Integrating AI into English for Electrical Engineering and Information Technology Learning Materials

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Abstract

Integrating artificial intelligence (AI) into English for specific purposes (ESP) teaching and learning offers promising advancements in developing learning materials tailored to specialised fields like electrical engineering and information technology. This study explores the application of ChatGPT, text-to-speech (TTS) and AI image generation technologies in designing ESP learning materials that enhance reading, listening, writing, and speaking skills, focusing on effective technical vocabulary learning. While ChatGPT's natural language processing capabilities enable the generation of context-specific texts, interactive writing prompts, personalised reading comprehension tasks and speaking activities, TTS applications provide authentic listening experiences through dynamic audio content, enhancing students' listening and pronunciation skills. The paper outlines methods for designing integrated language tasks using different AI tools, emphasising task authenticity, adaptability, and student engagement. It examines the pedagogical implications of using AI-driven tools in ESP, highlighting their potential for fostering autonomous learning and enhancing technical communication skills. The author addresses challenges related to content authenticity, task complexity, and technology integration, offering practical recommendations for ESP teachers. A questionnaire survey among 127 ESP teachers revealed that only 20 use AI in developing learning materials. The findings indicate that AI is primarily employed to enhance efficiency and creativity in generating texts and tasks, yet challenges such as accuracy, interactivity and real-world authenticity persist. The implications suggest that while AI enhances efficiency and content diversity, educators must critically assess its limitations. Future research should address AI's pedagogical impact and develop strategies for its optimal integration into ESP instruction.

Keywords: *ESP learning materials, ChatGPT, text-to-speech applications, AI image generation, language skills, specialised vocabulary, questionnaire survey*

1. Introduction

English for specific purposes (ESP) is a specialised branch of English language teaching that equips students with the language skills necessary for specific professional or academic fields such as engineering, medicine, law, or business [2, 3, 5]. At technical universities, ESP is crucial in preparing students for the global job market by providing them with the language proficiency required in their respective domains. Integrating artificial intelligence (AI) and natural language processing (NLP) technologies has significantly transformed the educational landscape. Among these technologies, OpenAI ChatGPT has emerged as a powerful tool for both teaching and testing ESP. ChatGPT is a conversational AI model that generates human-like text based on user prompts. Its ability to understand and produce text in various contexts makes it a valuable resource for ESP teachers and students [6, 15, 18]. On the other hand, TTS applications provide authentic listening experiences through dynamic audio content, enhancing ESP students' listening and pronunciation skills. Besides, integrating AI image generation technologies into developing ESP learning materials enhances visual context, making abstract concepts more accessible and engaging. This approach supports customised content creation, aligning educational resources with students' professional and academic needs.

Using ChatGPT in English for electrical engineering and information technology offers numerous possibilities for enhancing language skills and acquiring specialised vocabulary. ChatGPT can generate technical vocabulary lists, explain complex technical terms in simple English, and create context-specific tasks to practise technical reading, listening, writing and speaking. It can simulate real-life communication scenarios, like troubleshooting conversations or project discussions, helping students practice technical English in academic and professional contexts. Additionally, it can provide instant grammar and style feedback on students' written assignments. By customising lessons based on student-specific needs, ChatGPT supports personalised learning, making English instruction more engaging and relevant to their field [14, 25]. This paper examines a variety of approaches for using AI-

driven tools in ESP learning materials development, highlighting their potential for fostering autonomous learning and enhancing technical communication skills.

2. Chat GPT in ESP Learning Materials Development

2.1 Using Chat GPT to Design Reading Tasks

ESP teachers can leverage ChatGPT to design tailored and engaging reading tasks for their students [10, 21]. To generate domain-specific reading texts, teachers can provide ChatGPT with details about the students' field, such as electrical engineering or information technology, and their proficiency level. They can then request short articles, case studies, or reports on industry-relevant topics. For instance, they might ask ChatGPT to write a 300-word article on the latest trends in renewable energy technologies for intermediate-level students studying English for electrical engineering. The output can be used as a primary reading task to help students become familiar with field-specific content and vocabulary.

To assess comprehension, teachers can ask ChatGPT to generate comprehension questions based on a text they provide or one that ChatGPT generates. For example, they might request true/false, multiple-choice or open-ended questions based on a specific text to assess students' understanding and critical thinking. Teachers can also design vocabulary gap-fill tasks paired with the reading by asking ChatGPT to create tasks focused on domain-specific terminology.

