. Y., & Saraswati, N. P. R. T. A. K. H. (2024). A Systematic Review of AI-Powered Tools in English Language Learning for Vocational Students. International Journal of Natural Science and Engineering, 8(3), 201–214. https://doi.org/10.23887/ijnse.v9i2.101889
5. Du, Q. (2025). How artificially intelligent conversational agents influence EFL learners' self-regulated learning and retention. Education and Information Technologies, 1-67.
6. Eshbayev, O. A., Maxmudov, A. X., & Rozikov, R. U. (2022). An overview of a state of the art on developing soft computing-based language education and research systems: A survey of engineering English students in Uzbekistan. In Proceedings of the 5th International Conference on Future Networks and Distributed Systems (ICFNDS '21) (pp. 447–452). Association for Computing Machinery. https://doi.org/10.1145/3508072.3508160
7. Hsu, K. C., Barrett, N. E., & Liu, G. Z. (2025). English for tourism and AR-assisted context-aware ubiquitous learning: a preliminary design-based research study. Computer Assisted Language Learning, 38(3), 544-568.
8. Kalimbetova, X. (2025). ROLES OF AI PROGRAMS IN TEACHING ENGLISH FOR ESP STUDENTS. Наука и инновация, 3(24), 196-199.
9. Khan, I. A., Khan, K. A., & Mahmood, N. (2025). The Future of English Language Teaching in Pakistan: A Comparative Analysis of AI-Driven and Human-Led Instruction. Liberal Journal of Language & Literature Review, 3(1), 315-330.
10. Khellab, F., Demirel, Ö., & Mohammadzadeh, B. (2022). Effect of Teaching Metacognitive Reading Strategies on Reading Comprehension of Engineering Students. SAGE Open, 12(4). https://doi.org/10.1177/21582440221138069
11. Khreisat, M.N. (2022). English Language Learning Strategies during COVID-19 in the Middle East: A Systematic Review. Arab World English Journal, 13 (1) 56-71. https://dx.doi.org/10.24093/awej/vol13no1.4
12. Liashenko, I., Chepeliuk, N., & Rumiantseva, O. (2025). ENHANCING ESP FOR STEM STUDENTS: AI TOOLS AND THEIR EFFECTS ON LANGUAGE AND CONTENT LEARNING. Philological Treatises, 17(1), 284–293. https://doi.org/10.21272/Ftrk.2025.17(1)-25
13. Lin, C. J., & Hwang, G. J. (2025). Artificial intelligence-supported procedural scaffolding for promoting EFL learners' writing performance in flipped peer assessment activities. Interactive Learning Environments, 1–15. https://doi.org/10.1080/10494820.2025.2532629
14. Le Quang, D. (2021). From generalization to personalization: Designing a personalized ESP teaching model in a Vietnamese private university context. Social Science and Humanities Journal, 9(4), 7498–7510. https://doi.org/10.18535/sshj.v9i04.1784
15. Luckin, R., & Holmes, W. (2016). Intelligence unleashed: An argument for AI in education. UCL Knowledge Lab. https://discovery.ucl.ac.uk/id/eprint/1475756/
16. Nazari, O., & Atai, M. R. (2022). An exploratory study of EAP teachers' coping strategies. System, 106, 102764. https://doi.org/10.1016/j.system.2022.102764
17. Ng, S. L., & Ho, C. C. (2025). Generative AI in Education: Mapping the Research Landscape Through Bibliometric Analysis. Information, 16(8), 657.
18. Nguyen, A., Ngo, H. N., Hong, Y., Dang, B., & Nguyen, B. P. T. (2023). Ethical principles for artificial intelligence in education. Education and information technologies, 28(4), 4221-4241.
19. Nguyen, H. A. (2024). Harnessing AI-based tools for enhancing English speaking proficiency: Impacts, challenges, and long-term engagement. International Journal of AI in Language Education, 1(2), 18-29.
