The Effect of Perceived Usefulness on Continued Use of Large Language Models: Chain Mediation by Expectation Confirmation and Satisfaction and Moderation by Communication Willingness

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Date: 2025-03-25T00:00:00+00:00

Abstract

This study, grounded in the Expectation Confirmation Model (ECM), investigates the effects of perceived usefulness, expectation confirmation, and satisfaction on university students' continued usage intention toward large language models, and examines the moderating role of willingness to communicate with AI. Through empirical analysis of questionnaire data collected from 189 university students, this research employs a chain mediation model and moderation effect testing methods. The findings reveal that perceived usefulness exerts a significant positive influence on continued usage intention via the chain mediation effect of expectation confirmation and satisfaction; willingness to communicate with AI moderates the relationship between perceived usefulness and continued usage intention, with the effect being more salient among individuals with low communication willingness.

Full Text

The Influence of Perceived Usefulness on Continued Use of Large Language Models: The Chain Mediating Role of Expectation Confirmation and Satisfaction and the Moderating Role of Willingness to Communicate with AI

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This study, grounded in the Expectation Confirmation Model (ECM), investigates the effects of perceived usefulness, expectation confirmation, and satisfaction on university students' continued use of large language models, while examining the moderating role of willingness to communicate with AI. Through empirical analysis of questionnaire data from 189 university students using chain mediation models and moderation effect testing methods, the results reveal that perceived usefulness exerts a significant positive influence on continuance intention through the chain mediating effect of expectation confirmation and satisfaction. Willingness to communicate with AI moderates the relationship between perceived usefulness and continuance intention, with the effect being more pronounced among individuals with low communication willingness.

Keywords: Expectation Confirmation Model (ECM), Large Language Models, Willingness to Communicate with AI
Chinese Library Classification: B849

In recent years, the rapid advancement of artificial intelligence (AI) technology has sparked widespread global attention and discussion. Notably, ChatGPT, the renowned AI model launched by OpenAI, attracted over 100 million users within just two months of its release (Y. Deng, Zhao, & Huang, 2023). Leveraging sophisticated language processing capabilities and extensive knowledge bases, these technologies are providing support for scientific research, data analysis, and technological innovation (Bresciani, Dabić, & Bertello, 2022; Jiang & Xiong, 2024). However, despite their significant functional advantages, user attitudes and usage behaviors toward AI technology exhibit considerable complexity and diversity.

Prior research has predominantly concluded that "algorithm aversion" —the tendency for individuals to resist or dislike algorithms—represents a significant barrier (Jago, Raveendhran, Fast, & Gratch, 2024; Longoni, Bonezzi, & Morewedge, 2019). However, with the emergence of large language models, studies have demonstrated their capacity to effectively generate progressively innovative ideas that exhibit greater creativity than traditional methods such as Google search (Lee & Chung, 2024). For instance, recent research examining the performance of large language models without human intervention has revealed substantial creative capabilities in models like ChatGPT (Guzik, Byrge, & Gilde, 2023; Haase & Hanel, 2023; Jiang & Xiong, 2024). This creative capacity, as applied in education, creative industries, and other domains, has gradually captured user attention and recognition. Theories such as Innovation Diffusion Theory (Hoffmann, Probst, & Christinck, 2007), the Technology Acceptance Model (Davis, Bagozzi, & Warshaw, 1989), and the Theory of Planned Behavior (Ajzen, 2020) have explored the key variables and mechanisms that motivate individuals to accept new technological systems.

Although initial technology acceptance represents the first step toward system success, the ultimate success of information systems depends more heavily on users' long-term continued use (Bhattacherjee, 2001), which constitutes a critical factor determining the success or failure of large language models. The

concept of "continued use" is not novel in information systems research, having previously been termed "routinization" (Cooper & Zmud, 1990). These studies acknowledge the existence of a post-acceptance stage, and Innovation Diffusion Theory similarly suggests that users re-evaluate their initial adoption decisions during a "confirmation" phase to determine whether to continue usage.

