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Integrating AI into ELT for Improved English Writing in Engineering Education

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Abstract: Undergraduate engineering students often face persistent challenges in academic and technical English writing both in second language and foreign language domains. Moreover, artificial intelligence (AI) tools for writing, especially from grammar checkers to conversational chat-bots are rapidly refining literacy practices in higher education. This article reviews recent research on the use of AI tools to enhance English writing skills of engineering undergraduates through English Language Teaching (ELT) mode, focusing on tool types, documented learning gains, pedagogical benefits, risks, and best practice guidelines. The review concludes that AI tools can significantly support process-based output in writing, learner autonomy, and personalized feedback.

Keywords: *Artificial Intelligence; writing skills; English Language Teaching; Engineering Undergraduates; Academic Integrity; Generative AI.*

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Introduction

Engineering programs are placing increasing importance on written communication as a key graduate attribute. However, many undergraduates continue to struggle with producing texts in English that are clear, coherent, and appropriate for their intended audience. These challenges are often intensified for students learning English as a Foreign Language (EFL) or as a Second Language (ESL), where limited exposure and the pressure of high stakes assessments contribute to heightened anxiety and entrenched errors.

At the same time, AI-powered writing tools including grammar checkers, paraphrasing applications, and large language model (LLM) based chat-bots have become widely available, sparking debate over whether they serve to strengthen or weaken students' writing development.

From the perspective of English Language Teaching (ELT), the critical issue is not whether students will adopt AI tools, but how these technologies can be integrated to reinforce, rather than replace, essential processes such as planning, drafting, revising, and reflecting. This review draws together recent empirical and conceptual studies on AI-assisted writing in higher education and ELT, with particular attention to its implications for improving the English writing skills of undergraduate engineering students.

Theoretical and ELT Framework

In English Language Teaching (ELT) research, writing is generally understood not as a single finished product but as a **dynamic process shaped by cognitive, linguistic, and social influences**. This perspective underlies approaches like *process writing*, *genre based pedagogy*, and *sociocultural theory*, all of which highlight the value of **multiple drafts, guided revision, and structured support** that aligns with what learners are ready to achieve next, often described through Vygotsky's *zone of proximal development* concept, where learners perform best with appropriate guidance and scaffolding from teachers or peers.

These frameworks also stress the importance of **awareness of audience, communicative goals, and genre conventions** in writing instruction, encouraging learners to attend to both the purpose of their texts and the linguistic choices that shape meaning.

Within this kind of instructional environment, **AI tools can act as supplementary mediators**, offering additional language examples, feedback on form and content, and extra opportunities for practice.

For engineering undergraduates, an ELT informed perspective highlights the value of understanding specific genres such as lab reports, design proposals, and technical descriptions which demand not only specialized vocabulary but also appropriate rhetorical structures. Consequently, AI tools should be integrated into activities that emphasize the distinctive features of these genres and the kinds of thinking required in the discipline, rather than being used only as generic grammar or language checkers.

Types of AI Tools for Writing

Recent studies identify three main categories of AI tools used by university students for writing.

Grammar and style checkers deliver instant feedback on issues such as grammar, spelling, punctuation, and overall writing style. By identifying problems like wordiness or lack of clarity, they help writers refine drafts and eliminate surface level mistakes.

Paraphrasing and summarization tools are designed to rephrase sentences or compress lengthy passages into concise versions. These tools can enhance variety and brevity, but they also carry the risk of being misused to conceal weak comprehension or avoid genuine practice in paraphrasing.

Generative conversational systems powered by large language models can produce ideas, outlines, and complete paragraphs. They also provide interactive explanations and feedback, making them particularly impactful in extended, tutorial style exchanges.

For engineering students, all three categories of tools are highly relevant to routine academic and professional tasks, including lab report preparation, project documentation, technical explanations, and professional email writing.

Empirical Evidence on Writing Improvement

A growing number of studies indicate that **when AI-assisted writing is used in ways that are clear and well guided, it can have beneficial effects on students' English writing performance**. Research comparing groups of students who receive AI feedback with those who experience only traditional instruction has found that those using AI tend to make **notable improvements in grammatical accuracy, vocabulary use, and overall quality of their texts**. Additionally, learner surveys consistently show that many students appreciate AI tools for the **instant feedback, error detection, and time savings** they provide, especially during revision under tight deadlines.

At the same time, the evidence regarding **higher order writing skills** such as argumentation, critical thinking, and genre specific awareness is more complex. Some research suggests that AI can assist with **idea generation and macro level organization when it is explicitly used for tasks like brainstorming and outlining**, but other findings raise concerns that **excessive reliance on AI may encourage formulaic writing and reduce deeper engagement with source materials**.