If a text is too complex for students' proficiency level, teachers can ask ChatGPT to simplify it. For example, they might provide an article on the operating principle of a DC motor and ask ChatGPT to simplify it for pre-intermediate students. The adapted texts can gradually introduce students to challenging topics. Additionally, ChatGPT can generate pre-reading activities to activate students' prior knowledge, such as lead-in questions and brainstorming tasks that set the context for the reading. These activities engage students and prepare them for the content.

ESP teachers can also combine ChatGPT-generated tasks with real-world materials like industry reports, technical manuals, or emails to provide students with authentic content. By engaging students actively and incorporating their ideas or questions into tasks, teachers can enhance the learning experience. By creatively using ChatGPT, ESP teachers can streamline the design of reading tasks, making them more aligned with their students' professional and linguistic needs.

2.2 Using Chat GPT to Design Listening Tasks

ESP teachers can use ChatGPT to design listening tasks tailored to their students' professional or academic needs. One way to do this is by generating authentic listening transcripts based on real-world scenarios specific to students' fields. For example, teachers can ask ChatGPT to create a conversation between an electrical engineer and a technician troubleshooting a circuit malfunction or to generate a team meeting script where information technology specialists discuss the progress of a software development project. Requesting multiple versions of these transcripts can help introduce variety and design listening comprehension, providing authentic, context-specific dialogues that reflect workplace conversations.

In addition, teachers can use ChatGPT to create pre-listening activities by generating vocabulary lists and explanations for key terms in the listening transcript. They can also request discussion questions related to the topic, such as asking students what challenges engineers might face when troubleshooting a power failure in a smart grid or prompting predictions like what solutions developers could propose to enhance cybersecurity in a new software application. These engaging activities prepare students for listening, providing a strong foundation for the task.

Once the listening task is ready, teachers can use ChatGPT to generate comprehension questions, including true/false and multiple-choice questions to test understanding or higher-order thinking questions that require students to analyse scenarios, like asking about the possible consequences of ignoring advice. Teachers can also request questions focused on specific skills, such as identifying key details in a conversation. These tasks ensure a range of question types that assess understanding, inferencing, and critical thinking.

ChatGPT can customise listening tasks for various proficiency levels by adjusting the complexity of transcripts. Teachers can ask for simplified versions for intermediate students or more technical transcripts for advanced students. Requesting multiple versions, such as beginner, intermediate, and advanced versions of the same script, ensures that tasks are suited to students' proficiency levels, offering a challenge that matches their skills.

ChatGPT can also simulate accents and pronunciation by generating transcripts with instructions for text-to-speech tools to mimic specific accents or speech patterns. For example, teachers can request a conversation between a British electrical engineer and an American project manager, highlighting technical terminology, regional vocabulary, or idiomatic expressions related to engineering projects. This exposure to diverse accents and speaking styles is highly relevant for industries where international technical collaboration occurs frequently.

Regarding audio content creation, ChatGPT can generate transcripts that can be paired with TTS applications [8, 9, 10, 17, 19, 22, 23], which offer MP3 download options. This provides students with high-quality listening materials that replicate real-world conversations. Many TTS tools also allow users to select different accents, such as American, British, or Australian, helping students adapt to regional variations common in specific industries. This can be particularly useful for authentic pronunciation practice. For example, NaturalReader supports multiple languages and voices and is ideal for creating professional-sounding materials. It offers MP3 downloads in its free version, although with limited features. Similarly, ttsMP3 allows quick TTS conversion with natural voices and supports MP3 downloads with no sign-up required. FreeTTS offers a simple interface with support for multiple languages and direct MP3 downloads. TTSMaker allows users to adjust voice speed, volume, and pitch and supports downloading audio files in MP3 format. Balabolka is a desktop application for Windows that supports multiple TTS engines and MP3 export. Murf provides a wide range of natural-sounding voices tailored for specific purposes, such as monologues, dialogues, or group discussions and allows MP3 export. However, the free version of Murf has limitations on the number of downloads and voice options.

To support post-listening activities, ESP teachers can ask ChatGPT to generate clean, formatted transcripts for tasks like fill-in-the-blank activities. These transcripts make it easier for students to review the listening content and focus on details they may have missed during the initial listening.