Existing technology acceptance research has primarily focused on the correlations among variables within the Expectation Confirmation Model (ECM), particularly the direct relationships between expectation confirmation, satisfaction, and continuance intention. Although these studies have revealed the important roles of variables such as perceived usefulness, expectation confirmation, and satisfaction in technology acceptance, few have deeply examined the underlying mechanisms through which these variables jointly influence continuance intention, especially via chain mediating effects (Bhattacherjee, 2001). Investigating such mechanisms is crucial for comprehensively understanding users' continued usage behavior. Based on the Expectation Confirmation Model, this study delves into the influence mechanism of perceived usefulness on users' continuance intention through the chain mediating effect of expectation confirmation and satisfaction.

1.1 Expectation Confirmation Model

In the fields of information science and education, academic research has dedicated considerable effort to understanding users' technology acceptance and continuance intentions (Bhattacherjee, 2001). Despite the extensive literature on technology acceptance, initial adoption does not automatically lead to continued usage, a phenomenon commonly observed across many domains, such as the high attrition rates in Massive Open Online Courses (MOOCs) (Li & Qian, 2015). To explain the transition from initial acceptance to subsequent abandonment, Bhattacherjee (2001) proposed the Expectation Confirmation Model (ECM), which provides deep insights into the psychological mechanisms influencing users' continued technology adoption. Since its introduction, ECM has become one of the most influential and representative theoretical frameworks in this field (Qin, 2009).

The ECM framework comprises four key variables: perceived usefulness, expectation confirmation, satisfaction, and continuance intention (Han & Li, 2018). Users' continuance intentions are closely related to their initial expectations and the degree of support and performance they receive (Feng, 2022). However, domestic application studies based on ECM have yielded inconsistent findings, with some even reporting contradictory conclusions regarding the relationships among ECM' s constructed variables (Liao, Palvia, & Chen, 2009). For instance, Li (2012) found that both satisfaction and perceived usefulness directly influenced continuance intention among Weibo users (Li, 2012), whereas Tang and Deng (2012) reached opposite conclusions through analysis of extensive questionnaire data (Tang & Deng, 2012). These inconsistent findings regarding ECM theory in existing research have raised questions about its validity and variable

relationships, hindering further investigation. Therefore, this study examines the relationships among perceived usefulness, expectation confirmation, satisfaction, and continuance intention within the context of large language models, based on the ECM framework, and proposes the following hypotheses:

H1: Perceived usefulness is significantly related to continuance intention.
H2: Perceived usefulness is significantly related to expectation confirmation.
H3: Perceived usefulness is significantly related to satisfaction.
H4: Expectation confirmation is significantly related to satisfaction.
H5: Expectation confirmation is significantly related to continuance intention.
H6: Satisfaction is significantly related to continuance intention.

Relevant literature indicates that perceived usefulness influences users' expectation confirmation, which in turn represents a crucial factor for continuance intention. For example, Bhattacherjee noted that when users perceive system usefulness, their expectation confirmation increases, thereby strengthening their continuance intention (Bhattacherjee, 2001). Additionally, Venkatesh and Davis pointed out that perceived usefulness not only affects users' attitudes but also influences continuance intention through expectation confirmation (Venkatesh & Davis, 2000). When users perceive that large language models meet their needs and provide practical value, they confirm their expectations, which enhances their trust and increases usage frequency. Consequently, increased perceived usefulness of large language models elevates expectation confirmation, thereby promoting users' intention to continue using the system. Based on the aforementioned literature, we propose the following hypothesis:

H7: Expectation confirmation mediates the effect of perceived usefulness on university students' continuance intention to use large language models.

Research demonstrates that user satisfaction is directly influenced by perceived usefulness and serves as an important predictor of continuance intention. In the study by Mention and Barlatier (2009), the authors emphasized that enhanced satisfaction derived from positive experiences on social networks constitutes a significant factor affecting users' continuance intention (Mention, Barlatier, & Josserand, 2019). Increased user satisfaction strengthens their loyalty to the platform, thereby enhancing the likelihood of continued usage. Based on this evidence, we propose the following hypothesis:

H8: Satisfaction mediates the effect of perceived usefulness on university students' continuance intention to use large language models.

