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**Svitlana Nykyporets**
the senior English language lecturer,
Vinnytsia National Technical University,
Vinnytsia, Ukraine
*fotinia606@gmail.com*

# THE ROLE OF AI IN ENHANCING TECHNICAL VOCABULARY ACQUISITION AMONG ENGINEERING STUDENTS

***Annotation***. *This article explores the role of artificial intelligence in supporting technical vocabulary acquisition among engineering students. Through classroom integration of AI-powered tools – such as chatbots, personalized flashcards, and writing assistants – the study demonstrates how adaptive technologies can significantly improve both vocabulary retention and practical language use in engineering contexts. The findings highlight the pedagogical benefits of AI for individualizing instruction and bridging the gap between language learning and professional communication, while also outlining future directions for research and implementation.*

*The article also offers practical proposals for integrating AI into technical English curricula, including step-by-step implementation models, teacher training recommendations, and criteria for selecting effective AI tools. These proposals aim to guide educators and institutions in making informed decisions about using AI to enhance language instruction in engineering education.*

***Key words***: *artificial intelligence, technical vocabulary, engineering education, language acquisition, adaptive learning.*

***Анотація***. *У цій статті досліджується роль штучного інтелекту в підтримці засвоєння технічної лексики студентами інженерних*

*спеціальностей. Завдяки інтеграції в навчальний процес інструментів на основі штучного інтелекту – таких як чат-боти, персоналізовані картки та помічники для написання текстів – дослідження демонструє, як адаптивні технології можуть значно покращити як запам'ятовування лексики, так і практичне використання мови в інженерних контекстах. Результати дослідження підкреслюють педагогічні переваги штучного інтелекту для індивідуалізації навчання та подолання розриву між вивченням мови та професійним спілкуванням, а також окреслюють майбутні напрямки для досліджень і впровадження.*

*У статті також запропоновано практичні рекомендації щодо інтеграції ШІ в курси англійської мови майбутніх інженерів, включно з покроковими моделями впровадження, порадами для підготовки викладачів і критеріями вибору ефективних інструментів ШІ. Ці пропозиції мають на меті допомогти викладачам та освітнім закладам приймати обґрунтовані рішення щодо використання ШІ для вдосконалення мовного навчання в інженерній освіті.*

***Ключові слова**: штучний інтелект, технічна лексика, інженерна освіта, засвоєння мови, адаптивне навчання.*

**Introduction**. In today's rapidly evolving educational landscape, artificial intelligence (AI) has emerged as a transformative force, reshaping the way knowledge is accessed, processed, and retained. Nowhere is this impact more significant than in the realm of technical education, where the demand for precise and discipline-specific language proficiency is increasingly critical. For engineering students, acquiring technical vocabulary is not merely a linguistic challenge – it is a foundational skill that directly influences their ability to comprehend professional texts, engage with cutting-edge technologies, and participate in global scientific discourse.

Traditionally, the development of technical vocabulary has relied on textbook-centred learning, rote memorization, and classroom-based practice. While effective to some degree, these methods often fall short in addressing the individual learning

needs of students and the dynamic nature of technical terminology. In this context, AI-powered tools offer a promising alternative. Intelligent tutoring systems, adaptive learning platforms, natural language processing applications, and voice-assisted technologies can personalize vocabulary instruction, provide real-time feedback, and simulate authentic engineering communication scenarios.

This article explores the role of AI in enhancing technical vocabulary acquisition among engineering students, with a focus on its pedagogical potential, cognitive benefits, and practical applications in university classrooms.

Drawing on recent studies, classroom experiences, and pilot implementations in Ukrainian technical universities, we aim to critically assess how AI can bridge the gap between language learning and professional competence, preparing students to navigate the increasingly interdisciplinary and international demands of modern engineering practice.

The insufficient acquisition of technical vocabulary among engineering students remains [1] a persistent obstacle to their full participation in specialized academic and professional environments. This issue is closely connected to broader scientific and practical challenges in modern education, including the need for adaptive, technology-driven methods that align language instruction with the evolving demands of the engineering profession.

**The purpose of this article** is to investigate how artificial intelligence can effectively support the acquisition of technical vocabulary among engineering students, enhancing both their linguistic competence and professional readiness.

**Analysis of recent research and publications.** Recent scholarly investigations have increasingly focused on the integration of artificial intelligence (AI) to enhance technical vocabulary acquisition among engineering students. A study by Rousset et al. (2025) examined [2] the merging of general-purpose language models with domain-specific models, revealing that such integration pointedly improves the comprehension and usage of specialized engineering terminology.

In the realm of intelligent tutoring systems, Graesser et al. have developed [3] AutoTutor, which utilizes natural language dialogue to facilitate learning in subjects

like computer literacy and physics. This system has demonstrated substantial learning gains, particularly in deep reasoning tasks, highlighting the potential of AI-driven conversational agents in technical education.

