

Title: Bridging Technological Innovations and Language Acquisition: A Mixed-Methods Study on AI-Assisted Strategy Use Among Engineering Majors in Taiwan

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Abstract

Research Overview

This preliminary mixed-methods study investigates English language learning strategy use and artificial intelligence integration among Taiwanese engineering majors. Addressing the conference theme of technological innovation, it explores how discipline-specific factors and AI tools shape learning behaviors, offering global visions for bridging language acquisition and technical education through personalized, technology-assisted pedagogy.

Purpose of Study

As the globalized economy increasingly demands high English proficiency from engineering professionals, modern language acquisition is concurrently being mediated by artificial intelligence (AI) and digital innovations. The primary purpose of this mixed-methods study is to investigate the English language learning strategy use among university engineering majors located in central Taiwan. Specifically, this research aims to identify the categorical preferences of strategy use and critically examine how individual variables affect these choices. Furthermore, it seeks to explore participants' qualitative experiences and perceptions regarding the integration of generative AI tools into their English language learning processes. By doing so, the study examines how these local technological innovations influence learner autonomy, motivation, and overall skill development within a highly specialized academic demographic.

Research Methods

This study employed an explanatory mixed-methods design. In the quantitative phase, data were collected from 103 undergraduate engineering students at a private university in central Taiwan

using an adapted 30-item, 5-point Likert-scale questionnaire based on Oxford's Strategy Inventory for Language Learning (SILL, 1990). Descriptive statistics were utilized to establish the overall strategy use profile and examine differences across gender, specific engineering majors, and the perceived importance of English. Following the quantitative data collection, the qualitative phase was initiated. Semi-structured interviews were conducted with voluntary participants to gain deeper insights into their integration of AI tools for language learning. Interview transcripts were systematically analyzed to identify recurring themes regarding the platforms used, the perceived benefits of AI, and the impact of these technologies on specific language skills.

Results and Discussion

Quantitative results indicated a moderate overall level of strategy use ($M=2.97$). When evaluating the six specific strategy categories in descending order of frequency, participants most heavily favored Compensation strategies ($M=3.15$), followed closely by Affective strategies ($M=3.08$). These were subsequently followed by Cognitive strategies ($M=2.98$), Memory strategies ($M=2.91$), and Social strategies ($M=2.89$). Metacognitive strategies ranked as the least utilized category overall ($M=2.80$). At the individual item level, the single most frequently used strategy was of Cognitive in using the Internet, AI tools, or media for listening comprehension (Item 9, $M=3.57$).

Further analysis explored the mean strategy use across different engineering sub-disciplines, revealing notable variations based on the participants' academic focus. In descending order of strategy employment, Information Engineering participants demonstrated the highest frequency ($M=3.32$), followed by participants in the "Others" category ($M=3.11$), and Electrical Engineering participants ($M=3.09$). Participants in Environmental and Safety Engineering reported moderate use ($M=2.87$), followed closely by Semiconductor majors ($M=2.85$). Finally, Mechanical and Automation Engineering participants reported the lowest frequency of strategy employment ($M=2.67$).

The study also examined the descending order of strategy use across demographic factors, specifically gender and the perceived importance of English for career development. Regarding

gender, female participants ($M=3.08$) reported a higher frequency of overall strategy use compared to their male counterparts ($M=2.94$). Regarding the perceived importance of English, a direct positive correlation was observed. In descending order, participants who rated English as "Very Important" for their careers exhibited the highest strategy use ($M=3.20$). This was followed by those who viewed it as "Important" ($M=2.90$), those who considered it "Moderately Important" ($M=2.55$) or "Not Important" ($M=2.55$), and finally, the single participant who deemed it "Very Unimportant", demonstrating the absolute lowest use ($M=1.00$).

Qualitative findings corroborated and significantly expanded upon these quantitative results. The interview data revealed that participants heavily favor AI tools like Gemini and DeepSeek due to their high speed, customization capabilities, and adaptability to individual proficiency levels. Participants noted that AI drastically reduces the time required for translation, thereby significantly increasing their motivation to learn new vocabulary. Furthermore, while quantitative data showed low engagement in productive strategies like writing, the interviews highlighted that participants eagerly utilize AI as an adaptive environment for practicing speaking skills, valuing its memory capabilities and immediate feedback. However, despite this widespread reliance on technological tools, the qualitative data also highlighted alternative perspectives. One particular participant explicitly stated they rarely use AI for learning English, expressing a strong preference for traditional, physical teaching methods with a real human instructor. This participant, alongside others, emphasized that AI functions merely as an auxiliary tool, reinforcing the concept that true language proficiency ultimately requires proactive, autonomous learner effort rather than sole reliance on technology. These findings suggest that engineering students rely heavily on compensatory strategies and AI tools to bridge immediate linguistic gaps, yet the role of the traditional educator remains vital. To co-create knowledge and enhance global competencies, educators must leverage students' existing technological fluency to scaffold underutilized metacognitive planning and productive language skills.

Keywords: Language learning strategies, AI, engineering majors, mixed-methods, learner autonomy