2.3 Using Chat GPT to Design Writing Tasks

ESP teachers can effectively use ChatGPT to design and enhance writing tasks tailored to students' professional or academic needs [7, 13]. ChatGPT might suggest tasks such as writing a technical report on circuit design improvements, drafting a memo about updated electrical safety standards, or composing an email summarizing project milestones for a power system installation. It can also provide scaffolding for more complex writing tasks by breaking them down into manageable steps. For instance, when writing a technical report on a new electrical circuit design, it might guide students through the process by suggesting steps such as outlining the introduction, explaining the underlying principles, describing the design and its components, providing performance testing results, and summarizing with a conclusion and recommendations for future improvements.

Teachers can use ChatGPT to generate model answers, offering sample responses to serve as examples for students. For example, it could create a detailed cover letter for an engineering job application, showcasing proper structure, tone, and industry-specific terminology. When students draft their writing, teachers can ask ChatGPT to provide constructive feedback and suggestions, highlighting grammar issues, tone mismatches, or areas for structural improvement. ChatGPT can create writing tasks, such as gap-fill tasks or key word transformations. For instance, it might generate a gap-fill task for information technology students on software installation procedures, prompting students to complete sentences with appropriate technical vocabulary.

Moreover, ChatGPT can simulate collaborative technical writing scenarios, where students collaborate on a shared piece of writing, and cross-cultural writing contexts by providing tips for localizing website content and writing business emails with cultural considerations, such as using formality and honorifics when writing to clients in Japan. It can also generate a rubric for evaluating technical texts with categories such as conciseness, clarity and accuracy.

2.4 Using Chat GPT to Design Speaking Tasks

ESP teachers can leverage ChatGPT in several innovative ways to design speaking tasks that are engaging and relevant to the specific needs of their students. ChatGPT can create speaking tasks based on real-world professional contexts, such as generating role-play scenarios, including role-play cards for different students. Teachers can adjust the difficulty of the task and provide the necessary context.

ChatGPT can also facilitate interactive discussions in ESP classes by presenting questions or scenarios that prompt student interaction. For instance, in an English class for electrical engineering

students, ChatGPT might ask, "How would you explain the working principle of a transformer to a non-engineer?" or "What safety precautions should you follow when working with high-voltage equipment?" Teachers can guide the discussion, encouraging students to express their ideas clearly and use relevant terminology. Furthermore, ChatGPT can structure debates around current issues or topics relevant to a specific industry. For example, in English for information technology, ChatGPT could generate a debate proposition about the ethical implications of artificial intelligence in the workplace, asking students to argue whether AI should replace human jobs in critical sectors such as healthcare and cybersecurity. Teachers can guide students in structuring their arguments, using formal language, and presenting points logically.

2.5 Using Chat GPT for Specific Vocabulary Learning

ESP teachers can effectively use ChatGPT to design tasks that target specialised vocabulary practice in an engaging and relevant way to the students' professional context [20]. Teachers can prompt ChatGPT to generate a vocabulary list specific to a particular topic with definitions or synonyms and example sentences for each term, which helps students understand and remember key terms. ChatGPT can be used to design fill-in-the-blank, multiple-choice or matching tasks where students practice vocabulary in context. Teachers can also design translation tasks where students translate vocabulary into their native language, helping them connect professional terms with their first language. Word association tasks are another tool that ChatGPT can generate, where students match terms to their correct definitions or contexts. These tasks encourage students to solidify their understanding of vocabulary by linking terms with their meanings.

TTS applications can be valuable tools for teaching ESP vocabulary by providing accurate pronunciation models. Students can hear specialised terms in context, helping them develop listening and speaking skills relevant to their professional fields. As mentioned in Section 2.2, some TTS applications offer customisable voice settings, enabling students to practice with different accents and speech rates for more authentic language exposure.

3. AI Applications for Designing Visual ESP Learning Materials

AI applications can significantly enhance the design of visual ESP learning materials by automating processes, generating industry-specific visuals, and improving the overall learning experience. AI tools like DALL-E and DeepAI can design high-quality, relevant images based on specific prompts, helping ESP teachers create visuals that reflect industry-specific contexts, such as medical diagrams, business workflows, technical blueprints, or legal scenarios [1, 4]. For example, if a teacher designs a lesson on electrical engineering, they could generate visuals of circuit diagrams, electrical components, or power systems to support vocabulary learning. Following the detailed descriptions, such as "Create an illustration of a power distribution panel with labelled circuit breakers and wiring connections," the AI generates an image based on those inputs. These visuals help students connect vocabulary with real-world contexts, aiding comprehension.