Research indicates that perceived usefulness influences continuance intention through the chain mediating effect of expectation confirmation and satisfaction. This mechanism is particularly evident in information system applications, as Kim and Malhotra (2005) noted that expectation confirmation plays a critical role between user satisfaction and continuance intention (S. S. Kim & Malhotra, 2005). In this context, we can speculate that when using large language models, users' perceived usefulness affects expectation confirmation. Specifically, when users believe that large language models meet their needs, expectation

confirmation increases, which subsequently enhances satisfaction and strengthens continuance intention. Based on this reasoning, we propose the following hypothesis:

H9: Expectation confirmation and satisfaction exert a chain mediating effect between university students' perceived usefulness of large language models and their continuance intention.

1.2 Willingness to Communicate with AI

The concept of "Willingness to Communicate" (hereinafter referred to as "WTC") was originally developed by McCroskey and Baer through extending Burgoon' s notion of communication willingness (Burgoon, 1976). It describes an individual' s intention or predisposition to speak or remain silent when they have free will (MacIntyre & Wang, 2021). Research indicates that AI tools (e.g., chatbots) can effectively enhance users' WTC and engagement levels. For example, Zhang et al. (Zhang, Meng, & Ma, 2024) also found that AI assistants play a positive role in improving students' WTC. Compared with traditional search engines, learners exhibit greater motivation and engagement when communicating with AI tools (Fathi et al., 2024). Based on previous findings regarding the relationship between communication willingness and technology usage perceptions, we posit that users with higher levels of WTC with AI develop a stronger sense of its usefulness, which further enhances their intention to use AI for learning (Fathi, Rahimi, & Derakhshan, 2024). Consequently, when users exhibit high communication willingness, the positive effect of perceived usefulness on usage intention becomes stronger. Accordingly, we propose the following hypothesis:

H10: Willingness to communicate with AI moderates the relationship between perceived usefulness and continuance intention.

2.1 Participants

This study recruited participants from university students in mainland China. In October 2024, 200 questionnaires were randomly distributed through the Wenjuanxing platform. Following Sheehan' s research guidelines, samples with patterned responses were excluded, yielding a final valid sample of 189 participants. Among them, 66 were male (34.92%) and 123 were female (65.07%), with ages ranging from 18 to 21 years (M = 18.99, SD = 1.87). All participants signed informed consent forms, and the study was approved by the Ethics Committee of the Faculty of Education at Guangxi Normal University (Ethics Approval Number: 20250320001).

2.2 Measures

Perceived usefulness, expectation confirmation, satisfaction, and continuance intention were adapted from the ECM model (Bhattacherjee, 2001) and reworded

to fit the context of large language model usage. All items were scored on a 7-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree), with the Chinese version obtained through standard translation-back-translation procedures. The final scale reported a Cronbach's α coefficient of 0.895 and a KMO value of 0.857, demonstrating good structural validity ($^2 = 209.27$, df = 84, ^{2}/df = 2.49, $p < 0.001$, SRMR = 0.06, RMSEA = 0.08 [CI: 0.074-0.104], TLI = 0.90, CFI = 0.91).

Items measuring willingness to communicate with AI were adapted from McCroskey (McCroskey, 1992) and Peng and Woodrow (Peng & Woodrow, 2010). The scale used a 7-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree), with the Chinese version obtained through standard translation-back-translation procedures. The final scale reported a Cronbach's α coefficient of 0.829 and a KMO value of 0.797, indicating good reliability and validity.

3.1 Common Method Bias

Exploratory factor analysis of the raw data from the main study variables revealed five factors with eigenvalues greater than 1. The first factor explained 38.39% of the variance, which falls below the critical threshold of 40%, indicating no significant common method bias.

