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INTEGRATING AI IN EDUCATION AND IN ESP TEACHING: AN OVERVIEW OF RECENT ADVANCES

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A R T I C L E   I N F O

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A B S T R A C T

The integration of Artificial Intelligence (AI) into education and foreign language teaching marks a transformative shift and it has drawn much attention in recent literature. The present article aims to provide a comprehensive overview of the current debate on the integration of AI in education and English for Specific Purposes (ESP) teaching, focusing on both opportunities and challenges. It aims to synthesize recent literature to identify opportunities as well as challenges based on recent research on the topic. The integration of AI tools in education has the potential to enhance personalization, autonomy, engagement, and efficiency in learning environments, while also facilitating process automation and assessment. At the same time, it poses the ethical, social, and infrastructural challenges, such as academic integrity, algorithmic bias, and equitable access. Ultimately, the article highlights the need for clear guidelines, ethical frameworks, and AI literacy to ensure responsible integration, positioning AI as a complement to human educators rather than a replacement, and promoting a balanced approach that safeguards creativity, critical thinking, and inclusivity.

Keywords:

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1. INTRODUCTION

The integration of Artificial Intelligence (AI) into learning environments marks what several scholars (e.g. Solorzano et al., 2024), recognize as the fourth educational revolution, a process that is fundamentally driven by the expansion of digital technologies and was accelerated by the COVID-19 pandemic, which forced a rapid and massive reliance on information technologies for continuity in teaching and learning (Zawacki-Richter & Marín, 2019). This potential shift in education practices has captured the attention of the international research community in recent years, and the education sector has become the leading subject for AI-related scientific publications in various countries (Solorzano et al., 2024).

The goal of the present article is to provide an overview of the ongoing discussion on the opportunities and challenges posed by the integration of AI in teaching and learning, based on the literature on this topic published mainly over the past five years. More specifically, it aims to systematize current debates in specialized literature and identify core affordances of AI – such as personalization, learner autonomy, enhanced engagement, process automation, and assessment efficiency –, and persistent challenges – such as academic integrity, over-reliance, algorithmic bias, ethical concerns, and unequal access to digital infrastructure. The study focuses both on the implementation of AI tools in general education and in English for Special Purposes (ESP) education, highlighting how AI tools can be pedagogically aligned with professional and disciplinary language needs, and ultimately contributes to the field by critically mapping methodological trends, and perceived benefits and limitations of integration of AI in ESP instruction.

This article is based on a literature review of 100 publications identified through targeted browsing of Google Scholar conducted between November 2024 and January 2025. Although this approach allowed for broad coverage of recent and influential work on AI integration in education and ESP, several limitations should be underlined. The selection of studies was not guided by a fully systematic protocol and, therefore, relied on keyword relevance, citation visibility, and thematic alignment, which may introduce selection bias. The article does not aim to provide an exhaustive or statistically representative account of the field, but rather to synthesize dominant trends, perceived opportunities, and recurring challenges identified in recent literature.

The article is structured as follows: Section 2 will focus specifically on the opportunities for integrating AI tools into education in general, while Section 3 will focus specifically on the teaching of English as a Special Language. Section 4 will draw some conclusions.

2. AI IN EDUCATION

Since November 2022, the rise of ChatGPT and other generative AI models has brought much attention to the integration of AI technologies into classrooms. With the growing use of ChatGPT and similar models in educational settings, understanding the impact of AI on education has become increasingly urgent; because of this, much research in this respect has been made particularly in China, the United States, Spain, India, the United Kingdom, and Germany, although it is clear that Chinese research teams exert a dominant influence (Ivanova

et al. 2024). In what follows, we identify the main themes that emerge from a critical review of the literature in the field.

2.1. *Personalization of teaching activities*

Much literature on integrating AI tools into education points out that one of the main potential advantages is personalization and adaptive learning. AI enables teachers to customize educational activities to meet individual students' needs, thereby optimizing engagement and learning outcomes (Moleka 2023, Niveditha et al. 2024) and supporting student-centered learning. AI tools can provide real-time feedback, personalized content delivery, and self-directed learning paths, allowing teachers to tailor instruction to individual student needs and to measure improvements in student outcomes (Solorzano et al., 2024; see also Popenici, Kerr 2017, Hwang et al., 2020; Rospigliosi, 2023; Chisom et al., 2024).

As noted by Moleka (2023) and Mosly (2024), AI has the capacity to adjust instruction dynamically, creating an optimized learning experience for students with varying skill levels. This personalization fosters inclusivity and addresses varied learning needs, which in turn promotes autonomy and competence – central principles in Deci and Ryan's (1985) Self-Determination Theory (cf. Iftanti et al. 2023), according to which, "individuals are motivated to engage in activities that satisfy their innate psychological needs for autonomy, competence, and relatedness" (Iftanti et al. 2023: 458). Consequently, AI tools "foster a sense of control and ownership over their learning process," enhancing feelings of autonomy and competence, which can further strengthen motivation (ibid.).