Lucidchart can automatically generate flowcharts, organizational charts, and diagrams to visually represent processes or systems specific to an industry [16]. For example, in an engineering course, teachers can use these tools to design flowcharts showing processes like production lines or troubleshooting steps. Teachers input a list of steps or processes, and AI suggests visual flow or chart designs that assist teachers in helping students understand and memorize the steps involved in specific professional tasks.

AI-powered platforms like Genially or H5P allow teachers to create interactive visual content, such as clickable images, hotspots, and quizzes, engaging students in a way that enhances immersion [11, 12]. For example, a teacher could design an interactive infographic that explains the components of a business report, where students can click on different sections to see definitions and examples. Teachers create base visuals, and AI suggests interactive features like text annotations, image pop-ups, or clickable elements. Learners can engage directly with these visuals, reinforcing vocabulary and concepts through interaction.

AI applications in virtual reality (VR) and augmented reality (AR), such as zSpace [24], enable ESP teachers to create immersive 3D environments. These can be particularly useful for teaching industry-specific scenarios like electrical installations, circuit troubleshooting, or power system maintenance. For example, a VR module could allow students to practice conducting safety inspections in a virtual electrical substation or participate in a simulated power outage response. Teachers can design 3D

models or environments using AI tools, creating scenarios that students can navigate and then interact with the environment, exploring industry-specific vocabulary in a hands-on, immersive way.

4. Research on AI Use for ESP Learning Materials Development at Technical Universities

The research investigated using AI tools, such as ChatGPT and text-to-speech software, to design ESP learning materials at technical universities in the Czech Republic, Slovakia and Poland. A questionnaire survey (see Table 1) was conducted among 127 ESP teachers, of whom 20 admitted using AI for learning materials development. The survey aimed to explore the frequency of AI use, the motivations behind its adoption, and the challenges faced in implementing AI-generated content across reading, listening, writing, and speaking tasks.

Table 1. Use of AI in ESP Learning Materials Design by Teachers at Technical Universities

Questions and Answers	Frequency [%]
1) How often do you use AI tools like ChatGPT or text-to-speech software in designing learning materials?	
a) Rarely (a few times a year)	20
b) Occasionally (once a month)	30
c) Frequently (weekly)	35
d) Always (daily)	15
2) What is your main reason for using AI in learning materials design?	
a) To save time and effort.	40
b) To generate ideas and diversify content.	35
c) To create more engaging and interactive materials.	25
d) To align with modern teaching methodologies.	0
3) How do you use AI tools in designing reading materials?	
a) I do not use AI for this purpose.	15
b) To generate full reading texts.	20
c) To summarize or adapt existing texts.	30
d) To create comprehension questions and activities.	35
4) What challenges do you face when using AI for reading materials?	
a) AI-generated texts may lack accuracy or coherence.	25
b) AI content lacks domain-specific language nuances.	30
c) AI does not align well with learning objectives.	20
d) I have no challenges using AI for reading materials.	25
5) How do you use AI for designing listening materials?	
a) I do not use AI for this purpose.	15
b) To generate scripts for listening exercises.	25
c) To create audio recordings with text-to-speech tools.	30
d) To generate comprehension questions and listening tasks.	30
6) What limitations do you experience with AI-generated listening materials?	
a) AI voices lack natural intonation and emotion.	30
b) Pronunciation errors occur in AI-generated speech.	10
c) AI-generated scripts lack real-world authenticity.	40
d) I do not experience significant limitations.	20
7) In what ways do you use AI for designing writing tasks?	
a) I do not use AI for this purpose.	20
b) To generate writing prompts and model answers.	25
c) To provide feedback on student writing.	30
d) To create structured writing frameworks and guides.	25
8) What are the main concerns about using AI for writing tasks?	
a) AI-generated texts lack human creativity.	25
b) AI may encourage plagiarism or over-reliance.	30
c) AI struggles with complex writing structures and rhetorical styles.	25
d) I have no concerns about using AI for writing tasks	20
9) How do you use AI in designing speaking tasks?	
a) I do not use AI for this purpose.	30
b) To generate dialogue prompts and conversation topics.	40
c) To create pronunciation and fluency exercises.	10
d) To develop AI-powered interactive speaking simulations.	20
10) What are the biggest challenges of using AI for speaking tasks?	
a) AI does not provide real-time interactive conversation practice.	30
b) AI-generated prompts may not match authentic speaking contexts.	35

c) AI feedback on pronunciation and fluency is not always accurate.	5
d) I do not experience significant challenges.	30

