Fostering Goal-Setting, Self-Monitoring, and Reflective Learning in Medical English: A RAG-Powered AI Companion for Learners in Pakistan

Abstract

Artificial intelligence (AI) is reshaping language education, particularly through large language models (LLMs) such as GPT-4. While these models are capable of generating fluent and contextually appropriate language, their tendency to produce inaccurate or hallucinated information can undermine learning especially in high-stakes domains like Medical English. To address this challenge, this study integrates Retrieval-Augmented Generation (RAG), a technique that grounds LLM outputs in curated, domain-specific resources, enhancing the accuracy and relevance of generated responses. Despite its growing promise, the application of RAG-powered systems in English for Specific Purposes (ESP) education remains limited, particularly in healthcare contexts and under-resourced settings such as Pakistan. This study investigates the effectiveness of a GPT-4-powered, RAG-enhanced conversational agent designed to support autonomous learners of Medical English. Grounded in the theoretical frameworks of Self-Regulated Learning (SRL) and ESP pedagogy, the agent aims to foster key SRL behaviors such as goal-setting, self-monitoring, and reflective learning. The system draws from an authentic corpus of WHO guidelines, clinical reports, and patient communication transcripts to provide real-time, context-specific language support. A two-week intervention was conducted with 30 adult healthcare learners in Pakistan. Participants were divided into control and experimental groups. The control group used traditional self-study materials, while the experimental group interacted with the RAG-powered agent. Mixed-methods data collection included pre- and post-tests to measure Medical English proficiency, the System Usability Scale (SUS) to assess user satisfaction, and semi-structured interviews to explore learner experiences. Results showed that the experimental group made greater gains in medical vocabulary acquisition and task-based writing. Participants also reported increased learner autonomy, more effective goal management, and greater engagement in reflective language practice. These findings highlight the potential of RAG-enhanced conversational agents to serve as intelligent, adaptive learning companions in ESP contexts. The study demonstrates how such systems can support both language development and autonomous learning in healthcare education, particularly in resource-constrained environments. Future research could explore long-term impacts on professional communication, extend the system to other ESP domains, and investigate multilingual applications for broader accessibility.