20. Pérez, C., & González, M. (2023). Ethical implications of AI in ESP: Design and fairness. Journal of Educational Innovation and Technology, 10(2), 112–129.
21. Pitirimova, T. V. (2025). Artificial intelligence in foreign language learning for specific purposes: The use of AI chatbots, virtual assistants, and adaptive programs. In N. A. Gunina (Ed.), Artificial intelligence in foreign language learning (pp. 158–167). Tambov State Technical University. https://tstu.ru/book/elib1/pdf/2025/Gunina2.pdf#page=158

22. Rudneva, M. (2025). AI for pedagogic design in ESP. In EDULEARN25 Proceedings of the 17th International Conference on Education and New Learning Technologies (pp. 4758–4766). IATED. https://doi.org/10.21125/edulearn.2025.1215
23. Salem, A. A. M. S. (2025). Harnessing Wiki-Mediated Collaborative Writing to Enhance ESP Students' Persuasive Writing, 21st-Century Skills, and Self-Efficacy. Journal of Educational Computing Research, 07356331251337500.
24. Stuart J. Barnes. (2021). Understanding terror states of online users in the context of COVID-19: An application of Terror Management Theory. Computers in Human Behavior, 125, 106967. https://doi.org/10.1016/j.chb.2021.106967
25. Strielkowski, W., Grebennikova, V., Lisovskiy, A., Rakhimova, G., & Vasileva, T. (2025). AI-driven adaptive learning for sustainable educational transformation. Sustainable Development, 33(2), 1921-1947.
26. Unsworth, L., & Mills, K. A. (2020). English language teaching of attitude and emotion in digital multimodal composition. Journal of Second Language Writing, 47, 100712. https://doi.org/10.1016/j.jslw.2020.100712
27. Wiboolyasarin, W., Wiboolyasarin, K., Tiranant, P., Jinowat, N., & Boonyakitanont, P. (2025). AI-driven chatbots in second language education: A systematic review of their efficacy and pedagogical implications. Ampersand, 14, 100224.
28. Hashim, S., Omar, M. K., Ab Jalil, H., & Sharef, N. M. (2022). Trends on technologies and artificial intelligence in education for personalized learning: systematic literature. Journal of Academic Research in Progressive Education and Development, 12(1), 884-903.
29. Holmes, W., Bialik, M., & Fadel, C. (2019). Artificial intelligence in education: Promises and implications for teaching and learning (1st ed.). Center for Curriculum Redesign. https://discovery.ucl.ac.uk/id/eprint/10139722/
30. Snyder, H. (2019). Literature reviews as a research methodology: An overview and guidelines. Journal of Business Research, 104, 333–339. https://doi.org/10.1016/j.jbusres.2019.07.039
31. Yuping Wang, Xibin Han, & Juan Yang. (2015). Revisiting the Blended Learning Literature: Using a Complex Adaptive Systems Framework. Journal of Educational Technology & Society, 18(2), 380–393. http://www.jstor.org/stable/jeductechsoci.18.2.380
32. Xatamova, N., & Ashurov, J. (2024). The Future of Legal English Learning: Integrating AI into ESP Education. SPAST Reports, 1(7).
33. Xayitmuradova, S. M. (2025). THE ROLE OF ARTIFICIAL INTELLIGENCE TECHNOLOGIES IN ESP TEACHING. Экономика и социум, (3-2 (130)), 307-311.
34. Zawacki-Richter, O., Marín, V. I., Bond, M., & Gouverneur, F. (2019). Systematic review of research on artificial intelligence applications in higher education. International Journal of Educational Technology in Higher Education, 16(1), 1–27. https://doi.org/10.1186/s41239-019-0171-0
35. Zhao, J. Advancing english language education: A mixed-methods analysis of AI-driven tools'impact on engagement, personalization, and learning outcomes. Educ Inf Technol (2025). https://doi.org/10.1007/s10639-025-13560-2