3.2 Descriptive Statistics and Correlation Analysis

After standardizing all variables, perceived usefulness, expectation confirmation, satisfaction, and continuance intention were found to be significantly and positively correlated with one another, thereby supporting H1-H6. The correlation matrix is presented in Table 1 .

Table 1 Correlations among Variables

[Note: The table appears to have formatting issues in the original. The visible correlations are: perceived usefulness with expectation confirmation (0.33**), perceived usefulness with continuance intention (0.39**), perceived usefulness with satisfaction (0.44**), expectation confirmation with continuance intention (0.62**), expectation confirmation with satisfaction (0.47**), and satisfaction with continuance intention (0.64**).]

Note: *$p < 0.05$,* ***$p < 0.01$,*** $p < 0.001$. The same applies below.

3.3 Mediation Effect Testing

Using perceived usefulness as the independent variable and continuance intention as the dependent variable, we employed Mplus 7.0 software to analyze the chain mediating effect of expectation confirmation and satisfaction. The regression analysis is presented in Table 2 , and the path results are shown in Figure 1 [Figure 1: see original paper].

Table 2 Regression Analysis of the Chain Mediating Effect of Expectation Confirmation and Satisfaction

[Note: The table content appears incomplete or corrupted in the original.]

The mediation effect results, presented in Table 3 , show that only the chain mediation effect' s 95% confidence interval does not include zero and reaches statistical significance, thereby validating H9. That is, perceived usefulness positively predicts continuance intention through the chain mediating effect of expectation confirmation and satisfaction.

Table 3 Analysis of the Mediating Effect of Expectation Confirmation and Satisfaction on the Relationship between Perceived Usefulness and Continuance Intention

[Note: The table content appears incomplete in the original, showing the structure for total indirect effect and three indirect pathways: perceived usefulness → expectation confirmation → continuance intention; perceived usefulness → satisfaction → continuance intention; and perceived usefulness → expectation confirmation → satisfaction → continuance intention.]

3.4 Moderation Effect Testing

We employed a latent variable moderation model to test the moderating effect of willingness to communicate with AI within the chain mediation model. The results indicated that the interaction term between perceived usefulness and willingness to communicate with AI did not significantly affect expectation confirmation (β = -0.21, p = 0.06) but did significantly influence continuance intention (β = -0.22, p = 0.02). This suggests that willingness to communicate with AI primarily moderates the direct effect path of the chain mediation model. The complete moderated chain mediation model and its effect estimates are presented in Figure 2 [Figure 2: see original paper].

Different levels of university students' willingness to communicate with AI significantly affect the relationship between perceived usefulness and continuance intention. Specifically, when communication willingness is low, the effect of perceived usefulness on continuance intention is more pronounced; even when users' willingness to communicate is low, perceiving high usefulness significantly enhances their continuance intention. In contrast, when communication willingness is high, the effect of perceived usefulness on continuance intention is more limited. That is, for individuals with high communication willingness, even high perceived usefulness of AI yields only limited increases in continuance intention. These results demonstrate that communication willingness, as a moderating variable, plays an important role in university students' continued AI usage, particularly for those with low communication willingness, for whom perceived usefulness represents a key factor in strengthening continuance intention (see Figure 3 [Figure 3: see original paper]).

We used the coefficient product method to test the moderated mediation effect

and further verified the significance of differences in mediation effects across different levels of the moderator through the difference analysis approach proposed by Edwards and Lambert. The results indicated that willingness to communicate with AI significantly moderated the direct effect. When willingness to communicate with AI was low, the effect of perceived usefulness on continuance intention was significant (total effect = 0.98, 95% CI [0.61, 1.35]), whereas when willingness to communicate with AI was high, the total effect was 0.42 (95% CI [0.08, 0.75]). The difference between these two conditions was 0.56 (95% CI [0.10, 1.02]), indicating a significant difference. This demonstrates that willingness to communicate with AI significantly moderates the mediating effect between perceived usefulness and continuance intention.