Longer term studies also point to potential benefits of **sustained, reflective use of AI feedback**, such as enhanced self editing abilities and greater confidence in writing, though **clear evidence of lasting improvements in unaided writing without AI support remains limited**.

AI Tools in ELT and Engineering Contexts

Systematic reviews of AI in English language teaching show that writing support is among the most common applications, particularly at tertiary level. ELT oriented studies report that AI assisted writing can help learners notice recurrent errors, practice more complex structures, and receive more frequent feedback than teachers alone can provide. In contexts where class sizes are large and teacher workload is high, AI tools can function as supplementary tutors that increase opportunities for practice and revision.

For engineering undergraduates, AI tools have been used to support tasks such as drafting abstracts, refining methodology descriptions, and improving clarity in design reports. Research suggests that, when assignments explicitly highlight disciplinary genres, AI assistance can help students better articulate problem statements, justify design decisions, and summarize findings for technical and non-technical audiences. Nevertheless, disciplinary faculty often express concerns about accuracy, over simplification of complex concepts, and the risk that students accept AI generated technical explanations uncritically.

Pedagogical Benefits

Three major pedagogical benefits recur across ELT and higher education studies.

- **Enhanced feedback and revision:** AI tools deliver instant, personalized feedback on language accuracy and, increasingly, on organization and coherence. This enables students to revise their work through multiple cycles, while allowing instructors to concentrate on deeper aspects such as content, reasoning, and disciplinary conventions.
- **Learner autonomy and affective support:** Students often report feeling more confident and less anxious when they can consult AI before receiving teacher evaluation, particularly in high stakes assignments. Access to private, on demand assistance encourages them to experiment with new vocabulary and structures, fostering independence in learning.
- **Personalization and data informed learning:** Many AI systems detect recurring error patterns and provide tailored recommendations, aligning with calls in English language teaching for adaptive, needs-based instruction. For engineering cohorts with diverse linguistic backgrounds, such personalization can help reduce proficiency gaps and promote more equitable learning outcomes.

Risks, Limitations, and Academic Integrity

At the same time, research consistently highlights significant risks that must be addressed. Excessive dependence on AI for generating ideas or producing text can diminish students' involvement in planning, critical reading, and independent problem solving, thereby undermining essential writing and thinking skills. Evidence also suggests that some learners present AI-generated material as their own, raising serious concerns about plagiarism, authorship, and academic integrity.

Policy and legal perspectives stress the importance of establishing clear institutional guidelines for AI-assisted academic writing. These include rules on disclosure, acceptable levels of support, and data protection. Further challenges involve the risk of inaccurate or fabricated content, biased language patterns, and limited sensitivity to local academic conventions all of which necessitate careful human oversight. Moreover, unequal access to paid AI services may exacerbate disparities among students with differing resources.

Best Practice Guidelines for ELT in Engineering Education

- **Integrate AI into process writing:** Courses should require students to document their writing journey, including early drafts, AI generated prompts, and subsequent revisions. Making AI use a visible and assessable part of learning fosters metalinguistic reflection rather than passive reliance.
- **Emphasize higher order skills in the classroom:** While AI can appropriately support lower level language concerns, classroom instruction should prioritize argumentation, data commentary, and genre-specific

conventions in engineering writing. This ensures that reasoning and disciplinary literacy remain central to human teaching.

- **Develop critical AI literacy:** Students need explicit guidance on how to interrogate AI output, verify accuracy, identify fabricated references, and assess whether suggestions align with the assignment, audience, and disciplinary norms. Such training is essential for both
- **Align assessment with policy:** Evaluation should reward process, reflection, and oral defense of written work, reducing the incentive to depend on non-credited AI generated text. Course level policies must be consistent with institutional regulations and clearly communicate acceptable forms of AI assistance

Implications for Teachers and Institutions

The incorporation of AI tools into writing instruction is transforming both teaching roles and institutional responsibilities. Educators in ELT and engineering communication courses need continuous professional development to understand AI's capabilities and limitations, master prompt design, and address ethical considerations, while also learning effective strategies for classroom integration and assessment. At the institutional level, universities must establish transparent policies, ensure equitable access to approved tools, and promote research into context sensitive practices across disciplines and regions.

Evidence suggests that, when embedded within ELT informed, process oriented instruction and supported by strong governance, AI tools can significantly improve the English writing proficiency of undergraduate engineering students. The key challenge lies in leveraging these technologies to cultivate learner agency, critical thinking, and disciplinary literacy, rather than allowing them to undermine the very skills higher education aims to develop.

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