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Research Article

Role of AI in English Language Teaching for Specific Purposes

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Abstract

The integration of Artificial Intelligence (AI) into language teaching has significantly transformed pedagogical practices, particularly in the domain of English for Specific Purposes (ESP). This review critically examines the role of AI technologies—including Natural Language Processing (NLP), Machine Learning (ML), Deep Learning (DL), Intelligent Computer-Assisted Language Learning (ICALL), and Large Language Models (LLMs)—in reshaping language instruction. Drawing on interdisciplinary scholarship, the paper evaluates AI-driven applications in personalized learning, automated assessment, and domain-specific communication training. While AI enhances efficiency, learner engagement, and adaptability, it simultaneously raises concerns related to algorithmic bias, ethical accountability, reduced human interaction, and pedagogical oversimplification of language learning processes. The study argues that AI should function as an augmentative pedagogical tool rather than a substitute for human instructors. It concludes by proposing a balanced human–AI collaborative model grounded in ethical, contextual, and learner-centered practices and highlights practical implications for ESP classrooms.

Keywords

Artificial Intelligence, ESP, ICALL, NLP, Machine Learning, Language Pedagogy, LLMs

1. Introduction

Artificial Intelligence (AI) has emerged as one of the most transformative forces in contemporary education, reshaping how knowledge is generated, delivered, and assessed. In the field of language teaching, AI has introduced new paradigms of learning that emphasize adaptability, interactivity, and personalization. Its impact is particularly significant in English for Specific Purposes (ESP), where language instruction is closely tied to professional, vocational, or disciplinary contexts.

ESP differs from General English in its focus on specialized communicative competence. Learners in ESP settings are typically required to master not only grammatical and lexical accuracy but also discourse conventions specific to their domains, such as engineering reports, medical communication, business correspondence, or legal documentation. This domain-specific requirement makes ESP highly suitable for AI-supported instruction, as AI systems can analyze linguistic data at scale and generate context-sensitive learning materials.

Recent advances in Natural Language Processing (NLP), Machine Learning (ML), and Large Language Models (LLMs) have enabled systems to move beyond rule-based instruction toward adaptive, intelligent, and interactive learning environ-

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ments. As [12] note, AI-based systems can now respond dynamically to learner input, providing immediate feedback and personalized pathways.

However, the rapid adoption of AI in education also raises critical pedagogical and ethical questions. While AI enhances accessibility and efficiency, it also risks reducing language learning to automated pattern recognition, potentially neglecting socio-cultural, affective, and human interactional dimensions of communication. This paper critically explores these tensions and evaluates the role of AI in shaping ESP pedagogy.

2. Theoretical Framework

2.1. Natural Language Processing (NLP)

Natural Language Processing (NLP) forms the core of AI-driven language education systems. It enables machines to interpret, analyze, and generate human language in meaningful ways. According to [10] NLP allows for linguistic processing at multiple levels, including syntax, semantics, discourse, and pragmatics, making it particularly valuable for language learning environments.

In ESP contexts, NLP supports specialized functions such as:

1) Analysis of professional and technical discourse
2) Identification of domain-specific grammatical patterns
3) Automated corrective feedback in writing tasks
4) Context-sensitive vocabulary enhancement

By aligning computational analysis with authentic language use, NLP bridges the gap between theoretical linguistic knowledge and practical communication skills. This aligns with earlier CALL frameworks, which emphasize interaction and feedback as central to second language acquisition [3, 5, 6, 7, 9].

2.2. Machine Learning and Deep Learning

Machine Learning (ML) enables systems to learn patterns from data without explicit programming [1]. In educational contexts, ML facilitates adaptive learning systems that adjust instructional content based on learner performance.

Deep Learning (DL), a subset of ML, uses artificial neural networks to process large and complex datasets [11]. In language learning, DL contributes to:

1) Speech recognition and pronunciation assessment
2) Automated essay scoring
3) Predictive learner analytics
4) Adaptive sequencing of learning materials

In ESP environments, these capabilities allow for highly individualized instruction. For example, business English learners may receive different tasks based on their communicative competence in negotiation or report writing.

Such adaptive systems reflect broader developments in learning analytics and educational data mining [2], which aim to optimize learning outcomes through data-driven decision-making.

2.3. ICALL and Intelligent Tutoring Systems

Intelligent Computer-Assisted Language Learning (ICALL) represents an advanced evolution of traditional CALL systems. Unlike earlier systems, ICALL integrates AI techniques to provide adaptive feedback based on learner input.

Intelligent Tutoring Systems (ITS) simulate human tutoring by modeling learner knowledge and adjusting instruction accordingly [14]. These systems can:

1) Diagnose learner errors in real time
2) Adjust task difficulty dynamically
3) Provide scaffolding for language production

The convergence of ICALL and ITS has enabled scalable personalized instruction, reducing dependency on constant teacher intervention. However, scholars such as [13] emphasize that human mediation remains essential for meaningful language acquisition, particularly in socio-cultural contexts.

2.4. Large Language Models (LLMs)

Large Language Models (LLMs) represent the most recent advancement in AI-driven language education. These models generate human-like text and simulate interactive dialogue, making them highly useful in language learning environments.