5. Discussion on AI Use in ESP Learning Materials Design

The findings from the questionnaire survey provide valuable insights into how ESP teachers at technical universities incorporate AI tools such as ChatGPT and text-to-speech software into their learning materials design. The data indicates that AI integration is becoming more common, although its adoption varies among teachers depending on their familiarity with the technology and perceived benefits.

Regarding the frequency of AI use, most teachers (35%) report using AI tools weekly, while 30% use them occasionally (once a month). However, a significant portion (20%) still rarely engages with AI, indicating that some educators may not yet be comfortable or familiar with these technologies. The primary motivations for using AI include saving time and effort (40%) and generating diverse ideas (35%), indicating that AI is perceived as a tool that enhances efficiency and creativity in material development.

Regarding reading materials, AI is most commonly used to create comprehension questions and activities (35%) or to summarize and adapt existing texts (30%). However, challenges persist, with 30% of teachers expressing concerns about AI-generated content lacking domain-specific language nuances, while 25% cite issues related to accuracy and coherence. These findings highlight a need for human oversight to ensure that AI-generated texts meet the linguistic and contextual demands of ESP learners.

For listening materials, AI is primarily used for creating audio recordings (30%) and generating comprehension tasks (30%). However, limitations such as a lack of real-world authenticity (40%) and natural intonation in AI-generated voices (30%) present challenges in developing high-quality listening exercises. These findings suggest that while AI can assist in script creation and task generation, it may not yet be fully reliable for producing authentic and engaging audio content.

In writing tasks, AI is commonly used for generating prompts (25%) and providing structured frameworks (25%). Concerns related to AI in this area include the potential for plagiarism (30%) and the lack of human creativity (25%). This suggests that while AI can support structured writing practice, there is a risk that students might over-rely on AI, potentially diminishing their ability to develop independent writing skills.

Finally, in speaking tasks, AI is used mainly to generate conversation topics (40%), while only 10% of teachers use it for pronunciation exercises. However, challenges include the inability to provide real-time interactive conversations (30%) and match authentic speaking contexts (35%). This indicates that AI's role in speaking activities is still limited and requires further advancements to improve its effectiveness in spoken language assessment and interaction.

6. Conclusion

The benefits of ChatGPT for ESP teachers include efficiency, as ChatGPT can quickly generate a variety of tasks, saving time on learning materials development. Additionally, the tool allows for customisation, enabling teachers to tailor tasks to suit students' professional fields and proficiency levels. Teachers can use ChatGPT to create dynamic and interactive tasks incorporating real-world language use, making specialised vocabulary learning more effective and enhancing the development of reading, listening, writing, and speaking skills in a relevant and engaging manner.

AI applications also offer ESP teachers several tools for designing and enhancing visual learning materials. From automated image and diagram generation to creating immersive VR environments, AI can help teachers make complex concepts in specialised fields more accessible and engaging. By incorporating these technologies, ESP teachers can provide students with a richer, more personalised learning experience that caters to diverse professional needs and learning styles.

The research findings highlight the growing integration of AI tools in ESP material design, enhancing efficiency and creativity. However, challenges like accuracy, authenticity, and over-reliance underscore the need for human oversight and balanced implementation. The research sample was very small because the survey addressed only 20 teachers who admitted using AI for learning materials out of all 127 respondents. This limited sample size may not fully represent the broader population of ESP teachers and their experiences with AI tools. Future research should include a larger and more diverse sample to gain a more comprehensive understanding of AI's role in ESP education.

Overall, while AI tools offer significant advantages in designing ESP learning materials, teachers must remain critical of their limitations and integrate them strategically to maximize learning outcomes. Continuous professional development should help educators navigate AI's challenges and leverage its full potential effectively.

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