Article in Press

Applied Linguistics Inquiry

University of Birjand

ISSN: 2821-0441 E-ISSN: 3115-7998

Applied Linguistics Inquiry

Submit Date: 23 April 2024; **Accept Date:** 28 August 2024

Beyond Whiteboard EFL Classrooms: Uncurtaining the Links between AI Self-efficacy, AI Cognitive-emotion Regulation, AI-assisted L2 Learning Attitude, and AI Psychological Flow in Higher Education

Tahereh Heydarnejad

Assistant Professor of Applied Linguistics, Department of English Language, Faculty of Literature and Humanities, University of Gonabad, Gonabad, Iran

Abstract

The incorporation of artificial intelligence (AI) in English as a Foreign Language (EFL) instruction has led to a closer look at how it affects the experiences and outcomes of learners in this field. This study looks at how psychological flow, AI cognitive-emotion regulation, AI-assisted second language (L2) learning attitudes, and AI self-efficacy are related among 318 university students. By applying Structural Equation Modeling (SEM) via AMOS, the study explains how these variables cooperate in order to make the language learning experiences better. The results suggest that a more favorable attitude toward AI-assisted L2 learning is cultivated as a result of the positive impact of higher levels of AI self-efficacy on cognitive-emotion regulation. Additionally, a robust correlation was observed between these attitudes and the experience of psychological flow, indicating that the integration of AI can substantially improve student engagement and overall learning outcomes. The findings also emphasize the importance of cognitive-emotional processes in influencing students' perspectives on AI tools, demonstrating that emotional modulation strategies can alleviate feelings of apprehension and uncertainty, thereby fostering a more optimistic learning environment. Furthermore, the implications of these discoveries for curriculum development and teaching practices are addressed, offering educators valuable insights on how to effectively utilize AI technology.

Keywords: AI Self-efficacy; AI Cognitive-emotion Regulation; AI-assisted L2 Learning Attitude; AI Psychological Flow; Higher Education

Introduction

The swift development of AI in educational settings has revolutionized conventional language learning frameworks, especially in the instruction of EFL. AI technologies, including language learning apps, have arisen as potent instruments that may complement the educational experience by offering individualized feedback, adaptive learning trajectories, and real-time conversational practice (Zhai et al., 2024). AI technologies, such as language learning applications, have emerged as powerful tools that may enhance the educational experience by providing personalized feedback, adaptive learning paths, and real-time conversational practice (Chen et al., 2024). As these technologies become more incorporated into language instruction, understanding the psychological elements that affect students' engagement and efficacy in these settings is essential. This research examines several interrelated constructs: AI self-efficacy, AI cognitive-emotional control, AI-assisted second language learning attitude, and AI psychological flow. Each of these dimensions is crucial in molding learners' experiences and results in AI-enhanced language learning environments, eventually affecting their language ability and desire to study.

AI self-efficacy denotes an individual's confidence in their capability to effectively interact with AI technologies and use them for language acquisition. Bong (2013) highlighted that self-efficacy profoundly influences motivation, perseverance, and performance, making it an essential element in educational contexts. Individuals with elevated self-efficacy are more inclined to confront problems, establish loftier objectives, and dedicate more effort to attain them. In the realm of language learning, elevated self-efficacy correlates with enhanced perseverance and resilience, resulting in superior language learning results (Wang & Chuang, 2023). Moreover, self-efficacy affects learners' engagement with technology; individuals who possess confidence in their capacity to use AI technologies proficiently are more inclined to interact with them, thereby improving their entire learning experience (Huang et al., 2024).

AI cognitive-emotion regulation encompasses the techniques used by learners to govern their thoughts and emotions in reaction to AI-facilitated learning experiences. This concept is crucial since it affects how students manage problems, such as frustration or fear, that may occur throughout the learning process. Liu et al. (2024) asserts that proficient emotion control enhances academic achievement and general well-being, underscoring its significance in language development. Students who adeptly manage their emotions are more capable of sustaining attention, alleviating anxiety, and maintaining motivation, all of which are essential for language learning. Comprehending the mechanics of cognitive-emotional regulation in AI environments may provide educators with insights to assist students in managing their emotional reactions to technology-enhanced learning (Garnefski et al., 2020).

The attitude towards AI-assisted L2 learning includes learners' attitudes and emotions toward the use of AI technology in their language studies. Favorable perceptions of AI may augment motivation and engagement, resulting in more efficacious learning experiences. According to Zhai et al. (2024) indicates that learners' attitudes regarding technology substantially affect their readiness to embrace new tools. Students who perceive AI as a beneficial resource for improving their language abilities are more inclined to use these tools consistently, hence promoting superior language learning results. Conversely, adverse sentiments may lead to opposition to using AI, so limiting the potential advantages these technologies provide.

This research additionally examines AI psychological flow, which is described as students' deep absorption and engagement while using AI technology (Norsworthy et al., 2023). In language teaching, flow may be fostered by assigning students appropriately demanding tasks that are linked with their competency levels and interests. Individuals who experience flow may lose sense of time and become completely absorbed in the learning process, resulting in improved language retention and mastery (Liu et al., 2024). Therefore, an examination of the factors that promote fluidity in AI-assisted environments is critical for improving learning outcomes and ensuring that students completely benefit from new technologies.

Notwithstanding the expanding literature on AI in education, a substantial study vacuum persists regarding the interaction among these dimensions in EFL situations. Although research has investigated AI self-efficacy and its influence on learning outcomes (e.g., Heydarnejad et al., 2024; Yang et al., 2023; Zhai et al., 2024), empirical data about the interaction between cognitive-emotion regulation, learning attitudes, self-efficacy, and psychological flow remains few. This gap underscores the need for thorough research that synthesizes these components to provide a more refined understanding of AI's function in language acquisition. Furthermore, current research often emphasizes discrete notions instead of exploring their interrelations, perhaps resulting in insufficient understanding of the learning process. Therefore, this research seeks to enhance the current literature and provide significant insights for educators and policymakers in EFL environments by examining the relationships among these dimensions using SEM. Comprehending the interplay of these psychological components helps guide the development of AI-enhanced learning environments that facilitate language acquisition and foster delighted learner experiences. To meet these purposes the following research questions were explored:

RQ1: Does AI self-efficacy contribute to AI-assisted L2 learning attitude and AI psychological flow in Iranian EFL landscape?

RQ2: Does AI cognitive-emotion regulation contribute to AI-assisted L2 learning attitude and AI psychological flow in Iranian EFL landscape?

Literature Review

Theoretical Framework

AI Self-Efficacy

AI self-efficacy, grounded on Bandura's Social Cognitive Theory (2012), has demonstrated an impact on students' motivation, perseverance, and overall learning results, especially in digital and technology-enhanced educational environments. It pertains to a learner's self-assurance in their ability to effectively utilize AI-driven technology to improve their language skills (Wang & Chuang, 2024). According to Bandura (1977), self-efficacy is impacted by social and personal circumstances, especially in collectivist settings. The opinions of their peers, teachers, and the educational environment at large may have a significant impact on students' assessments of their AI skills in Iran, which is a collectivist country. Iranian EFL learners are more inclined to cultivate elevated AI self-efficacy when AI technologies are approved or exemplified by esteemed authority figures or peers, rather than only through self-directed inquiry. Consequently, fostering AI self-efficacy in Iran may necessitate culturally attuned tactics that prioritize collective affirmation and institutional support. The Technology Acceptance Model (Davis, 1989) serves as a relevant paradigm for comprehending AI self-efficacy. The model indicates that perceived ease of use and perceived utility are essential determinants of technology adoption. In Iran, where access to AI technology is restricted and digital literacy varies, the perceived usability may be diminished, especially among students from under-resourced digital areas. The cultivation of AI self-efficacy among Iranian learners involves not just personal conviction but also systemic support, accessibility, and culturally relevant training.