Furthermore, Mzwri et al. (2025) conducted [4] a mixed-methods study on prompt engineering interventions, finding that targeted training enhances students' AI self-efficacy and their ability to craft effective prompts, thereby improving interactions with AI tools for learning purposes.

Despite these advancements, gaps remain in the literature concerning the long-term retention of technical vocabulary acquired through AI-assisted methods and the scalability of such interventions across diverse educational settings. This article aims to address these unresolved aspects by exploring sustainable and adaptable AI-driven strategies for technical vocabulary acquisition in engineering education.

**Presentation of the main material of the study**

To explore the practical impact of artificial intelligence on technical vocabulary acquisition, we conducted a semester-long study among third-year engineering students at a Ukrainian technical university. The study involved the integration of three AI-based tools into regular English for Specific Purposes (ESP) classes: a vocabulary-focused chatbot, a personalized spaced-repetition platform, and an AI-powered writing assistant with domain-specific terminology support.

**Example 1. Vocabulary chatbot with NLP capabilities.**

Students used a chatbot developed with GPT-4's natural language processing capabilities to simulate real-life engineering dialogues. For instance, power engineering students engaged in a series of scaffolded conversations about turbine systems, in which the chatbot would introduce and reinforce terms such as *rotor blade*, *fluid dynamics*, and *thermal efficiency*. These terms were chosen dynamically based on students' responses and misuses. After three weeks of guided use, 87,2% of students reported improved confidence in using technical terminology orally, while vocabulary test scores rose by 22,7% on average.

**Example 2. AI-enhanced spaced-repetition system.**

To improve long-term retention, we introduced a spaced-repetition tool that integrated with student-written lab reports. The AI extracts unfamiliar technical terms (e.g., *semiconductor substrate*, *Fourier transform*, *finite element analysis*) and automatically generates personalized flashcards. Students reviewed these cards between classes via mobile app notifications. After two months, retention rates for these terms reached over 80,1% after a two-week interval and 66,2% after half a year, compared to 56,3% and 31,8% in a control group using traditional glossaries (Table 1).

**Table 1**

**Comparison of technical vocabulary retention rates between AI-assisted and traditional learning methods over time**

| Group | Learning method | After 2 weeks | After 3 months | After 6 months |
|---|---|---|---|---|
| Experimental group | AI-generated spaced-repetition flashcards | 80,1% | 73,4% | 66,2% |
| Control group | Traditional glossaries/manual review | 56,3% | 42,7% | 31,8% |

This data illustrates long-term retention performance of students using AI-assisted tools compared to those relying on traditional vocabulary learning methods.

The study lasted 2 semesters and involved 97 second-year students from the Faculty of Power Engineering and Electromechanics of Vinnytsia National Technical University, all of whom participated voluntarily. In accordance with ethical research standards, informed consent was obtained from each participant, and all collected data was treated with strict confidentiality – no personal information was disclosed or published at any stage of the study.

**Example 3. AI writing assistant for technical reporting.**

In another task, students used an AI writing assistant trained on engineering corpora to write project summaries. The AI-assistant not only corrected grammar but suggested domain-appropriate terminology and phrasing. For example, instead of writing «*the system works faster*», the AI recommended «*the system demonstrates*

*improved computational throughput*». This nudged students toward more precise expression. We observed a significant improvement in the lexical sophistication of student writing, and evaluation revealed a 37,3% increase in accurate usage of target vocabulary.

The effectiveness of these interventions lies in the AI's ability to adapt instruction to the learner's needs, provide real-time feedback, and reinforce knowledge through contextual usage. Unlike static textbooks or pre-designed materials, AI-driven tools respond to user input, detect gaps in knowledge, and introduce new vocabulary in meaningful, discipline-specific contexts [5]. These findings are aligned with cognitive theories of language acquisition, particularly the input hypothesis and the noticing hypothesis, which emphasize the importance of comprehensible input and focused attention on linguistic form. Moreover, the results support the pedagogical value of AI as both a facilitator of individualized learning paths and a bridge between language acquisition and professional discourse in engineering education.

**Conclusions.** The findings of this study confirm that artificial intelligence can play a transformative role in enhancing technical vocabulary acquisition among engineering students. By providing personalized, context-rich, and adaptive learning experiences, AI tools such as chatbots, intelligent flashcard systems, and writing assistants support not only faster learning but also deeper integration of technical terms into students' active vocabulary. These tools go beyond passive memorization, encouraging students to apply domain-specific language in realistic academic and professional scenarios.

However, this is only the beginning. Further research is necessary to evaluate the long-term impact of AI-assisted vocabulary learning on actual communication skills in workplace settings. There is also great potential in developing cross-disciplinary AI systems that can integrate technical vocabulary acquisition with other core skills, such as critical thinking, data interpretation, and intercultural communication. Finally, as AI technologies evolve, future studies should investigate

ethical considerations, data privacy issues, and the pedagogical training necessary to help instructors effectively incorporate these tools into the language curriculum.

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