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STRATEGIC AI INTEGRATION FOR ENHANCING ENGLISH FOR SPECIFIC PURPOSES IN TECHNICAL UNIVERSITIES

Golub T.P.
PhD., as. prof.
ORCID: 0000-0002-7757-880X
National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute",
Kyiv, Prospect Beresteiskyi 37, 03056

Abstract. *The need for personalization, instant contextual feedback, and simulation of complicated professional communication settings frequently arises the question of the efficacy of English for Specific Purposes courses at technical universities. This paper studies the strategic use of artificial intelligence and Large Language Models as methodological tools for bridging instructional gaps and considerably improving the quality and relevance of English for Specific Purposes curriculum. We analyze four key areas of artificial intelligence application: automated needs analysis, personalized practice and contextual feedback, authentic communication simulation, and adaptive, data-driven assessment. Furthermore, we introduce the critical implementation and ethical challenges inherent in this transition. The research states that when artificial intelligence is systematically incorporated, it can serve as a powerful augmentative tool, improving linguistic accuracy, enabling autonomous learning, and increasing instructor efficiency by automating low-stakes, high-volume jobs. The study concludes that a comprehensive human-AI hybrid paradigm equips technical university graduates with communication abilities that can be directly applied to their specialized domains.*

Key words: *artificial intelligence, English for Specific Purposes, autonomous learning, adaptive assessment, higher education, educational technology.*

Introduction.

English for Specific Purposes (ESP) programs at technical universities are critical for teaching students to succeed in the global professional environment. Unlike General English classes which emphasise broad linguistic competence, English for Specific Purposes necessitates a sharp focus on the specific language, discourse markers, syntax, and rhetorical conventions required for navigating specialised fields such as computer science, mechanical engineering, biotechnology, etc. This specialisation requires students to understand not only terminology but also communicative acts specific to their prospective career such as submitting a project proposal, providing a technical defence, or negotiating an intellectual property agreement.

The primary challenge for ESP teachers stems from two realities: first, the need to maintain contextual validity in the face of the rapid, often nonlinear, evolution of specialized professional communication; and second, the difficulty of providing

individualized feedback across complex, discipline-specific tasks in large class settings. Traditional, static curricula struggle to stay current and relevant, frequently resulting in a perceived disconnect between classroom learning and industry expectations (Swales, 2014). The pedagogical gap is defined by an teacher's inability to access and assess the vast, constantly updated corpus of global professional communication needed to successfully guide the curriculum.

The advent of highly capable Artificial Intelligence (AI), particularly Large Language Models (LLMs) and advanced machine learning techniques, offers a new paradigm for addressing these critical challenges. Artificial intelligence tools can analyze massive datasets of technical discourse, provide instant and iterative feedback scaled to thousands of students, and create highly realistic communicative environments.

This article seeks to move beyond general discussions of artificial intelligence applications in language learning to propose a systematic framework for integrating AI specifically to improve the pedagogical integrity, efficiency, and outcome relevance of ESP courses in technical university settings. This approach ensures that graduates are genuinely prepared for the linguistic demands of the 21st-century technical workforce.

Main text.

The strategic integration of artificial intelligence can improve the English for Specific Purposes course across four critical phases: curriculum design, personalized practice, authentic simulation, and continuous evaluation. A fundamental principle of effective ESP is a Needs Analysis (NA) – the process of identifying what students need to learn to perform a specific job or academic task (Long, 2005). In its turn, artificial intelligence tools can enhance this process, ensuring that the curriculum reflects real-time, current industry demands and learner characteristics.

Adaptive AI platforms can analyze extensive student intake data, including prior language test scores, departmental major, specific program track, and declared career goals, to create nuanced, multi-dimensional learner profiles. This rich data allows the course structure to dynamically adjust content modules for students. For instance, a profile indicating an aspiration toward consultancy might trigger an increase in

modules focused on oral presentation and persuasive argumentation skills, whereas a profile targeting research and development would prioritize complex report writing and analytical summary skills. Thus, artificial intelligence ensures personalization at scale, going beyond simple placement tests.