Cognitive-Emotion Regulation

The utilization of cognitive strategies to regulate emotional responses in stressful or difficult circumstances is referred to as cognitive-emotion regulation (Garnefski & Kraaij, 2007). Using AI-powered tools to assist learners in managing their cognitive and emotional states is referred to as AI cognitive-emotion regulation. This may involve adaptive learning pathways, motivational prompts, or personalized feedback that promote resilience and alleviate frustration. According to Keegan and Holas (2009), Cognitive-Behavioral Theory (CBT) serves as a theoretical foundation for these interventions by emphasizing the interplay between thoughts, emotions, and behaviors. In contexts where learners may dread failure or lack confidence with new technologies, cognitive reappraisal and other CBT-based strategies enable learners to reframe challenges as opportunities for growth. AI tools that foster emotional autonomy and encourage positive reframing can be transformative in Iran, where learners may be acclimated to correction-focused feedback and one-way instruction. Gross's (2002) Emotion Regulation Theory provides additional evidence in favor of the utilization of AI for emotional support. In formal classroom settings, emotional expression is frequently suppressed. AI-driven platforms can provide learners with a private and judgment-free environment in which to manage frustration, receive encouragement, and develop emotional resilience. Iran is particularly in need of this support, as the affective engagement with new technologies may be impeded by rigorous pedagogical norms and limited learner autonomy.

L2 Learning Attitudes

L2 learning attitude includes cognitive and emotional reactions to language learning, including motivation, self-assurance, and total involvement (Dörnyei, 2005). In AI-mediated learning settings, instruments such as chatbots, virtual tutors, and adaptive platforms may influence these attitudes via real-time feedback and interactive experiences. In the Iranian educational setting, student perceptions regarding AI are significantly influenced by conventional pedagogical standards. Traditionally, instruction has been characterized by grammar-translation approaches and teacher-centered practices, prioritizing precision and rote memorization above interaction or learner autonomy. Consequently, learners may first exhibit skepticism towards AI tools that prioritize communicative learning, such as conversational agents, while demonstrating more receptiveness to tools that correspond with their previous experiences, such as grammar checkers and translation programs. Gardner's Socio-Educational Model (1985) offers a valuable framework for understanding the formation of these attitudes. This approach posits that integrative motivation (interest in the culture of the target language) and instrumental motivation (practical advantages of language ability) both affect language learning results. AI technology may enhance both motivating aspects, such as providing culturally appropriate information or emphasizing the employment advantages of language proficiency. To successfully augment motivation among Iranian EFL learners, these technologies need to align with or progressively broaden the expectations established by conventional educational experiences.

Psychological Flow

Psychological flow, as defined by Csikszentmihalyi (1990), is a state of profound engagement and genuine pleasure in an activity, marked by concentrated attention, explicit objectives, and an equilibrium between difficulty and skill. In language acquisition, attaining flow correlates with enhanced motivation and superior results. AI-driven platforms, especially adaptive systems, effectively facilitate flow by aligning task complexity with learner ability (Heydarnejad et al., 2024). In the Iranian setting, attaining and maintaining flow poses distinct obstacles. A significant obstacle is limited and inconsistent internet connectivity, which may disrupt learning sessions and hinder the sustained engagement necessary for flow. Technological disturbances may induce frustration, impair focus, and diminish learners' feeling of control—essential circumstances for achieving a flow state. Furthermore, some Iranian learners may lack familiarity with self-directed, immersive learning experiences owing to their educational backgrounds. Consequently, even optimally built AI systems may have difficulties in promoting flow unless they are accompanied by reliable infrastructure, user training, and culturally attuned design elements. Therefore, while Csikszentmihalyi's (1990) theory offers a significant perspective on optimum learning experiences, it need adaptation to address the infrastructural and pedagogical challenges encountered by Iranian learners. Developing AI products for this demographic necessitates adaptive functionalities, stability, accessibility, and support systems that alleviate environmental disturbances and foster sustained concentration.

Experimental Studies

In learning a language, if learners see AI technologies as user-friendly and beneficial for attaining linguistic objectives, they are more inclined to cultivate greater self-efficacy in using these instruments. As Chen et al. (2024) concluded, AI-driven language learning systems considered as user-friendly enhance learners' self-efficacy, hence augmenting engagement and overall learning efficacy. Huang et al. (2024) investigated the link between AI self-efficacy and student engagement in a digital language learning environment. They discovered that students with greater AI self-efficacy were more inclined to use language learning applications and actively participate in language activities. Furthermore, Xu and Wang (2024) investigated effectiveness of artificial intelligence on English language learning achievement. They discovered that emotional experiences when interacting with AI tools might either increase or decrease AI self-efficacy. AI aids in cognitive control by assisting learners in managing the cognitive load related to language acquisition. Garnefski et al. (2020) examined the efficacy of AI language learning platforms in alleviating cognitive load by deconstructing complex language problems into smaller, manageable components and offering contextual cues as necessary. These platforms used machine learning algorithms to modify the difficulty level according on the learner's progress, so mitigating cognitive overload and enhancing learning results. This method enables learners to concentrate on the learning process without succumbing to frustration, which may adversely affect their emotional control. Xiao et al. (2024) demonstrated that in AI integrated language learning the state of self-esteem and cognitive-emotion regulation are closely related to their academic enjoyment and language success.

In this regard, Karataş et al. (2024) investigated the manner in which AI-driven language learning applications customize information according to learners' competence and individual preferences, resulting in a notable enhancement of learners' attitudes towards the language learning process. Yang et al. (2023) examined the function of AI in delivering tailored learning experiences and enhancing intrinsic motivation. The research indicated that students using AI-assisted platforms, which adjusted to their advancement by presenting more challenging assignments at suitable intervals, encountered reduced frustration and heightened delight. These results highlight AI's capacity to improve learners' emotional reactions, transforming their attitudes from negative to positive by reducing stress and anxiety. Furthermore, Zhai et al. (2024) investigated the influence of AI-driven individualized learning systems on the psychological flow of second language learners. Their study indicated that learners using AI-driven platforms tailored to their ability level and learning speed were more inclined to achieve a state of flow. This research concluded that these AI systems facilitated the attainment of flow by delivering consistent, timely feedback and enabling learners to advance through more challenging tasks.

AI technologies, which provide dynamic and individualized teaching methods, have been progressively included into language learning settings in higher education in recent years. Intelligent tutoring systems (ITS) are one important use; they provide adaptive learning experiences by customizing feedback and material to each learner's unique profile. Platforms like Duolingo, for example, use AI algorithms to modify the difficulty of lessons according on students' continuous performance, guaranteeing that practice is focused on their areas of competency. AI-driven chatbots and virtual assistants are another well-known technology that mimics conversational exchanges to promote linguistic ability in a relaxed setting. Real-time interaction is facilitated by apps such as Replika, which provide instantaneous corrections and encourage the development of fluency via immersive practice (Yaseen et al., 2025). Speech recognition technology enhances speaking proficiency by providing users with rapid feedback on their pronunciation and fluency. Learners may practice oral skills on their own with the use of tools like Google's speech-to-text and AI-powered pronunciation applications, which boost confidence and reinforce classroom learning. Additionally, learners' emotional reactions to educational materials are interpreted using sentiment analysis technologies. Teachers may modify their teaching methods in real time with the help of these technologies. For instance, writing tools such as Grammarly help students improve their written communication by analyzing tone and purpose in addition to providing grammatical and stylistic fixes (Faisal & Carabella, 2023). Last but not least, AI-enhanced gamified learning systems like Kahoot! and Quizlet modify tasks and tests according on user performance and engagement. The learning process is made more engaging and fun by this adaptive gamification, which also boosts motivation (Waluyo & Balazon, 2024). All in all, these examples show how AI may revolutionize foreign language learning by enabling student autonomy, individualized training, and emotional involvement in ways that were previously impossible with conventional approaches.