In ESP contexts, LLMs can:

1) Generate professional communication texts (emails, reports, proposals)
2) Simulate workplace conversations
3) Provide real-time writing assistance
4) Support brainstorming and idea development

Bonner, E. et. al. [4] argue that LLMs enhance learner engagement by enabling interactive, context-aware communication practice. However, concerns remain regarding factual accuracy, hallucination, and over -reliance on automated systems.

3. Applications of AI in ESP

3.1. Personalized Learning

AI enables the creation of individualized learning pathways by analyzing learner data such as performance history, error patterns, and engagement levels. This ensures that ESP learners receive content tailored to their professional needs and proficiency levels.

3.2. Automated Assessment

AI-driven assessment tools provide real-time evaluation of grammar, pronunciation, coherence, and vocabulary use. This reduces teacher workload and ensures immediate feedback, which is crucial for language acquisition.

3.3. Content Generation

AI systems can generate domain-specific learning materials, including case studies, technical texts, and workplace scenarios. This enhances authenticity in ESP instruction.

3.4. Interactive Simulation

AI-powered chatbots and virtual environments simulate real-world communication contexts such as business meetings, medical consultations, or technical discussions. This improves communicative competence in authentic settings.

4. Benefits of AI in ESP

AI integration offers several pedagogical advantages:

1) Enhanced personalization of learning experiences
2) Increased learner motivation through interactive tools
3) Efficient automation of repetitive teaching tasks
4) Scalability for large learner populations
5) Improved accessibility across geographical and institutional boundaries

These benefits position AI as a significant enhancer of ESP pedagogy, particularly in resource-constrained environments.

5. Challenges and Limitations

Despite its advantages, AI presents several challenges:

1) Algorithmic Bias: AI systems may reflect biases present in training data.
2) Reduced Human Interaction: Overuse of AI may weaken communicative and socio-emotional learning.
3) Inaccuracy and Hallucination: AI-generated responses may contain errors.
4) Digital Divide: Unequal access to technology may widen educational inequality.
5) Teacher Readiness: Many educators lack adequate training in AI integration. [8]

These limitations highlight the need for critical and context-sensitive implementation.

6. Ethical Considerations

The use of AI in education raises important ethical concerns. Issues of data privacy, surveillance, and learner autonomy are central to current debates. Educational institutions must ensure transparency in data usage and algorithmic decision-making.

Zhai, X. et al [15, 16] emphasize that unchecked AI integration may reinforce systemic inequalities and reduce pedagogical agency. Ethical frameworks must therefore guide AI deployment in ESP contexts to ensure fairness and accountability.

7. Future Directions

Future developments in AI-enhanced ESP are likely to include:

1) Human–AI collaborative teaching models
2) Explainable AI systems for transparent learning feedback
3) Domain-specific AI tutors for professional training
4) Integration with immersive technologies such as AR/VR
5) Emotion-sensitive AI for affective learning support

These advancements suggest a move toward more holistic, interactive, and adaptive learning ecosystems.

Table 1. *AI Applications in ESP Learning.*

AI Technology	Application in ESP	Pedagogical Benefit
NLP	Grammar & discourse analysis	Context – aware feedback
ML	Adaptive learning systems	Personalized learning paths
ICALL	Error diagnosis & tutoring	Individualized instruction
LLMs	Chatbots & content generation	Real-world communication practice
Speech Recognition	Pronunciation training	Improved fluency

8. Conclusion

Artificial Intelligence has fundamentally transformed ESP pedagogy by enabling personalized, efficient, and scalable language learning systems. Its applications in NLP, ML, ICALL, and LLMs demonstrate significant potential for improving language instruction in professional contexts. However, AI must be understood as a complementary pedagogical tool rather than a replacement for human educators.

The future of ESP lies in a balanced human–AI partnership

that integrates technological innovation with pedagogical sensitivity, ethical responsibility, and human-centered learning principles. Only through such a balanced approach can AI contribute meaningfully to sustainable and equitable language education.

In real classroom contexts, AI tools are increasingly being used to support ESP instruction. For example, in business English courses, AI-based chatbots can simulate professional communication scenarios such as negotiations, interviews, and email writing tasks. Similarly, in medical English contexts, AI systems can generate patient–doctor interaction simulations, enabling learners to practice specialized discourse in a low-risk environment Writing support tools powered by AI can assist learners in producing technical reports by providing real-time feedback on grammar, tone, and domain-specific vocabulary. Additionally, pronunciation tools using speech recognition help learners refine their spoken communication, which is particularly important in fields such as aviation and healthcare.

From a teaching perspective, AI can support instructors by generating lesson plans, quizzes, and assessment rubrics tailored to specific disciplines. However, effective implementation requires teacher training and critical awareness to ensure that AI tools are used as pedagogical aids rather than replacements for human instruction.

Abbreviations

ICALL	Intelligent Computer-Assisted Language Learning
ESP	English for Specific Purposes
ML	Machine Learning
LLM	Large Language Models
ITS	Intelligent Tutoring Systems
NLP	Natural Language Processing
DL	Deep Learning

Author Contributions

Suchismita Tagore Mukherjee: Conceptualization, Resources, Data curation, Methodology

Data Availability Statement

Data can be shared with author's approval as per requirements of journal.

Conflicts of Interest

The authors declare no conflicts of interest.

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