International Journal of Computer-Assisted Language Learning and Teaching
Volume 16 • Issue 1 • January-December 2026

How Can AI-Powered Chatbots Drive EFL Learners' Learning Performance?

Mediation by Social Perceptions and Moderation by Usage Frequency

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Received: September 11th, 2025 | **Accepted:** November 27th, 2025

ABSTRACT

This study proposes research based on the stimulus-organism-response model to examine determinants affecting English as a foreign language (EFL) learners' continuance intention of artificial intelligence (AI)-powered chatbots and learning outcomes, and to test whether usage frequency can moderate path relationships within the research model. Sample data for this study were collected from learners who had experience with using AI-powered chatbots to learn English in Taiwan, and 395 usable questionnaires were analyzed using structural equation modeling. The results demonstrate that EFL learners' perceived anthropomorphism and perceived intelligence of AI-powered chatbots positively influenced the perceived warmth and perceived competence elicited by the chatbots, which together encouraged their continuance intention of using AI-powered chatbots, and in turn improved their learning outcomes. Further, this study showed that EFL learners' usage frequency of using AI-powered chatbots partially and significantly moderated path relationships in the research model.

KEYWORDS

AI-powered Chatbots, EFL Learners' Learning Outcomes, Social Perceptions, Continuance Intention of AI-powered Chatbots, Usage Frequency

INTRODUCTION

Recently, artificial intelligence (AI)-powered chatbots have caused a stir with their potential to revolutionize educational systems and have received increasing attention on a worldwide scale (Bhatt & Muduli, 2024; Hasan et al., 2024; Thongsri et al., 2025). With advances in natural language processing, AI-powered chatbots have become individualized, interactive, and immersive. Such tools can enhance the authenticity of the learning experience by simulating real-world human language, behavior, and thoughts, and even by making judgments similarly to humans (Lai & Lee, 2024; Wang et al., 2024). Particularly in the context of language learning, AI-powered chatbots can serve as conversational partners for language learners (Lai & Lee, 2024; Wang et al., 2024; Zou et al., 2025b) and can provide learners with real-time feedback and personalized interactions based on their interests and proficiency levels in a stress-free environment (Tai & Chen, 2024). Prior studies have shown that learners can benefit from interacting with AI-powered chatbots in language learning (Lai

DOI: 10.4018/IJCALLT.397405

& Lee, 2024) and that such tools can incorporate empathy to elicit appropriate emotional responses for language learners (Jiang et al., 2022; Wang et al., 2024).

While AI-powered chatbots offer potential benefits that have been valued as practical solutions to the expanding demand for language education around the world, prior studies on factors that affect learners' usage of AI-powered chatbots in the English as a foreign language (EFL) field remain quite limited (Du & Daniel, 2024). To fill this gap, this study considers two AI feature constructs as antecedents to learners' usage of AI-powered chatbots: perceived anthropomorphism (PA) and perceived intelligence (PI; Pillai et al., 2024; Tram et al., 2024). PA signifies an AI system that behaves similarly to humans when learners process learning tasks (Ma & Huo, 2023; Pillai et al., 2024; Tram et al., 2024), and PI describes an AI system with efficient and autonomous behaviors that help learners to address learning tasks (Pillai et al., 2024; Tram et al., 2024).

Furthermore, recent research has paid more attention to learners' learning outcomes (LO) associated with usage of AI-powered chatbots, which may be a more noteworthy issue for understanding how learners evaluate the benefits of chatbots (Bhatt & Muduli, 2024; Chang et al., 2022; Elbaz et al., 2024). Synthetically speaking, there is still little sound research investigating the influences of PA and PI on learners' usage of AI-powered chatbots and perceived LO. Hence, there is a need for more studies into this question, especially in the EFL context (Chang et al., 2022). The existing gap in empirical evidence can become an obstacle to understanding how EFL learners' chatbot usage and perceived LO can be improved. Therefore, this study proposes research question RQ1: What factors significantly affect EFL learners' AI-powered chatbot usage and perceived LO in the AI-enabled learning environment?

In addition, usage frequency (UF) influences the user decision-making process (Hong et al., 2023). While prior studies have verified that UF moderates the relationships between determinants and behavioral intention in various settings (Chen, 2013; Hernández et al., 2010; Hong et al., 2023; Hsieh and Lee, 2024; Liébana-Cabanillas et al., 2016; Tosun et al., 2015), there is a current lack of knowledge about the impacts of determinants on EFL learners' usage of AI-powered chatbots and their perceived LO under different levels of UF. Addressing such a gap will provide deeper insights into the decision-making processes of frequent and infrequent EFL learners in the AI-enabled learning environment. Therefore, this study proposes research question RQ2: Do various levels of UF influence determinants of EFL learners' usage of AI-powered chatbots and their perceived LO in the AI-enabled learning environment?

To resolve these research questions and fill in the research gaps described above, a robust research model for understanding how PA and PI influence EFL learners' usage of AI-powered chatbots and perceived LO is required. While some models have been employed in previous studies on exploring learners' AI-powered chatbots usage—including the technology acceptance model (e.g., Duong et al., 2023; Elbaz et al., 2024; Foroughi et al., 2025; Hasan et al., 2024; Kashive et al., 2021; Le et al., 2024; Pillai et al., 2024; Tram et al., 2024), the uses and gratifications theory (e.g., Chang et al., 2022; Le et al., 2024; Thongsri et al., 2025), the DeLone and McLean information systems success model (e.g., Foroughi et al., 2025; Thongsri et al., 2025), the theory of planned behavior (e.g., Bhatt and Muduli, 2024), and the unified theory of acceptance and use of technology (e.g., Duong et al., 2024; Ma & Huo, 2023; Xu & Thien, 2025)—these models have placed less emphasis on the crucial role of individual internal processing in response to environmental stimuli in learners' usage of AI-powered chatbots, which may be an important user belief that influences learners' usage of AI-powered chatbots (Chang et al., 2022; Xu & Thien, 2025).

The stimulus-organism-response (S-O-R) model, introduced by Mehrabian and Russell (1974), states that external environmental stimuli (S) can motivate individuals' inner organisms (O), which can cause individuals' behavioral responses (R) via a series of psychological impacts (Mehrabian & Russell, 1974; Shahzad et al., 2024). The S-O-R model has been applied to the usage of AI-powered chatbots in various contexts (e.g., Duong & Nguyen, 2024; Pham et al., 2024; Shahzad et al., 2024) and may provide a better theory of EFL learners' usage of AI-powered chatbots by examining the effects of