Method

Participants

The research included 316 individuals, consisting of 187 females and 129 males, all enrolled in undergraduate and graduate programs at different universities in the provinces of Gilan, Khorasan Razavi, Shiraz, and Tehran. Participants were pursuing degrees in Teaching English as a Foreign Language (TEFL), English Literature, and Translation Studies. Participants included diverse academic standings, including sophomores, juniors, seniors, and master's students, therefore assuring a comprehensive academic spectrum. Furthermore, learners indicated varying degrees of English competence, spanning from intermediate to advanced, as determined by self-assessment and institutional placement examinations. The sample's academic and geographic variety offers a robust basis for analyzing the psychological and attitudinal aspects of AI-assisted EFL learning in various educational and cultural settings.

Instruments

The Artificial Intelligence Self-Efficacy Scale (AISES) for measuring an individual’s perceived self-efficacy in regard to the use of AI technologies/products. This scale was designed by Wang and Chuang (2023) and entails 22 questions in four subscales as following: Assistance (6 items), Anthropomorphic Interaction (5 items), Comfort with AI (5 items), and Technological Skills (6 items). The AISES’s reliability as determined by Cronbach’s alpha was satisfactory for the present inquiry, with values ranging from 0.782 to 0.841).

The AI Cognitive-emotion Regulation (AICERQ), was utilized to assess the particular cognitive emotion regulation strategies that participants employed when confronted with menacing or distressing life events. To this end, CERQ by Garnefski and Kraaij (2007) with 36 items was revised and the AI environments was added to the items: self-blame, other-blame, rumination, catastrophizing, positive refocusing, positive reappraisal, acceptance, and planning on a five-point Likert scale. In this study, the internal consistencies of each subscale fall within the acceptable range of 0.812 to 0.866.

The AI-assisted second language (L2) learning attitude scale (AL2AS) by Suh and Ahn (2022) was utilized to gauge the attitudes and experiences of students while using AI in learning. AL2AS included 26 items on a five Likert scale in following subcomponents: Cognitive, Affective, and Behavioral. Based on analysis, the internal consistency of this scale was satisfactory (ranged between 0.789 to 0.855.

The AI Psychological Flow Scale (AIPFS) was applied to gauge the thoughts and feelings the students may have experienced while applying AI. In so doing, the Psychological Flow Scale by Norsworthy et al. (2023) was modified. This scale included 9 items in seven-point Likert scale in the following subscales: Absorption (e.g., All my attention was on the task/activity), Effort-less Control (e.g., I felt like I could easily control what I was doing), and Intrinsic Reward (e.g., The experience felt satisfying). The Cronbach’s alpha value for AIPFS yielded an acceptable result (ranging from 0.801 to 0.844)

Data Collection Procedure and Analysis

Data collection used structured questionnaires to evaluate the four primary constructs: AI self-efficacy, AI cognitive-emotion regulation, AI-assisted L2 learning attitude, and AI psychological flow. Each dimension was assessed using established scales tailored to the context of AI in language learning. To improve accessibility and convenience for respondents, the surveys were administered online. To evaluate the validity and reliability of the instruments, a pilot study was carried out with a smaller group of students before they were distributed. Throughout the whole study procedure, ethical issues were given top priority. All respondents gave their informed permission, and participation was entirely voluntary. To address data privacy, responses were anonymized and stored on secure, encrypted servers to prevent unauthorized access. Furthermore, the questionnaire's design prevented gathering personally identifying information. In terms of algorithmic bias, attention was made to employ validated and impartial assessment tools to limit the potential of biased results, especially for demographic factors like as gender, proficiency level, and cultural background.

Following the data collection, analysis was performed using SEM and CFA with AMOS software. SEM enables the examination of variable correlations while considering measurement error, providing a thorough framework for clarifying the complex relationships in this study. CFA was used to evaluate the factor structure of the measurement model and determine the accurate representation of the constructs. The data was subjected to a series of analyses. Initially, descriptive statistics were first computed to summarize the demographic data and key variables. Consequently, CFA was used to validate the measurement model. Following confirmation, SEM analysis was performed to assess the suggested relationships among the constructs. Fit indicators, such as the Comparative Fit Index (CFI), Root Mean Square Error of Approximation (RMSEA), and Chi-Square/df ratio, were used to assess model fit.

Result

This section analyzes and delineates the interrelationships among AI Self-efficacy, AI Cognitive-emotion Regulation, AI-assisted L2 Learning Attitude, and AI Psychological Flow within the context of EFL in AI-integrated language learning.

Table 1

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. deviation
Assistance	316	1	7	4.32	1.49
Anthropomorphic Interaction	316	1	7	4.87	1.69
Comfort with AI	316	1	7	5.13	1.62
Technological Skills	316	1	7	5.90	1.57
Self-blame	316	1	5	4.42	0.87
Other-blame	316	1	5	4.79	0.61
Rumination	316	1	5	4.47	0.72
Catastrophizing	316	1	5	3.74	1.00
Putting into Perspective	316	1	5	4.23	0.79
Positive Refocusing	316	1	5	4.11	0.80
Positive Reappraisal	316	1	5	3.96	0.78
Acceptance	316	1	5	4.29	0.68
Planning	316	1	5	4.17	0.71
Cognitive	316	1	5	4.71	0.52
Affective	316	1	5	4.64	0.58
Behavioral	316	1	5	4.43	0.68
Absorption	316	1	7	4.39	1.80
Effort-less Control	316	1	7	4.40	1.67
Intrinsic Reward	316	1	7	4.45	1.65

According to Table 1, The assistance variable had a mean score of 4.32, reflecting a modest perception of support, accompanied by a standard deviation of 1.49, signifying variability in responses. In contrast, the humanistic interaction construct had a higher mean of 4.87 (SD = 1.69), indicating a comparatively positive opinion of interactions with AI systems. The concept of comfort with AI was significant, with a mean score of 5.13 (SD = 1.62), indicating that participants mostly felt at ease while engaging with artificial intelligence. The mean score for technology abilities was 5.90 (SD = 1.57), reflecting a robust self-assessment of technological competence among the respondents. Regarding coping techniques, self-blame had a mean of 4.42 (SD = 0.87), but other-blame was somewhat elevated at 4.79 (SD = 0.61). Mean scores for rumination and catastrophizing were 4.47 (SD = 0.72) and 3.74 (SD = 1.00), respectively, indicating that individuals exhibit some negative thinking patterns, with catastrophizing being less common. Positive coping methods, including perspective-taking (mean = 4.23, SD = 0.79) and positive reappraisal (mean = 3.96, SD = 0.78), garnered modest ratings, suggesting that individuals use these strategies intermittently. Acceptance (mean = 4.29, SD = 0.68) and planning (mean = 4.17, SD = 0.71) exhibited comparable levels of involvement, indicating a balanced use of both adaptive and maladaptive techniques. Subsequent examination of emotional and behavioral reactions indicates cognitive methods with a mean of 4.71 (SD = 0.52), affective responses at 4.64 (SD = 0.58), and behavioral responses at 4.43 (SD = 0.68). The results suggest that individuals display a variety of emotional and cognitive reactions, underscoring a sophisticated method of navigating their experiences. Finally, components associated with task engagement, including absorption (mean = 4.39, SD = 1.80), effort-less control (mean = 4.40, SD = 1.67), and intrinsic reward (mean = 4.45, SD = 1.65), demonstrate moderate degrees of interest and satisfaction in their pursuits. The results provide a comprehensive analysis of participants' opinions of their interactions with technology and their coping strategies, highlighting a blend of positive and negative reactions throughout the assessed areas.

Table 2

The Analysis of Skewness and Kurtosis

	skewness		kurtosis	
	statistic	std. error	statistic	std. error
Assistance	.926	.137	-.288	.273
Anthropomorphic Interaction	.243	.137	-1.395	.273
Comfort with AI	.189	.137	-1.732	.273
Technological Skills	-.832	.137	-.971	.273
Self-Blame	-1.752	.137	3.335	.273
Other-Blame	-1.920	.137	7.875	.273
Rumination	-1.510	.137	3.020	.273
Catastrophizing	-.701	.137	.218	.273
Putting into Perspective	-.873	.137	.592	.273
Positive Refocusing	-.735	.137	.660	.273
Positive Reappraisal	-.661	.137	.817	.273
Acceptance	-.626	.137	.052	.273
Planning	-.468	.137	-.165	.273
Cognitive	-1.743	.137	2.993	.273
Affective	-1.757	.137	4.744	.273
Behavioral	-1.163	.137	1.802	.273
Absorption	.435	.137	-1.123	.273
Effort-Less Control	.600	.137	-.903	.273
Intrinsic Reward	.494	.137	-.797	.273

The examination of skewness and kurtosis for the variables in Table 2 elucidates the distribution features of the data. Skewness denotes the extent of asymmetry in the distribution, while kurtosis signifies the degree of peakedness or flatness in comparison to a normal distribution.