In their turn, LLMs and specialized computational linguistics tools can be trained on proprietary or publicly available corpora of current technical discourse, including patents, open-source code documentation, regulatory filings, and professional correspondence from relevant industries (for instance, aerospace, software development). Artificial intelligence performs n-gram analysis and collocational pattern extraction to map the linguistic landscape of a target profession. This allows teachers to identify and prioritize the most frequently used vocabulary and lexical bundles, isolate key functional language, and determine the prevalent rhetorical moves that are specific to document genres (for example, the structure of an engineering feasibility report versus a software bug report).

At the same time, artificial intelligence's generative capabilities are transformative for material development. Thus, artificial tools can instantly generate authentic, field-specific reading comprehension texts, listening exercises based on synthesized technical conversations, or context-specific gap-filling exercises. Crucially, this content creation can be iterated on demand, allowing the teacher to rapidly produce materials based on a newly emerged technical concept, reducing the teacher's time spent on creating bespoke materials and ensuring maximum contextual relevance and topical currency.

The highest-impact practical use of artificial intelligence is in providing high-volume, low-stakes, and highly personalized feedback on technical communication tasks. This capability overcomes the critical limitation of a single human teacher's capacity to provide the frequent, detailed feedback necessary for mastering the language.

For instance, students can submit drafts of complex technical documents such as abstracts, lab reports, patent applications, or proposals to an LLM-based tool. This tool is programmed not just with standard grammar rules but also with specific ESP style

guides like APA for engineering, IEEE citation style, departmental style guides, etc. And the AI can provide instant feedback categorized by an established error taxonomy, like:

- mechanical errors (spelling, grammar, punctuation);
- stylistic errors (vagueness, wordiness, inappropriate passive voice use, etc.);
- structural or rhetorical errors (for example, deviations from the required IMRaD structure, missing key moves in an abstract). This iterative, automated process allows students to refine their work independently up to 80% of common errors can be corrected before submission freeing the human teachers to focus on higher-order issues like content clarity, logical argument flow, and critical analysis.

For computer science and software engineering students, artificial intelligence can extend to reviewing accompanying documentation, README files, or comments written in English. The AI assesses clarity, conciseness, and adherence to industry documentation standards, thus providing a unique form of feedback that bridges the gap between coding skills and practical linguistic output, a skill that is often overlooked in traditional ESP course.

In its turn, a specialized AI speech-analysis software can analyze a student's delivery of technical presentation scripts, focusing the feedback specifically on the clear articulation of field-specific terminology, pacing, and the appropriate use of emphatic intonation necessary for professional delivery. This targeted practice ensures the student is prepared for high-stakes oral communication in technical conferences and meetings.

Besides, AI-powered conversational agents can move beyond simple, scripted chatbots to create sophisticated, context-aware simulation environments for communication practice, a pedagogical necessity recognized by Yang et al. (2024). Thus, students can be engaged in simulated technical negotiations or critical discussions, such as discussing project timelines, resolving design conflicts or pitching a new product with an artificial intelligence agent. This agent is programmed with a deep, persistent persona, adopting the role of a skeptical client, a demanding

supervisor, or a non-native English-speaking international collaborator. To provide these, the artificial intelligence utilizes a context memory to maintain a consistent conversational history. It is trained to recognize and respond appropriately to technical jargon and industry acronyms, providing genuine communicative pressure and validating the student's knowledge of their future speciality. And at last, the system evaluates the student's affective language use, noting the tone and formality of their language.

Artificial intelligence can also conduct realistic mock technical job interviews in English. Thus, the system dynamically adapts follow-up questions based on the student's previous answers, testing their ability to articulate complex technical concepts under pressure, discuss their resume, and manage professional discourse which is a really essential element career readiness notifier of students. The artificial intelligence can also generate a post-interview analysis reports, rating the student on clarity, confidence, content depth, and professional language use.

