Language Related Research
E-ISSN: 2383-0816
https://lrr.modares.ac.ir
https://doi.org/10.48311/lrr.2025.118514.83043
https://lrr.modares.ac.ir/article_28050.html

Tarbiat Modares University

Vol. 17, No. 3
pp. 1-28
Fall 2026

Received: 22 June 2023
Received in revised form: 9 August 2023
Accepted: 20 August 2023

The Role of Multimodal AI Technologies in EFL Students' Perceived Positive and Negative Achievement Emotions: An Existential Positive Psychology (EPP) Perspective

Ali Derakhshan[*1] & *Yujong Park*[2]

Abstract

Various aspects of English as a foreign language (EFL) education are affected by the adopting of artificial intelligence (AI) tools with both monomodal and multimodal capacities. However, the emotional consequences of AI-mediated second/foreign language (L2) education remain underexplored in the existing literature. To address this gap, the current experimental study drew on the principles of existential positive psychology (EPP) to explore the role of multimodal AI technologies in shaping students' positive and negative achievement emotions. A total of 82 Iranian EFL students were assigned to a control (n = 41) and an experimental group (n = 41) and completed a validated achievement emotions questionnaire a questionnaire twice (pretest and posttest). Students in the experimental group went through a multimodal AI-mediated instructional intervention, while their peers in the control group received conventional teacher-fronted instruction. The results of analysis of covariance (ANCOVA) revealed that multimodal AI-mediated instruction had a statistically significant impact on EFL students' achievement emotions. Specifically, there were significant improvements in learners' positive emotions, while their negative emotions significantly decreased after the intervention. Interpreted through an EPP lens, these findings suggest that engagement with multimodal AI technologies may simultaneously foster emotional flourishing and alleviate emotionally adverse experiences in EFL learning contexts. The

[1] Corresponding Author: Professor of Applied Linguistics, Department of English Language and Literature, Faculty of Humanities and Social Sciences, Golestan University, Gorgan, Iran; ORCID ID: https://orcid.org/0000-0002-6639-9339; *Email: a.derakhshan@gu.ac.ir*

[2] Professor of Applied Linguistics, Department of English Language and Literature, Sungkyunkwan University, Seoul, South Korea; ORCID ID: https://orcid.org/0000-0003-2607-0958; *Email: yujpark@gmail.com*

study foregrounds often-overlooked emotional dimension of AI-mediated L2 education and provides theoretical and pedagogical implications pertaining to multimodal AI adoption by students and teachers in EFL contexts. .

***Keywords*:** Artificial Intelligence (AI), achievement emotions, EFL students, existential positive psychology (EPP), L2 education, multimodal AI technologies

1. Introduction

The incorporation of Artificial Intelligence (AI) technologies, with both monomodal and multimodal potentials, into language education has attracted increasing scholarly attention, with a growing body of research highlighting their pedagogical affordances and psycho-emotional implications (e.g., Derakhshan & Lalli, 2025; Kohnke, 2025; Liu & Wang, 2024; Stockwell, 2024; Wei, 2023; Zou et al., 2023). Previous studies have demonstrated that AI-mediated instruction can enhance language learning by providing customized practices, rich input, instant feedback, and diverse communicative tasks (Dai & Liu, 2024; Liu & Fan; 2024; Nguyen & Le, 2023; Wu & Wang, 2025). Likewise, AI-driven language education allows learners access to learning materials that align well with their proficiency levels and learning interests (Liu & Ma, 2023). Additionally, AI tools such as multimodal chatbots are reported to augment learner autonomy, engagement, and language skill development (Derakhshan, 2025b; Derakhshan & Taghizadeh, 2025; Su et al., 2023; Zare et al., 2025). This growing literature accentuates the transformative potential of AI in reshaping both instructional practices and the psycho-affective dimensions of language education (Moorhouse & Kohnke, 2024; Zhou & Hou, 2024).

Concurrent with these advancements in AI technologies, scholarly interest in emotional factors in AI-mediated instruction has garnered attention in language education (Huang & Derakhshan, 2025; Lu et al., 2024). Research evidence suggests that multimodal AI inclusion can induce a wide spectrum of pleasant and unpleasant emotional experiences for both teachers and learners (Xin & Derakhshan, 2025; Yang & Zhao, 2025). In this regard, students' achievement emotions are also likely to be affected by the integration of AI technologies (Chen et al., 2025). Achievement emotions refer to the emotions experienced during achievement-related activities and outcomes (Pekrun, 2006). Such emotions can entail a wide range of positive and negative emotional experiences, such as joy, hope, stress, and anxiety, and the like during language education (Kruk et al., 2022; Shao et al., 2023). Since achievement emotions have been witnessing a soaring interest in language education (Li et al., 2025), a growing number of studies have attempted to examine such emotions in the context of AI inclusion (e.g., Chen et al., 2025; Wu & Li, 2025).