Table 3

Correlations Overview

	AI Self-efficacy	AI Cognitive-emotion Regulation	AI-assisted L2 Learning Attitude	AI Psychological Flow

AI Self-efficacy	1.000			
AI Cognitive-emotion Regulation	0.446 **	1.000		
AI-assisted L2 Learning Attitude	0.433 **	0.516 **	1.000	
AI Psychological Flow	0.291 **	0.514 **	0.321 **	1.000

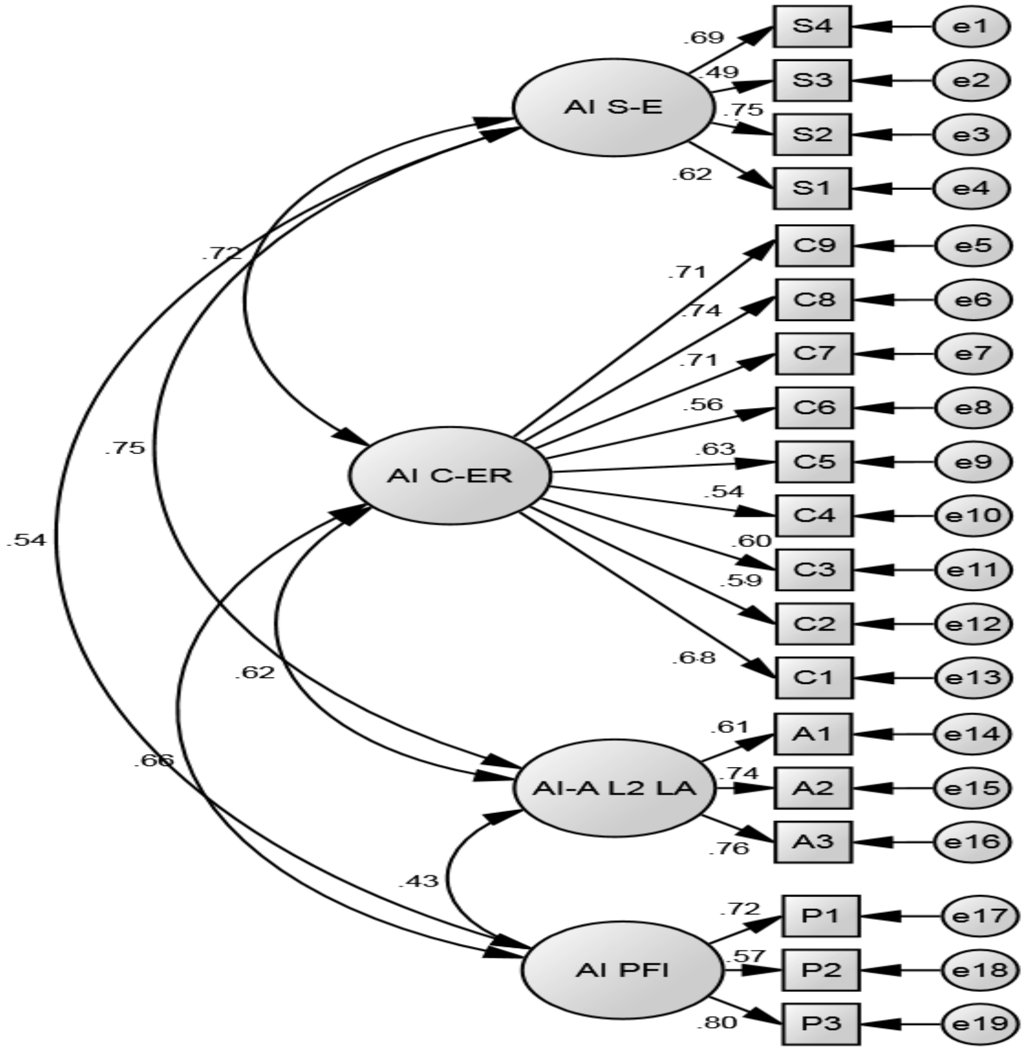
** Correlation is significant at the 0.01 level (2 tailed).

Table 3 depicts the links between four constructs: AI Self-efficacy, AI Cognitive-emotion Regulation, AI-Assisted L2 Learning Attitude, and AI Psychological Flow. Each of these notions is important for understanding how people engage with AI during language acquisition. AI Self-efficacy has a strong positive association with AI Cognitive-emotion Regulation ($r = 0.446$, $p < 0.01$). This shows that people who are more confident in their abilities to utilize AI successfully are more likely to apply adaptive cognitive-emotional techniques while interacting with AI. This association suggests that self-efficacy may improve emotional and cognitive control during AI encounters. AI Self-efficacy significantly correlates with AI-assisted L2 Learning Attitude ($r = 0.433$, $p < 0.01$). This study suggests that those who feel more skilled in utilizing AI are more likely to have a favorable attitude regarding employing AI in language acquisition. A good self-view of one's AI talents may encourage an openness to incorporating technology into the learning process. Additionally, there is a significant link between AI Cognitive-emotion Regulation and AI-assisted L2 Learning Attitude ($r = 0.516$, $p < 0.01$). This suggests that students who use efficient cognitive-emotional management skills are more likely to have a positive attitude toward AI-assisted language acquisition. This finding implies that skillfully controlling emotions and ideas might improve learners' receptivity to AI technologies. The relationships with AI Psychological Flow provide valuable information. AI Self-efficacy has a positive correlation with AI Psychological Flow ($r = 0.291$, $p < 0.01$), suggesting that stronger self-efficacy leads to more flow state during AI interactions. Flow is defined by deep involvement and immersion, implying that trust in utilizing AI may lead to more enriched learning opportunities. Furthermore, AI Cognitive-emotion Regulation has a significant correlation with AI Psychological Flow ($r = 0.514$, $p < 0.01$). This research emphasizes the significance of cognitive-emotional methods in facilitating an immersive learning experience. Learners who can successfully control their emotions and ideas are more likely to enter a state of flow, which improves their overall engagement with AI technologies. The connection between AI-assisted L2 Learning Attitude and AI Psychological Flow ($r = 0.321$, $p < 0.01$) indicates that having a good attitude towards AI-assisted learning increases the chance of feeling flow. This supports the notion that how students perceive and feel about AI technologies may dramatically improve their engagement and learning results.

The following figure displays the outcomes of a structural equation modeling analysis, emphasizing the interrelations among several latent constructs: AI Self-efficacy (AI S-E), AI Cognitive-emotion Regulation (AI C-ER), AI-assisted L2 Learning Attitude (AI-A L2 LA), and AI Psychological Flow (AI PF).