In these high-fidelity simulations, the artificial intelligence is configured to not only correct surface-level grammatical errors but also to flag pragmatic failures, such as using inappropriate levels of directness, making unverified assumptions, or using overly informal language in a professional context. This trains students in cross-cultural communication competence, preparing them for interactions in diverse global technical teams where linguistic effectiveness depends heavily on contextual and cultural sensitivity.

In this way, artificial intelligence facilitates a critical shift from traditional summative, endpoint assessments to continuous, adaptive evaluation focused on core, measurable competencies developed while studying English for specific purposes. Thus, AI-driven platforms continuously log and tag student performance data across various tasks: writing, speaking, and simulation outcomes and as a result can create a multi-dimensional competency profile for each student. While doing it, the system uses predictive analytics to:

- highlight specific, persistent linguistic deficiencies such as, for instance, consistent misuse of the conditional tense in risk assessment or inappropriate

modal verbs in recommendation sections;

- automatically generate remedial practice modules tailored to the exact skill gap;
- provide the teacher with a class-wide heatmap of learning outcomes, identifying modules that have to be improved, rearranged or remade.

Artificial intelligence can also handle objective grading of specific tasks, such as technical summaries and objective report sections, using such pre-defined scoring models as, for example, analytic rubrics that focus on coherence, cohesion, and vocabulary density. This reduces potential subjective human bias and ensures consistent application of the grading rubric for structural and mechanical errors. In such a way, while the teacher remains essential for qualitative and content-level evaluation, the artificial intelligence handles the quantitative groundwork, speeding up the assessment cycle. At the same time, aggregating and anonymizing student performance data across multiple cohorts provides powerful quantitative evidence of curriculum gaps, strengths, and overall efficacy. This allows English for specific purposes program coordinators to engage in continuous curriculum validation, modifying course design based on empirical results from thousands of data points rather than unproven evidence. This data also enables longitudinal tracking of skill development, tying specific linguistic interventions to long-term professional outcomes (Li et al., 2025).

The deployment of artificial intelligence in technical university English for Specific Purposes courses, while being very promising, is not without significant practical and ethical drawbacks that must be addressed for its successful and equitable integration. Thus, the reliance on artificial intelligence platforms necessitates the collection and analysis of extensive student performance data, including transcripts of speech and written work. Looking back on these, technical universities have to implement data governance policies to address the following:

- Security. For ensuring that students' data is protected against breaches, especially when using third-party AI vendors;
- Anonymization. For properly anonymizing performance data before using it for curriculum validation or research;
- Consent and Ownership. For clearly defining who owns the linguistic output

generated by the student and the performance data derived from it.

Moreover, successful integration of artificial intelligence requires significant institutional investment and strategic planning. It includes: infrastructure – ensuring reliable network access and computing resources across campus, especially for running high-fidelity simulations or VR-based training; teacher training, as ESP teachers require comprehensive training not only in the technical use of artificial intelligence tools but also in AI literacy – understanding how the models work, interpreting the AI-generated data, and knowing when to override or ignore automated feedback; and access equity that ensure that all students, regardless of their social and economic background or prior technological exposure, have equitable access to AI-powered learning resources, preventing the exacerbation of an existing digital divide.

At the same time, Large Language Models are trained on vast, often general, internet corpora, which introduces the risk of algorithmic bias. This can cause several problems within an English for specific purposes context. One of the issues is jargon misinterpretation. The artificial intelligence may interpret valid, discipline-specific technical jargon, acronyms, or stylistic conventions like heavy use of nominalization in scientific writing as incorrect or overly complex because they deviate from general language patterns. Another problem may be cultural bias, when simulation agents may rely on culturally biased models of professional behaviour, potentially penalizing non-Western communication styles in a global ESP environment. Teachers have to actively check and control artificial intelligence models using a curated corpus of field-specific, verified professional documents to minimize these issues and ensure the artificial intelligence reinforces appropriate norms of English for specific purposes.