In this perspective, AI shifts teachers' roles from information providers to facilitators, and instructors will consequently need to develop technological competencies to effectively integrate AI tools into their teaching. In turn, this will increase their responsibilities in guiding students in using AI, supporting socio-emotional development, and ensuring ethical standards.

2.2. *AI and learning autonomy*

AI-driven platforms are widely recognized for fostering student autonomy by enabling dynamic, low-stakes learning environments with instant, personalized feedback (Bissessar 2023, Ahmed et al., 2024; Gond et al., 2024; Mosly, 2024). These features allow learners to monitor progress, clarify doubts, and receive efficient evaluations independently.

A related benefit is greater engagement and interactivity through tools such as gamified applications (Chisom et al. 2024), chatbots, and immersive simulations. AI tools make learning more motivating, improve knowledge retention (Ahmed et al., 2024; Chisom et al., 2024), and can induce a "flow" state conducive to active learning (Rospigliosi, 2023).

Students also report that AI saves time and effort in academic tasks; for example, ChatGPT simplifies writing and information retrieval (Chan et al., 2023; Ahmed et al., 2024).

Beyond efficiency, according to some studies, AI supports critical thinking by prompting learners to evaluate responses and verify information (Saylam et al., 2023, Yazdani Motlagh et al., 2023, Ali & Wardat, 2024, Gond et al., 2024, Solorzano et al., 2024). Educators

can design assignments that leverage AI for analytical and creative problem-solving, which students perceive as enhancing their skills (Ahmed et al., 2024, Ali & Wardat, 2024).

2.3. AI and process automation

A second benefit of integrating AI into education is its ability to simplify teachers' administrative workload through task automation. This includes planning – scheduling, recordkeeping, and communication management (Ahmed et al., 2024) –, generating instructional materials such as summaries, exercises, and test questions, providing real-time feedback, which minimizes the need for manual intervention (see Ali and Wardat, 2024), and grading assignments. Thus, AI can streamline routine processes, enabling educators (and administrators) to dedicate more time and resources to instructional design and student engagement.

As for pedagogical practices in themselves, it is often pointed out in the literature that AI can be seen as a catalyst for more engaging pedagogical practices, as it fosters active student participation through gamified learning, making education interactive, motivating, and conducive to better knowledge retention. More specifically, Iftanti, Awalin, and Izza (2023) emphasize the role of gamified AI applications in enhancing engagement, drawing on Flow Theory (Csikszentmihalyi, 1990), which highlights deep concentration and enjoyment during learning. Additionally, AI integration strengthens student interaction through chatbots and conversational agents (e.g., ChatGPT) and supports flipped and blended learning by providing on-demand content (Motlagh et al., 2023).

Another significant advantage of incorporating AI into education lies in its potential to enhance efficiency and consistency in student assessment. The use of AI tools for essay evaluation, for instance, can substantially reduce educators' workload while ensuring standardized grading practices across diverse educational contexts (Ahmed et al., 2024). In this regard, Bektik et al. (2024) emphasize the need for a revised teaching philosophy to effectively integrate chatbots into educational assessment, since AI-driven analytics provide detailed, data-based insights that help identify at-risk students and enable tailored interventions. Furthermore, AI can monitor patterns in student engagement and performance, facilitating early intervention and supporting continuous assessment rather than relying solely on traditional exams.

At the same time, Popenici and Kerr (2017) caution against excessive reliance on AI as a replacement for sound pedagogical practices, advocating instead for its role as a complement to human educators: while AI offers remarkable opportunities to enhance teaching and learning, it cannot substitute the human-centered essence of education. Therefore, a balanced approach is essential – one that leverages AI to augment human capabilities while preserving creativity, critical thinking, and ethical responsibility.

2.4. Teachers' attitude towards AI integration in education

Based on a sample of 83 science teachers, Al Darayseh (2023) revealed that science teachers have a high level of acceptance for using AI applications in their classrooms. The article shows that the most influential factors shaping teachers' behavioural intention to adopt

AI include self-efficacy, perceived benefits, ease of use, and overall attitudes toward AI tools. If Al Darayseh's recommendations for fostering acceptance of AI in science education are extended to the broader educational context, several measures should be adopted, including the promotion of targeted training programs, organizing awareness sessions and seminars, delivering practical instruction on the use of AI applications for in-service teachers, incorporating AI concepts and tools into pre-service teacher education curricula, and providing clear guidelines for the effective integration of AI in teaching practices.