Figure 1

The Results of the CFA



Based on Figure 1, the indicators of AI Self-efficacy (S1, S2, S3, and S4) exhibit robust positive correlations. The estimates for S1 (0.624) and S2 (0.751) are significant at the 0.01 level, with critical ratios of 2.617 and 2.550, respectively, demonstrating that these indicators substantially contribute to the concept of AI Self-efficacy. S3 has a notably elevated estimate of 0.495, accompanied by an extraordinarily high critical ratio of 6.734, with a significance level of ($p < 0.001$), underscoring its substantial influence. Despite S4 lacking a standard error or significance value, its presence underscores its pertinence to the construct. The indices of AI Cognitive-emotion Regulation (C1 to C9) provide uniformly high estimations, all of which are statistically significant. Estimates for C1, C2, C3, C4, C5, C6, C7, and C8 range from 0.540 to 0.742, with crucial ratios demonstrating robust connections (all significant at $p < 0.001$). The greatest critical ratio, 11.225, is recorded for C7, demonstrating its significant contribution to the build. This trend highlights the significance of cognitive-emotional management mechanisms in AI interactions. In the context of AI-assisted L2 Learning Attitude, indicators A1, A2, and A3 exhibit positive correlations, with A2 (0.740) and A3 (0.759) displaying high significance ($p < 0.001$) and critical ratios of 9.333 and 9.428, respectively. The data reveal that favorable opinions regarding AI-assisted language acquisition are considerably affected by these indicators, but A1's estimate of 0.613, albeit lacking standard error or significance, nonetheless denotes its importance. Finally, the indices for AI Psychological Flow (P1, P2, P3) demonstrate robust correlations. P1 has a substantial influence, with an estimate of 0.720. P2 and P3 enhance this construct with values of 0.570 and 0.796, respectively, accompanied by substantial critical ratios of 8.888 and 10.661, both indicating strong associations with AI Psychological Flow. The analysis indicates that all constructs are significantly affected by their respective indicators, particularly highlighting the substantial roles of cognitive-emotional regulation and self-efficacy in promoting positive attitudes towards AI-assisted learning and improving psychological flow. The findings provide a persuasive case for the significance of these variables in the successful incorporation of AI inside language learning contexts.

Table 4

Model Fit Summery

CMIN	DF	CMIN/DF	TLI	CFI	RMSEA	GFI	AGFI	PGFI	GFI
384.19	146	2.631	.940	.978	.098	.909	.951	.922	.909
CMIN/DF ≤ 3, RMSEA≤ 0.09, TLI, CFI, **GFI, AGFI, PGFI, GFI ≥ 0.9**									

Table 4 offers an evaluation of the structural equation model's performance through various fit indices. Each index provides an evaluation of the alignment between the proposed model and the observed data. The CMIN (Chi-Square) value is 384.19, with 146 degrees of freedom (DF), yielding a CMIN/DF ratio of 2.631. This ratio is below the recommended threshold of 3, indicating an acceptable fit between the model and the data. A lower CMIN/DF ratio suggests that the model adequately accounts for the variance in the data. The Tucker-Lewis Index (TLI) and CFI exhibit robust values of 0.940 and 0.978, respectively. The indices span from 0 to 1, with elevated values signifying a superior fit. Both indices surpass the benchmark of 0.90, thereby confirming the model's effectiveness in elucidating the relationships among the constructs. RMSEA is reported at 0.098, marginally exceeding the optimal threshold of 0.09. This indicates a moderate level of fit, suggesting potential for model improvement. A lower RMSEA value is preferred, indicating a superior fit of the model to the data. Furthermore, the Goodness of Fit Index (GFI) and Adjusted Goodness of Fit Index (AGFI) are recorded at 0.909 and 0.951, respectively. Both values exceed the 0.90 threshold, indicating a favorable fit. The Parsimony Goodness of Fit Index (PGFI) is significant at 0.922, suggesting that the model maintains goodness of fit while considering model complexity.

Figure 2

SEM Model

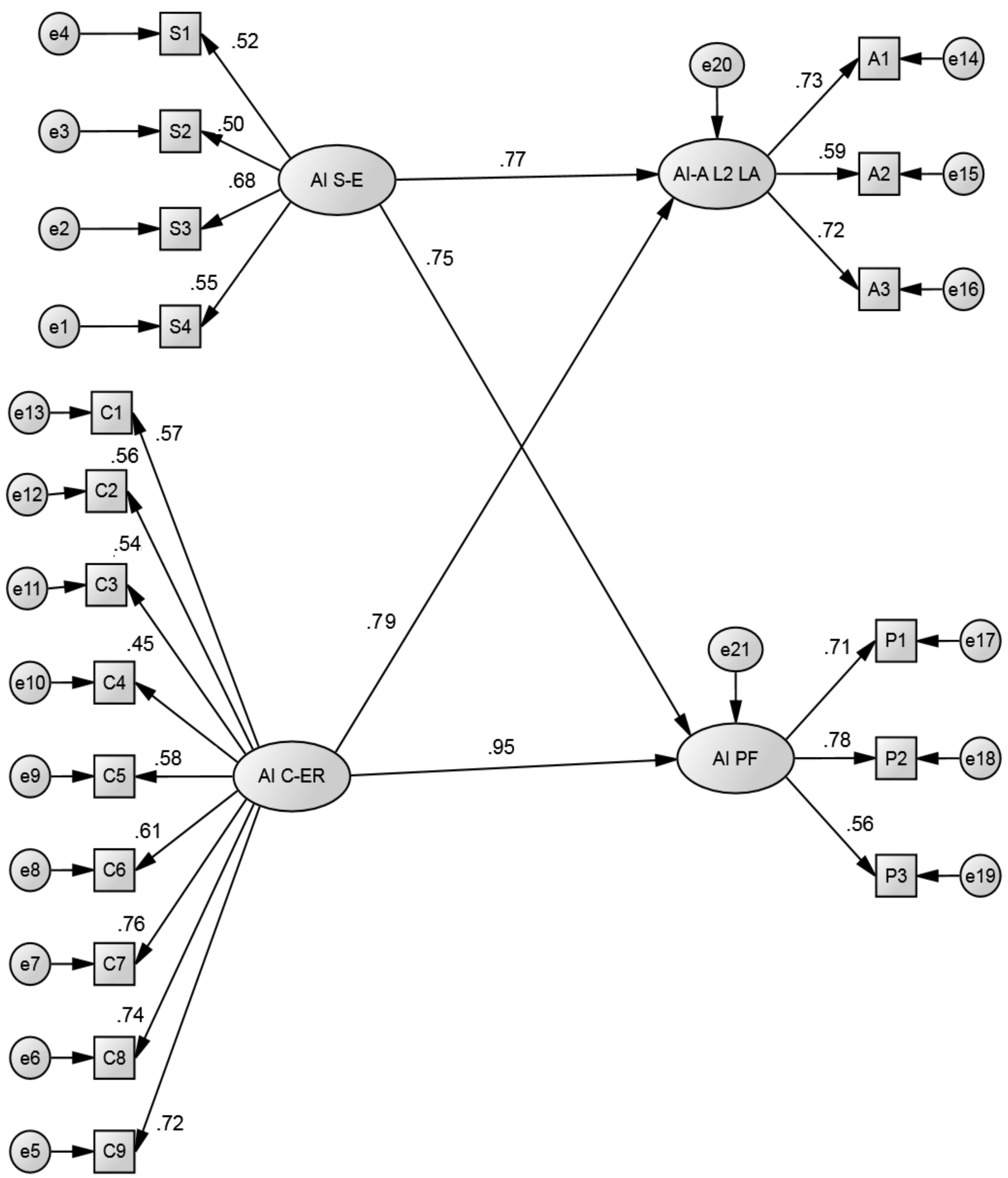


Table 5

The Results of Path Analysis Between the Main Variables

			Estimate	S.E.	C.R.	P	RESULT
AI S-E	--->	AI-A L2 LA	.77	.076	4.612	***	Accept
AI C-ER	--->	AI-A L2 LA	.79	.043	5.800	***	Accept
AI S-E	--->	AI PF	.75	.114	2.129	***	Accept
AI C-ER	--->	AI PF	.95	.107	7.378	***	Accept