The integration of artificial intelligence fundamentally redefines the roles of both the student and the teacher in the English for specific purposes environment, fostering a dynamic human-AI hybrid model. Thus, artificial intelligence tools promote self-regulated learning by making the learning process entirely transparent, customizable, and instantly actionable. Students receive instantaneous, consistent, and non-judgmental feedback on their technical communication output, encouraging more frequent practice and iterative refinement. By automating responsibility for mechanical

error correction and basic skill repetition, artificial intelligence forces students to transition from being passive recipients of instruction to active managers of their linguistic progress and professional development. This shift is particularly valuable in technical education, where independence, iterative design, and problem-solving are highly prized professional attributes. Students gain a level of agency over their learning path previously unavailable in traditional classrooms.

By automating time-intensive tasks, such as grading first drafts, correcting low-level grammar errors, creating customized practice sets, and basic data compilation, artificial intelligence significantly reduces the administrative and repetitive work of English teachers. This automation is critical, as it allows the human teacher to reallocate their expertise to tasks that demand higher-order cognitive interaction and human judgment. Thus, the teacher gets a possibility to focuse more on the rhetorical effectiveness, ethical implications, criticality, and nuance of complex technical communication like assessing the persuasive power of a funding application or the clarity of a safety warning. The teacher also gets more time for leading debates, organising critical reading sessions, advanced intercultural communication workshops, and ethical discussions that require human emotional intelligence and real-time adaptability.

The resulting hybrid model leverages the computer for efficiency, scale, and objective data analysis, while simultaneously retaining the human teacher for motivation, empathy, context interpretation, and the facilitation of complex critical thinking and socio-pragmatic competence. This transition requires the teacher to evolve from a content provider to a communication creator and mentor.

Summary and conclusions.

The integration of Artificial Intelligence offers an unparalleled opportunity to modernize and enhance English for Specific Purposes courses in technical universities. By applying artificial intelligence systematically across automated needs analysis, personalized practice, authentic simulation, and adaptive assessment, English for Specific Purposes programs can move decisively from generalized instruction to hyper-contextualized, data-driven education.

While the implementation presents significant challenges including managing data privacy, mitigating algorithmic bias, and ensuring institutional readiness, these are navigable through targeted policy and robust technical solutions. The effective usage of artificial intelligence does not mean the replacement of the human teacher; rather, it empowers them to focus their specialized expertise on the qualitative, contextual, and ethical aspects of communication that computers cannot yet replicate. The future success of technical university graduates in the global workforce depends on their ability to communicate effectively and strategically in English for their specific field. Artificial intelligence provides the necessary technological scaffolding to ensure that English for Specific Purposes courses deliver on this critical educational manner, creating a generation of highly competent, linguistically and digitally fluent technical professionals.

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Анотація. *Потреба в персоналізації, миттєвому контекстному зворотному зв'язку та моделюванні складних професійних комунікативних умов часто викликає питання ефективності курсів англійської мови для спеціальних цілей у технічних університетах. У цій статті досліджується стратегічне використання штучного інтелекту та моделей великих мов як методологічних інструментів для подолання прогалин у навчанні та значного покращення якості та актуальності навчальної програми з англійської мови для спеціальних цілей. Стаття аналізує чотири ключові сфери застосування штучного інтелекту: автоматизований аналіз потреб, персоналізована практика та контекстний зворотний зв'язок, моделювання автентичного спілкування та адаптивне оцінювання на основі даних. Крім того, в статті представлено критичні проблеми впровадження та питання етики, які характерні для цього переходу. У дослідженні стверджується, що коли штучний інтелект систематично впроваджується, він може служити потужним допоміжним інструментом, покращуючи лінгвістичну точність, забезпечуючи автономне навчання та підвищуючи ефективність викладачів шляхом автоматизації великих за обсягом завдань. У дослідженні робиться висновок, що комплексна гібридна парадигма людини та штучного інтелекту сприяє сформуванню комунікативних здібностей у студентів технічних університетів, які вони зможуть безпосередньо застосовувати в їхній подальшій професійній діяльності.*

Ключові слова: *штучний інтелект, англійська мова для спеціальних цілей, автономне навчання, адаптивне оцінювання, вища освіта, освітні технології.*

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