At least two other aspects that teachers have focused on in relation to the integration of AI in training emerge from the literature. First, AI offers significant potential for promoting equity and accessibility in education. It can help bridge learning gaps through features such as language translation and accessibility tools (Iftanti et al., 2023) and support diverse learning needs via adaptive platforms (Moleka, 2023; Saylam et al., 2023; Niveditha et al., 2024; Chisom et al., 2024; Iftanti et al., 2023). However, disparities in access to digital infrastructure risk widening the educational divide, as equitable implementation depends on investment in technology and inclusive design (Dzhanegizova et al., 2023, Bettayeb et al., 2024).

Second, AI integration in education raises several critical challenges that demand ethical, social, and policy attention. Key concerns include data privacy and algorithmic bias, while excessive reliance on AI risks undermining creativity and critical thinking and may encourage academic dishonesty through AI-generated content. Addressing these issues requires institutions to establish clear ethical frameworks, ensure transparency, and implement continuous monitoring (Popenici & Kerr, 2017; Dzhanegizova et al., 2023).

2.5.AI and learning: potential drawbacks

Despite its potential benefits, as already mentioned, the literature extensively discusses the challenges and disadvantages of AI integration in education, particularly for students. One of the most critical concerns is the risk to academic integrity, including plagiarism and cheating, which some authors compare to "contract cheating,", the practice of students using third parties to dishonestly perform assignments (Popenici & Kerr, 2017; Bissessar, 2023; Chisom et al. , 2024; Motlagh et al., 2024). Students may generate assignments using AI without genuine learning, and AI-produced content is often indistinguishable from authentic work.

Another widely noted issue is overreliance on AI, which can reduce engagement and hinder the development of essential cognitive skills such as critical thinking, analytical ability, and creativity (Iftanti et al., 2023; Rhaman & Watanobe, 2023; Dzhanegizova et al., 2024; Gond et al. 2024; Solorzano, et al., 2024; Saylam et al., 2023), although some studies argue that proper use can enhance these skills (Selwyn, 2019). Chan et al. (2023) also highlight concerns about diminished opportunities for social interaction.

Further challenges include accuracy and reliability, as AI may provide incomplete or incorrect information and even fabricate references (i.e. "hallucination") (Motlagh et al. 2023).

Ethical issues such as algorithmic bias and lack of cultural sensitivity are also significant, with AI systems potentially perpetuating biases from training data and failing to reflect diverse norms (Chan et al., 2023, Moleka 2023; Ali & Wardat, 2024; Ahmed et al., 2024; Bettayeb et al., 2024; Gond et al., 2024; Mosly, 2024; Niveditha et al., 2024).

Another limitation that is often mentioned in the literature is AI lack of emotional intelligence, which prevents it from replicating the empathy, adaptability, and ethical guidance provided by human teachers (Ahmed et al., 2024; Chan et al., 2023).

Finally, effective implementation requires substantial infrastructure and resources, raising concerns about the digital divide and cost barriers for underprivileged students (Bissessar 2023, Chisom et al., 2024; Niveditha et al., 2024).

3. AI IN ESP TEACHING

This section presents a focused review of recent academic literature concerning the integration of AI within the field of English for Specific Purposes (ESP). The primary objective of this review is to map the current landscape of AI application in university-level ESP instruction, evaluating both the perceived benefits and the inherent challenges associated with these technologies. The swift development in this domain is evidenced by the concentration of relevant studies published predominantly between 2022 and 2024. The scope of this analysis covers the impact of AI tools on student learning outcomes and perceptions, as well as the evolving professional role of educators.

3.1. Methodological approaches

The existing body of research regarding AI integration in ESP classrooms can be systematically organized by analysing the methodological structure of the studies and the core applications of the technology. While such a categorization provides a useful analytical framework, it also reveals uneven methodological development within the field, which has important implications for how findings should be interpreted.

The research in this field is broadly divided into three distinct methodological strands, each addressing different aspects of AI integration. Firstly, perception studies, exemplified by the work of Synekop et al. (2024), focus on surveying the attitudes, anxieties, and overall beliefs of students and instructors regarding the use of AI in language learning environments. These studies are crucial for understanding user acceptance and identifying key stakeholder concerns. However, the strong reliance on self-reported data limits the extent to which such studies can account for actual learning outcomes, as positive perceptions do not necessarily translate into measurable gains in linguistic competence.

Secondly, experimental studies, such as that conducted by Dou (2024), employ controlled designs to rigorously test the effectiveness of specific AI tools in enhancing language acquisition. By comparing the results of experimental groups (using AI) against control groups (traditional instruction), these studies often demonstrate statistically significant improvements in learning outcomes within the AI-integrated cohorts. Despite their greater methodological rigor, some of the studies are constrained by small samples, short intervention periods, or narrowly defined instructional targets, which may reduce the generalizability of their results across different ESP domains.