Figure 2 as well as Table 5 display the results of path analyses investigating the associations among AI Self-efficacy (AI S-E), AI Cognitive-emotion Regulation (AI C-ER), AI-assisted L2 Learning Attitude (AI-A L2 LA), and AI Psychological Flow (AI PF). Every entry comprises estimates, standard errors (S.E.), critical ratios (C.R.), and significance levels (P), accompanied by a concluding column that reflects the outcomes of hypothesis testing. The relationship between AI self-efficacy and AI-assisted L2 learning attitude exhibits a robust positive estimate of 0.77, accompanied by a standard error of 0.076 and a critical ratio of 4.612, which is significant at the $p < 0.001$ level. This suggests that greater self-efficacy in AI use correlates with a more positive disposition towards AI-assisted language acquisition, hence supporting the acceptance of this theory. The relationship between AI Cognitive-emotion Regulation and AI-assisted L2 Learning Attitude is strong, with an estimate of 0.79, a standard error of 0.043, and a critical ratio of 5.800, all significant at the $p < 0.001$ level. This study indicates that efficient cognitive-emotional management procedures substantially improve attitudes regarding AI-assisted language acquisition, and this hypothesis is similarly accepted. The research reveals a robust correlation between AI Self-efficacy and AI Psychological Flow, with an estimate of 0.75, a standard error of 0.114, and a critical ratio of 2.129, deemed significant ($p < 0.001$). This indicates that enhanced self-efficacy favorably influences the sensation of psychological flow during AI encounters, hence supporting the acceptance of this concept. The correlation between AI Cognitive-emotion Regulation and AI Psychological Flow is notably robust, with an estimate of 0.95, a standard error of 0.107, and a critical ratio of 7.378, indicating high significance ($p < 0.001$). This suggests that the proficient modulation of cognitive and emotional reactions is essential for attaining a state of flow when interacting with AI, hence supporting this idea.

Table 6

The Results of Path Analysis Between the Subscales

			Estimate	S.E.	C.R.	P	RESULT
AI S-E	--->	S1	.52	.161	4.922	***	Accept
AI S-E	--->	S2	.50	.117	2.060	.039	Accept
AI S-E	--->	S3	.68	.105	2.638	.008	Accept
AI S-E	--->	S4	.55				Accept
AI C-ER	--->	C1	.57	.100	7.447	***	Accept
AI C-ER	--->	C2	.56	.079	12.571	***	Accept
AI C-ER	--->	C3	.54	.091	11.954	***	Accept
AI C-ER	--->	C4	.45	.092	9.550	0.031	Accept
AI C-ER	--->	C5	.58	.091	10.101	***	Accept
AI C-ER	--->	C6	.61	.116	8.952	***	Accept
AI C-ER	--->	C7	.76	.084	9.508	***	Accept
AI C-ER	--->	C8	.74	.071	6.087	***	Accept
AI C-ER	--->	C9	.72				Accept
AI-A L2 LA	--->	A1	.73	.101	7.552	***	Accept
AI-A L2 LA	--->	A2	.59	.160	8.421	***	Accept
AI-A L2 LA	--->	A3	.72				Accept
AI PF	--->	P1	.71	.191	8.435	***	Accept
AI PF	--->	P2	.78	.083	8.543	***	Accept
AI PF	--->	P3	.56				Accept

Table 6 provides an in-depth examination of the interrelations among main AI constructs—AI S-E, AI C-ER, AI-A L2 LA, and AI PF—alongside their corresponding subscales. The results demonstrate substantial positive correlations across all examined variables, indicating that these dimensions are interrelated and crucial in affecting diverse educational outcomes. For example, AI S-E demonstrates a robust correlation with S3 (estimate of 0.68, C.R. of 2.638, $p = 0.008$), as well as significant associations with S1 (0.52, $p < 0.001$) and S2 (0.50, $p = 0.039$), underscoring the critical role of self-efficacy in improving performance. AI C-ER has strong associations, especially with C7 (0.76, $p < 0.001$) and C8 (0.74, $p < 0.001$), indicating that proficient cognitive-emotional regulation substantially enhances favorable emotional and cognitive results. The AI-A L2 LA construct has significant correlations, particularly with A1 (0.73, $p < 0.001$) and A2 (0.59, $p < 0.001$), suggesting that a positive disposition towards AI in language acquisition is essential for achievement. Finally, AI PF demonstrates substantial correlations with P1 (0.71, $p < 0.001$) and P2 (0.78, $p < 0.001$), underscoring the importance of psychological flow in augmenting engagement and performance. These results indicate that promoting self-efficacy, cognitive-emotional control, favorable attitudes towards AI, and psychological flow may substantially improve educational experiences and outcomes.

Discussion

This study underlines the crucial roles of AI self-efficacy and AI cognitive-emotion regulation in improving AI-assisted L2 learning attitudes and psychological flow in the Iranian EFL environment. The major objective was to investigate AI cognitive-emotion regulation as a significant determinant affecting learners' views about AI-assisted language learning. Cognitive-emotion regulation pertains to learners' capacity to control and adjust their emotional reactions to AI tools—a crucial skill for sustaining motivation and cultivating good attitudes in the face of adversity. In technology-enhanced learning environments, learners frequently encounter challenges such as acclimating to new AI systems or contending with the inherent limits of these tools. Thus, learners' emotional control profoundly influences their perception of AI technology as either advantageous or disheartening and disengaging. The results indicate that students with enhanced emotional control abilities are more inclined to maintain positive views regarding AI-assisted learning. This aligns with Gross's Emotion Regulation Theory (2002), which asserts that learners use adaptive ways to manage their emotions during stress or failure sustain more motivation and engagement. Hoang (2025) underscores the influence of emotional regulation on learners' views of AI, promoting AI functionalities that assist in mitigating frustration and adverse emotions. Xiao et al. (2024) also affirm that learners who experience more control over their emotional responses are inclined to embrace and evaluate instructional technology favorably. These observations highlight the essential function of cognitive-emotional control in influencing learners' perceptions of AI-assisted language learning, especially in environments characterized by anxiety or fear of failure.

Moreover, the collectivist cultural norms characteristic of Iranian society uniquely influences AI self-efficacy and emotional regulation. In collectivist settings, learners often prioritize social harmony and approval, which can affect their confidence in independently using AI tools. Iranian EFL learners may rely more heavily on peer or instructor validation when engaging with AI, which in turn influences their self-efficacy beliefs differently than learners from individualistic cultures. This cultural orientation may also affect emotional regulation strategies, as learners might suppress overt expressions of frustration to maintain social cohesion, thereby shaping their engagement with AI-mediated learning in culturally specific ways.

The research illustrates a robust correlation between AI cognitive-emotional management and psychological flow. Csikszentmihalyi's Flow Theory (1990) posits that flow is attained when learners encounter an ideal equilibrium between challenge and competence, promoting profound attention and intrinsic satisfaction. Individuals proficient in emotional regulation are more capable of navigating the hurdles presented by AI-driven language activities without succumbing to stress or adverse emotions. This emotional modulation enhances the persistent concentration necessary for flow, promoting ongoing engagement and motivation despite obstacles (Namaziandost et al., 2023). These findings correspond with Çelik and Aşık (2023), who discovered that adept emotional management enhances the probability of attaining flow in language acquisition. Likewise, Heydarnejad et al. (2024) and Halkiopoulos and Gkintoni (2024) present more evidence that AI-assisted emotional regulation improves student focus and fosters good educational experiences.

However, it is important to consider that restricted internet access—common in many Iranian educational contexts—may pose a significant barrier to attaining psychological flow. Unstable or limited connectivity can disrupt the seamless interaction necessary for flow, leading to frustration and attention lapses. This highlights the necessity of designing AI tools that accommodate such infrastructural limitations, for example through offline functionality or adaptive data use, to support uninterrupted learner engagement. Additionally, traditional Iranian pedagogical practices, which tend to be teacher-centered and grounded in grammar-translation methods, may shape learners' initial attitudes toward AI-assisted learning. Iranian students accustomed to authoritative and structured instruction might exhibit skepticism toward AI conversational tools, perceiving them as less credible or effective than human teachers. Conversely, AI applications that complement established practices, such as grammar-checkers, may be more readily accepted. These pedagogical factors are likely to influence learners' self-efficacy and attitudes toward different AI tools, emphasizing the importance of culturally responsive AI designs.