On the other hand, notwithstanding the advancements in AI integration, research on multimodal AI-mediated instruction has mainly overlooked the potential of

existential positive psychology (EPP) as a guiding framework (Derakhshan & MacIntyre, 2025a, b). EPP, which integrates existential philosophy with positive psychology (PP), offers a holistic framework for understanding the dynamic interplay of positive and negative emotions in educational contexts (Frankl, 1984; Wong, 2021; Wong et al., 2022). By emphasizing polarity, balance, self-transcendence, and true positivity at its core, EPP acknowledges the role of both the dark and bright sides of emotional experiences (Mayer, 2020; Wong & Bowers, 2019). Furthermore, EPP explicitly considers a "dialectical interplay between positive and negative experiences" (Derakhshan & MacIntyre, 2026; p. 6). In accordance with its capacity in understanding individuals' emotional experiences, EPP has only been limitedly adopted by language researchers to delve into learners' and teachers' well-being, suffering, or their emotion regulation strategies (Derakhshan & MacIntyre, 2025a, b; Wang & Marecki, 2021). Nevertheless, Derakhshan and MacIntyre (2026) maintain that EPP can be utilized as a valuable framework for examining different negative emotions and their role as integral parts of human growth and development in technology-mediated educational contexts.

However, despite its conceptual promise, EPP has remained largely unexplored in AI-mediated instruction. Moreover, exploring the impacts of multimodal AI technologies on EFL students' positive and negative achievement emotions through the lens of EPP constitutes an empirically research area. In response to these gaps, the present study sets out to probe the role of multimodal AI-mediated instruction in shaping EFL students' achievement emotions by adopting an intervention-based design under the theoretical lens of EPP. By situating the inquiry within this framework, this study aims to shed light on the complex and dialectical nature of learners' emotional experiences in multimodal AI-mediated language education. Additionally, this study expands the theoretical scope of EPP beyond conventional contexts into AI-enhanced language learning environments.

2. Literature Review

2.1. AI and L2 Education

Research into the role of AI integration in language education has been thriving and has divulged numerous affordances for fostering teaching and learning processes (e.g., Jeon, 2022; Kohnke et al., 2023; Wang et al., 2025). There is mounting evidence in the literature to highlight that AI has been instrumental for language

education (Zhou & Hou, 2024). It is asserted that AI-mediated L2 instruction caters to learners' needs and learning preferences through providing access to customized learning practices (Derakhshan & Solhi, 2025; Nguyen & Le, 2023). AI-enhanced language education can allow access to abundant language input, instant feedback, and a wide range of communicative learning tasks (Fryer et al., 2020; Guo et al., 2023). It is vital to mention that AI inclusion promotes the adoption of innovative teaching practices, culminating in effective language learning processes (Fathi et al., 2024). AI technologies can aid teachers in designing engaging learning environments and performing tedious tasks such as assessment or material development (Luckin et al. 2022; Pokrivcakova, 2019).

More notably, AI chatbots can expose language learners to authentic language content by constructing different dialogues with learners (Kartal &Yeşilyurt, 2024). Different multimodal chatbots, such as ChatGPT can be beneficial in enhancing learners' language skills and subskills (Zhang & Derakhshan, 2025; Zare et al., 2025). Moreover, AI incorporation in language education can boost learners' autonomy through facilitating access to learning content without time or place restrictions (Huang et al., 2023). Likewise, AI-mediated instruction can enhance learners' engagement through the provision of different types of activities (Dai & Liu, 2024). Additionally, AI inclusion can exert influence on teachers' and learners' emotional experiences (Wu & Derakhshan, 2025).

With the widespread presence and affordances of AI technologies, numerous studies have been conducted on different dimensions of AI inclusion in language instruction. For instance, Zhou and Hou (2024) argued that AI technologies can empower L2 education with their potentials in increasing various dimensions of engagement (i.e., behavioral, cognitive, and emotional). In another study, Wei (2023) explored the effects of AI-mediated instruction on EFL learners' achievement, motivation, and self-regulated learning through dividing students into experimental group receiving AI instruction and control group being taught through conventional methods. Results uncovered that the AI group outperformed the control group in terms of language learning outcomes and had higher levels of motivation, engagement, and self-regulation. Likewise, Zhou and Hou (2024) explored the role of AI in behavioral, cognitive, and emotional engagement through semi-structured interviews with 24 EFL teachers and 38 college learners. The results indicated that behavioral engagement is shown in frequent use of AI tools in language activities, cognitive engagement was reflected in the recognition of AI

potential to enhance teaching strategies and learning processes, and emotional engagement revealed the integration of different attitudes from optimism to apprehension. Furthermore, Derakhshan (2025b) reported the positive impact of GenAI tools like Gemini on EFL students' anxiety reduction during L2 writing instruction. Likewise, Huang and Derakhshan (2025) found the use of AI tools effective in EFL learners' motivation, self-regulation, and digital literacy skills. While substantiated to be influential, adopting AI tools largely depends on personal and professional resources (Wu & Derakhshan, 2025).