Finally, practical applications and case studies detail the concrete implementation of AI tools tailored for specific ESP contexts. Researchers like Boeru (2024) document the utility of

various applications and specialized tools, such as chatbots designed for maritime English communication, providing essential instructional blueprints. While these context-specific investigations offer valuable insights into authentic professional practices, their limited engagement with comparative or theoretical analysis often positions them as illustrative rather than explanatory.

3.2. Core applications and opportunities

From the documented applications, two key opportunities for AI stand out in the ESP context: personalization and autonomous learning. AI systems demonstrate the capability to dynamically tailor educational materials to align with individual student proficiency levels and professional requirements (Kovačević, 2023; Rudik et al., 2024). This adaptive capacity is realized, for instance, through specialized chatbots that simulate realistic professional communication scenarios (Boeru, 2024). Furthermore, sophisticated AI tools promote autonomous learning by offering immediate, real-time feedback and progress tracking. This encourages self-directed study, enabling students to independently use large language models like ChatGPT to analyse stylistic features in their writing or clarify grammar rules with contextual examples (Du & Alm 2024; Synekop et al., 2024).

3.3. Pedagogical impact: benefits and challenges

The literature, primarily from perception surveys, identifies several key benefits stemming from AI adoption, impacting both students and educators. One major benefit is enhancing the learning environment itself, as students consistently report that AI makes the learning process more dynamic and flexible (Erito, 2023). Crucially, the non-judgmental nature of AI interaction is highly valued as it creates a safe space for practice (Du & Alm, 2024). This environment leads directly to improved outcomes and confidence: personalized feedback and the low-pressure setting significantly contribute to improved accuracy and a notable increase in student confidence (Kim, 2022; Synekop et al., 2024). Finally, for educators, AI provides tangible support and efficiency by assisting with course planning, material adaptation, and potentially reducing the overall professional workload, allowing teachers to focus more on high-value, communicative activities (Benabdallah, 2023).

Despite the benefits, the literature consistently raises several challenges that necessitate careful consideration and policy development. A central institutional concern is academic integrity and authorship, involving the risks of plagiarism and the difficulty in assigning clear student authorship to work generated or assisted by AI (Hanane, 2023; Synekop et al., 2024). This requires clearer institutional guidance for both faculty and students. Additionally, issues related to accuracy and over-reliance are significant: students and researchers express valid concerns regarding the accuracy and reliability of AI-generated content, especially within highly specialized ESP domains. Furthermore, warnings exist against over-reliance on AI tools, which may undermine the organic development of critical thinking and foundational language skills (Brebera & Bezdickova, 2024). Finally, human and practical barriers include other documented pedagogical drawbacks, such as the potential for reduced human interaction (Taylor, 2024). On a systemic level, practical barriers, such as limited internet access and

unequal technological infrastructure, remain a significant impediment to the equitable implementation of AI in various educational contexts.

Overall, the literature suggests that research on AI in ESP is still largely exploratory, with a strong reliance on perception-based studies. While AI shows clear potential to enhance personalization and learner engagement, the limited use of mixed-methods designs constrains conclusions about sustained and long-term learning benefits. Recurring concerns regarding academic integrity, over-reliance, and reduced human interaction point not to the rejection of AI, but to the need for pedagogically informed integration models. Within this perspective, AI emerges as a mediating tool that supports communicative and sociocultural approaches, reinforcing the teacher's role as a critical facilitator rather than a content provider.

4. CONCLUSIONS

The integration of AI tools in education presents a complex scenario of opportunities and challenges. On the positive side, AI enables highly personalized learning experiences, enhances engagement through interactive tools, improves efficiency, supports skill development, expands access to education, and fosters motivation and autonomy (Ahmed et al., 2024; Chisom et al., 2024). However, significant concerns remain, including risks to academic integrity such as plagiarism and cheating (Popenici & Kerr, 2017; Bissessar ,2023), over-reliance that may hinder critical thinking and creativity (Saylam et al., 2023), issues of accuracy and reliability requiring verification (Motlagh et al., 2023), algorithmic bias and data privacy concerns (Chan et al., 2023, Moleka, 2023), and inequities in access due to infrastructure limitations (Bissessar, 2023; Niveditha et al., 2024).

To navigate these challenges, AI should complement rather than replace human educators, augmenting learning while safeguarding core educational values. Effective integration depends on clear guidelines and ethical frameworks, investment in infrastructure, and professional development for educators and students. Fostering digital and AI literacy is essential so learners understand AI functioning, limitations, and ethical implications, and can critically evaluate AI-generated content. Only through responsible implementation can AI transformative potential be realized without undermining essential human skills and values.

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