The outcomes of this study illuminate the ways in which AI cognitive-emotion regulation and AI self-efficacy can improve attitudes toward AI tools and facilitate psychological flow, thereby contributing to a more engaging and effective language learning experience, within the specific context of Iranian EFL learners. In traditional classrooms, Iranian EFL learners frequently encounter a variety of challenges, such as inadequate exposure to native speakers, overcrowded classes, and inadequate individual attention (Namaziandost et al., 2025). In this context, AI tools offer a chance to confront these obstacles by providing personalized learning experiences that can enhance motivation and promote learner autonomy. Additionally, AI tools may aid in the maintenance of positive attitudes and a state of fluidity by assisting learners in regulating their emotions. This emphasizes the significance of AI tools that are culturally pertinent and that consider the unique emotional and pedagogical requirements of Iranian EFL learners.

Conclusion

The current research investigated the links between AI self-efficacy, AI cognitive-emotion regulation, AI-assisted L2 learning attitude, and AI psychological flow in the setting of Iranian EFL students. The results demonstrated that AI cognitive-emotion regulation had an important role in changing learners' attitudes toward AI tools and supporting the achievement of psychological flow, which is defined as deep engagement and immersion in the learning process. It indicates that cognitive and emotional aspects play important roles in shaping learners' interactions with AI systems in language learning. EFL teachers may build more effective and interesting learning environments by developing better levels of self-efficacy and boosting emotion management, allowing students to not only improve their language proficiency but also enjoy the learning process. The findings contribute to the literature on AI in language learning by illustrating the intricate relationships between self-efficacy, cognitive-emotion regulation, attitudes, and flow. Although earlier research has addressed these characteristics individually, this study takes a more holistic approach, stressing how these psychological dimensions impact the entire learning experience in AI-enhanced language learning environments. The findings contribute to a more profound comprehension of the ways in which AI can influence the motivation, engagement, and ultimately, the language learning outcomes of learners by demonstrating the significance of these psychological factors.

To enhance self-efficacy in learners, instructors must provide opportunities for students to develop their confidence in using AI-based learning technology. Practical approaches may include providing guided tutorials, encouraging experiential learning, and ensuring early exposure to AI technology in the language development process. Teachers may increase students' self-efficacy and, therefore, their motivation and engagement with AI applications by organizing the learning process and allowing them to experiment with them in a stress-free environment. Moreover, the results underscore the significance of AI cognitive-emotion control in enhancing learners' interactions with AI tools. Consequently, it is important for instructors to assist students in navigating the spectrum of emotions they may encounter when using AI technologies, particularly adverse emotions like irritation or worry. Teachers may integrate emotion regulation tools, including cognitive reappraisal, mindfulness, and stress management techniques, into the curriculum to provide EFL learners with the necessary abilities to handle difficult emotions. These strategies will assist learners in surmounting possible obstacles and sustaining motivation, resulting in more efficient use of AI technologies and improved educational results. The research underscores the importance of fostering favorable views towards AI-assisted language learning. To cultivate favorable attitudes, instructors have to emphasize the advantages of AI technologies, demonstrating their capacity to personalize learning and provide customized feedback that caters to learners' specific requirements.

Motivating learners to see AI as a beneficial educational ally may foster ongoing engagement with these technologies. Conversely, adverse sentiments about AI tools may lead to hesitance in using these resources, impeding learning advancement. Consequently, it is essential for educators to provide explicit elucidations of how AI technologies facilitate language acquisition and to present tangible instances of their efficacy. Ultimately, psychological flow has surfaced as a vital element in engaging learners in AI-assisted language acquisition. Flow, defined as complete absorption and delight in a learning activity, has been shown to significantly enhance both motivation and effective learning. Teachers should create AI-enhanced learning activities that correspond with students' interests and skill levels. Tasks that are suitably hard, but attainable, cultivate a feeling of achievement and flow. By providing learners with a mix of challenge and competence, educators may guarantee that students stay thoroughly engaged with the educational content, hence improving their learning results.

The study's results indicate many viable approaches for the implementation of AI-enhanced language learning that include both cognitive and emotional aspects. Initially, instructors may implement confidence-enhancing activities by providing systematic advice and practical encounters using AI technologies. Such instruction should be structured to facilitate learners' progressive acclimatization to the technologies, therefore alleviating feelings of uneasiness or uncertainty. Furthermore, offering students early chances for success helps reinforce their confidence in using AI technologies proficiently. Teachers may include targeted tactics into the curriculum to enhance emotional control. Instructing students on managing irritation and stress while encountering obstacles using AI technologies helps alleviate anxiety. Cognitive reappraisal, which involves reframing negative beliefs, and mindfulness techniques, which emphasize present-moment awareness, may be especially beneficial. These methods facilitate learner concentration and reduce the probability of discouragement, hence sustaining positive involvement with the educational process.

A further pragmatic approach is the incremental integration of AI technologies. Teachers should start with fundamental resources rather than inundating students with intricate technology, gradually integrating more advanced AI systems as students gain proficiency. This systematic method guarantees that trainees remain unencumbered and may concentrate on acquiring fundamental abilities prior to advancing to more complex functionalities. Moreover, instructors have to provide tailored learning experiences that address the specific requirements of individual learners. AI technologies that adjust to learners' capabilities and preferences might provide more immersive experiences that promote psychological flow. Customized feedback, individualized activities, and adaptive learning functionalities may empower learners to take charge of their advancement, hence enhancing their motivation and involvement in the process. Ultimately, ongoing feedback mechanisms are crucial for sustaining learner engagement and enhancing self-efficacy. AI-driven educational systems must provide instantaneous feedback, enabling learners to monitor their progress and implement necessary modifications. This continuous feedback assists learners in remaining focused and assures them that their efforts are acknowledged, therefore bolstering their confidence and motivation.

This research offers significant insights into the interplay of AI self-efficacy, AI cognitive-emotional regulation, AI-assisted L2 learning attitudes, and AI psychological flow; nevertheless, some limitations need to be recognized. These constraints may guide future research directions to enhance our understanding of the variables affecting AI-assisted language development. The primary limitation of this research is the sample size. To mitigate this constraint, further research may include cross-cultural studies by enlisting participants from many nations and educational backgrounds. This would assist in ascertaining if psychological factors affecting AI-enhanced language development are universal or whether cultural characteristics influence learners' interactions with AI tools. A further weakness of this research is its cross-sectional design. This approach measures the connections between variables at a particular moment in time, capturing correlations between constructs without demonstrating causation or studying the evolution of these interactions across time. Future study might use a longitudinal approach to examine changes in AI self-efficacy, emotional control, attitudes, and psychological flow over an extended duration.

Moreover, dependence on self-reported data can generate biases, such as social desirability effects, potentially causing participants to exaggerate favorable actions or attitudes toward AI technologies. Future research should integrate strategies to identify or alleviate these biases, or corroborate self-reported data with alternative sources. This research was undertaken within the distinctive socio-political setting of Iran, characterized by restricted internet access and variable digital infrastructure. These contextual elements may affect the accessibility, usage behaviors, and perceptions of AI technologies among learners. Future study can specifically investigate how these limits influence AI adoption and incorporate cross-cultural comparisons to assess the generalizability of the results. This study predominantly utilized self-report questionnaires to evaluate categories such as AI self-efficacy, emotional regulation, and learner attitudes. Future research may use a mixed-methods approach to attain a more comprehensive and nuanced understanding of learner interactions with AI in real-time. This may encompass qualitative interviews, behavioral observations, and the study of use logs from AI-based devices, facilitating a more profound understanding of learners' genuine experiences and psychological conditions during AI-enhanced language acquisition. Furthermore, the study failed to include external variables as access to technology, socioeconomic position, and disparities in educational infrastructure. These factors may substantially affect the correlation between psychological characteristics and AI learning results. Future research should investigate the impact of digital literacy, resource accessibility, and overarching socioeconomic factors on learners' interaction with AI technologies. Comprehending these contextual characteristics is essential for recognizing obstacles to equitable AI adoption and guiding solutions that foster inclusive and accessible technology use for all learners, irrespective of their background.