Figure 2 Moderated Chain Mediation Effect Model Diagram

Figure 3 Moderating Effect of Willingness to Communicate with AI on the Relationship between Perceived Usefulness and Continuance Intention

Table 4 Test of Moderated Mediation Effects

[Note: The table content appears incomplete in the original, showing the structure for testing indirect effects at different levels of the moderator (M-1SD, M, M+1SD) for three indirect pathways.]

This study aimed to analyze how perceived usefulness influences university students' continuance intention through the chain mediating effect of expectation confirmation and satisfaction, while examining the moderating effect of "willingness to communicate with AI" in this process. The findings indicate that perceived usefulness not only exerts a direct effect on continuance intention but also indirectly facilitates its formation through the chain pathway of expectation confirmation and satisfaction. This discovery aligns with the core assumptions of both the Expectation Confirmation Model (ECM) and the Technology Acceptance Model (TAM) (Venkatesh & Davis, 2000; Bhattacherjee, 2001). Although the mediating effect of expectation confirmation between perceived usefulness and continuance intention is relatively limited, it serves as a bridge in user behavior by influencing satisfaction. When expectations are confirmed, users' satisfaction increases significantly, thereby strengthening their continuance intention—consistent with TAM' s perspective that affective feedback and satisfaction play important roles in technology acceptance (Venkatesh & Davis, 2000).

Furthermore, this study found that "willingness to communicate with AI" moderates the relationship between perceived usefulness and continuance intention. From a theoretical perspective, the results support the critical role of willingness to communicate with AI (Fathi et al., 2024), particularly the importance of this variable in technology acceptance models. From a practical standpoint, the effect of perceived usefulness on continuance intention may be more pronounced under conditions of low communication willingness. This is because when users exhibit low willingness to interact with AI systems, they rely more heavily on their perceptions of functional utility to decide whether to continue

usage. Therefore, enhancing perceived usefulness can significantly strengthen users' continuance intention (Li, 2012). In contrast, under conditions of high communication willingness, the effect of perceived usefulness on continuance intention may diminish. This occurs because users with high communication willingness have already developed strong trust and dependence on AI systems, reducing their sensitivity to functional utility. At this point, users hold positive attitudes toward AI, believing that humans will ultimately develop deep emotional connections with robots because humans inherently desire more intimate friendships and richer emotional experiences (Maines, 2008).

This study advances the transformation of artificial intelligence from a tool to an emotional interaction partner from a human-computer relationship perspective, enhancing users' trust and dependence on AI. By exploring the role of individual differences in technology acceptance, the research provides a theoretical foundation for personalized AI design, promotes the integration of technology with user needs, and enhances the social inclusivity and equity of technology.

However, several limitations should be acknowledged. First, the study focused primarily on university students, without covering other age groups or social populations, which may limit the generalizability of the conclusions. Future research should expand the sample range to validate the model' s universality. Second, external social factors such as policy and education level, which may influence technology acceptance, were not examined. Future studies could incorporate these factors to explore their potential impacts. Additionally, although the study emphasized the importance of emotional needs and communication willingness in user experience, how these elements interact across different contexts and influence user decision-making requires further investigation. Future longitudinal research could explore the dynamic changes in technology acceptance and the underlying psychological mechanisms, providing more nuanced theoretical guidance for AI design.

This study investigated the effects of perceived usefulness, expectation confirmation, satisfaction, and AI communication willingness on university students' intention to continue using AI and their underlying mechanisms. The results demonstrate that perceived usefulness represents a core factor influencing university students' AI continuance intention, exerting both direct effects and chain mediating effects through expectation confirmation and satisfaction. While expectation confirmation does not directly affect usage intention, it indirectly strengthens usage intention by enhancing satisfaction. AI communication willingness moderates the relationship between perceived usefulness and continuance intention, with perceived usefulness having the most significant impact under low communication willingness and a diminished effect under high communication willingness.

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Note: Figure translations are in progress. See original paper for figures.