References

Bandura, A. (1997). *Self-efficacy: The exercise of control*. W H Freeman/Times Books/ Henry Holt & Co.

Bandura, A. (2012). Social cognitive theory. In P. A. M. Van Lange, A. W. Kruglanski, & E. T. Higgins (Eds.), *Handbook of theories of social psychology* (pp. 349–373). Sage Publications Ltd. https://doi.org/10.4135/9781446249215.n18

Bong, M. (2013). Self-efficacy. In J. Hattie & E. M. Anderman (Eds.), *International guide to student achievement* (pp. 64–66). Routledge/Taylor & Francis Group.

Çelik, H. R., & Aşık, A. (2023). Experiencing Flow with Technology in Foreign Language Classrooms. *Language Teaching and Educational Research*, *6*(2), 124-142. https://doi.org/10.35207/later.1307395

Chen, D., Liu, W., & Liu, X. (2024). What drives college students to use AI for L2 learning? Modeling the roles of self-efficacy, anxiety, and attitude based on an extended technology acceptance model. *Acta Psychol*. 249:104442. https://doi.org/10.1016/j.actpsy.2024.104442

Csikszentmihalyi, M. (1990). Flow: The psychology of optimal experience. Harper & Row.

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly, 13*(3), 319-340. https://doi.org/10.2307/249008

Dörnyei, Z. (2005). The Psychology of the Language Learner: Individual Differences in Second Language Acquisition. Lawrence Erlbaum Associates Publishers.

Faisal, F., & Carabella, P, A. (2023). Utilizing Grammarly in an academic writing process: Higher-education students' perceived views. *Journal of English Language Teaching and Linguistics, 8*(1), 2023, 23-42. http://dx.doi.org/10.21462/jeltl.v8.i1.1006

Gardner, R. C. (1985). *Social Psychology and Second Language Learning: The Role of Attitudes and Motivation*. London: Edward Arnold. https://doi.org/10.1037/h0083787

Garnefski, N., & Kraaij, V. (2007). The cognitive emotion regulation questionnaire: Psychometric features and prospective relationships with depression and anxiety in adults. European *Journal of Psychological Assessment, 23*(3), 141–149. https://doi.org/10.1027/1015-5759.23.3.14

Garnefski, N., Van Den Kommer, T., Kraaij, V., Teerds, J., Legerstee, J., & Onstein, E. (2020). The relationship between cognitive emotion regulation strategies and emotional problems: comparison between a clinical and a non-clinical sample. *Eur J Pers. 16*(5),403–20. https://doi.org/10.1002/per.458

Gross, J. J. (2002). Emotion regulation: Affective, cognitive, and social consequences. *Psychophysiology, 39*(3), 281-291. https://doi.org/10.1017/S0048577201393198

Halkiopoulos, C., & Gkintoni, E. (2024). Leveraging AI in E-Learning: Personalized Learning and Adaptive Assessment through Cognitive Neuropsychology—A Systematic Analysis. *Electronics, 13*(18), 3762. https://doi.org/10.3390/electronics13183762

Heydarnejad, T., Lotfi Gaskaree, B., Zahedi Moghaddam, S. and Mavaddat Kakhki, A. (2024). Beauty in the Minds of EFL Learners: Mirroring the Nexus between AI Psychological Flow, Grit Tendencies, Mental Health, and Critical Thinking in AI-Assisted Instruction. *Applied Linguistics Inquiry*, *2*(2), 102-118. https://doi.org/10.22077/ali.2025.8870.1089

Hoang, N. H. (2025). Investigating EFL students' emotional responses in AI-assisted language learning: a Broaden-and-Build Theory approach. *Interactive Learning Environments*, 1–16. https://doi.org/10.1080/10494820.2025.2512567

Huang, F., Wang, Y., & Zhang, H. (2024). Modelling generative AI acceptance, perceived teachers' enthusiasm and self-efficacy to English as a foreign language learners' well-being in the digital era. *European Journal of Education*. https://doi.org/ https://doi.org/10.1111/ejed.12770

Karataş, F., Abedi, F.Y., Ozek Gunyel, F. et al. (2024). Incorporating AI in foreign language education: An investigation into ChatGPT's effect on foreign language learners. *Educ Inf Technol*, *29*, 19343–19366. https://doi.org/10.1007/s10639-024-12574-6

Keegan, E., & Holas, P. (2009). *Cognitive-behavior therapy: Theory and practice*. In R. Carlstedt (Ed.), Integrative clinical psychology, psychiatry and behavioral medicine (pp. 605–630). Springer Publications.

Liu, Y., Zhang, H., Jiang, M., Chen, J., Wang, M. (2024). A systematic review of research on emotional artificial intelligence in English language education. *System 126*(1),103478. https://doi.org/10.1016/j.system.2024.103478

Namaziandost, E., Heydarnejasd, T., Rezai, A., & Kargar Behbahani, H. (2025). To boldly go in distance language learning: A picture of nexus between academic resilience, academic buoyancy, learner self-efficacy, learner enjoyment, and academic well-being. *Teaching English Language, 19*(1), 473-514. https://doi.org/ 10.22132/tel.2024.431472.1547

Namaziandost, E., Rezai, A., Heydarnejad, T., & Kruk, M. (2023). Emotion and cognition are two wings of the same bird: insights into academic emotion regulation, critical thinking, self-efficacy beliefs, academic resilience, and academic engagement in Iranian EFL context. *Thinking Skills and Creativity*, 50, 101409. https://doi.org/10.1016/j.tsc.2023.101409

Norsworthy, C., Dimmock, A. J., Nicholas, J., Krause, A., & Jackson, B. (2023). Psychological flow scale (PFS): Development and preliminary validation of a new flow instrument that measures the core experience of flow to reflect recent conceptual advancements. *International Journal of Applied Positive Psychology*. https:// doi. org/ 10. 1007/ s41042-023- 00092-8

Suh, W., & Ahn, S. (2022). Development and validation of a scale measuring student attitudes toward artificial intelligence. *SAGE Open*, *12*(2), Article 21582440221100463. https://doi.org/10.1177/21582440221100463

Wang, Y., & Chuang, Y. (2023). Artificial intelligence self-efficacy: Scale development and validation. *Education and Information Technologies*, *29*(4), 4785–4808. https:// doi.org/10.1007/s10639-023-12015-w

Waluyo, B., & Balazon, F. G. (2024). Exploring the impact of gamified learning on positive psychology in CALL environments: A mixed-methods study with Thai university students, *Acta Psychologica*, 251, 104638. https://doi.org/10.1016/j.actpsy.2024.104638

Xiao, T., Yi, S., & Akhter, S. (2024). AI-Supported Online Language Learning: Learners' Self-Esteem, Cognitive-Emotion Regulation, Academic Enjoyment, and Language Success. *The International Review of Research in Open and Distributed Learning, 25*(3), 77–96. https://doi.org/10.19173/irrodl.v25i3.7666

Xu, T., & Wang, H. (2024). The effectiveness of artificial intelligence on English language learning achievement. *System*, 103428. https://doi.org/10.1016/j.system.2024.103428

Yang, H., Shankar, A., & Velliangiri, S. (2023). Artificial Intelligence-Enabled Interactive System Modeling for Teaching and Learning Based on Cognitive Web Services. *International Journal of e-Collaboration, 19*(2), 1-18. https://doi.org/10.4018/ijec.316655.

Yaseen, H., Mohammad, A. S., Ashal, N., Abusaimeh, H., Ali, A., & Sharabati, A.-A. A. (2025). The Impact of Adaptive Learning Technologies, Personalized Feedback, and Interactive AI Tools on Student Engagement: The Moderating Role of Digital Literacy. *Sustainability, 17*(3), 1133. https://doi.org/10.3390/su17031133

Zhai, X., Zhao, R., Jiang, Y., & Wu, H. (2024). Unpacking the Dynamics of AI-Based Language Learning: Flow, Grit, and Resilience in Chinese EFL Contexts. *Behavioral Sciences, 14*(9), 838. https://doi.org/10.3390/bs14090838