2.2. Students' Achievement Emotions in AI-mediated L2 Education

Language education is regarded as an emotionally-embedded practice, which encompasses diverse positive and negative emotions (Richards, 2020). In this sense, the notion of achievement emotions has gained momentum in language education during recent years (Li et al., 2025; Shao et al., 2023). Achievement emotions are conceptualized as "emotions directly linked to achievement activities or outcomes" (Pekrun, 2006, p. 317). Achievement emotions are mainly categorized based on three aspects of their valence (whether positive or negative), their activation level (energizing or dampening), and their object focus (connected to the learning activity itself or to its anticipated outcomes), as posited in the control value theory (CVT) (Pekrun, 2006). CVT, is one of the most popular models for researching emotions in academia, which highlights the antecedents and consequences of one's emotional experiences in relation to their appraisals of control and value in an activity. Therefore, this model suits the study of emotional states in L2 education, wherein teachers and learners encounter diverse achievement emotions, namely enjoyment, boredom, anxiety, relief, joy, hope, pride, and anger (Kruk et al., 2022).

The widespread integration of advanced technologies has brought increased attention to emotional dimensions in technology-mediated education (Lee & Chei, 2020). The integration of innovative technologies might induce numerous positive and negative emotions in both learners and teachers (Rudolph et al., 2023). Among emerging technologies, AI is considered as a means of impacting different affective factors, namely enjoyment, engagement, motivation, and the like in language education (Liu & Reinders, 2025; Wang et al., 2023; Wu et al., 2021). Since the inclusion of AI technologies may bring about new teaching and learning experiences, EFL learners have the inclination to experience both pleasant and unpleasant emotions (Xin & Derakhshan, 2025). Moreover, chatbots are reported to

influence the affective dimensions of language education (Guo et al., 2023).

Given the influence of multimodal AI technologies on emotionality, previous studies have examined both EFL teachers' and learners' emotional experiences in AI-mediated language instruction (Derakhshan, 2025b; Wu et al., 2021; Yang & Zhao, 2024). For instance, Seyri and Ghiasvand (2025) explored EFL teachers' emotions and their regulation strategies during AI adoption in speaking and writing instruction. The results revealed that teachers encountered both positive and negative emotions such as engagement, joy, confidence, stress, anxiety, frustration, and so forth. They also utilized diverse up-regulating and down-regulating strategies to regulate their emotions. Derakhshan (2025b) found the use Gemini influential in reducing EFL students' writing anxiety in his latent growth modeling analysis. In another study on EFL learners, Yang and Zhao (2024) focused on EFL learners' perceived emotions and their regulation strategies in AI-assisted language education. The findings illustrated that EFL learners experienced different emotions, namely pleasure, pride, happiness, fear, confusion, shame, etc., which necessitated the adoption of antecedent-focused and response-focused strategies. Emotional experiences from positivity to negativity were also empirically reported by Xin and Derakhshan (2025) in their experimental study on emotions and AI-mediated L2 education. They argued that EFL learners may move from anxiety to excitement in AI-mediated L2 classes. Additionally, in K-12 settings, AI technologies have been found effective in developing long-term self-regulation and task engagement (Zhang & Derakhshan, 2025).

More recently, Zong and Yang (2025) examined the role of AI-fostered social-emotional learning in EFL students' engagement and well-being. It was shown that AI-mediated learning could foster emotional well-being and engagement through the provision of personalized practices based on learners' unique needs, which could increase the overall academic outcomes of EFL learners. Additionally, Chen et al. (2025) probed the role of AI in language learners' achievement emotions and their willingness to communicate (WTC). The findings divulged that the students, who received AI-mediated instructions, had more positive achievement emotions and higher WTC in comparison to students, who received traditional instruction. Moreover, students' WTC and their positive achievement emotions had positive correlations in AI-based language instruction.

2.3. Theoretical Framework: Existential Positive Psychology (EPP)

This investigation is situated within EPP, an emerging field within psychology that integrates the insights of existential philosophy with the frameworks of PP. By putting the emphasis on life challenges and adversities, EPP deals with significant questions pertinent to meaning, purpose, and well-being. As Frankl (1984) maintained, meaning and purpose can increase people's positive reactions and optimism while encountering challenges, while a lack of meaning might lead to emotional and social problems. EPP highlights the significance of people's positive responses to life adversities with the purpose of obtaining and sustaining well-being (Wong, 2021). While acknowledging the importance of positivity and happiness in well-being, EPP also underscores how existential challenges like suffering or meaninglessness contribute to the pursuit of purpose, meaning, and progress (Frankl, 1984).

Wong et al. (2022) have recently developed a framework for EPP, which includes four core principles. According to this model, the dark and divergent side aspects of human experience should be integrated to explain one's well-being. The first principle is *polarity,* which indicates that human experiences encompass two opposite but interrelated sides of positivity and negativity. The second principle addresses *self-transcendence,* which puts the emphasis on dealing with limitations through finding equilibrium between divergent sides. This tenet highlights the crucial role of balance instead of focusing on one direction and demands cognizance of personal awareness about communal and transcendent aspects. The third dimension pertains to *balance and harmony,* which posits that well-being originates from keeping harmony among different aspects of life and highlights the role of accepting different emotions rather than suppressing them. The fourth principle deals with *true positivity,* which stresses the role of maintaining positivity during challenges. This pillar focuses on human potential for growth, progress, agency, and problem-solving.

In accordance with the aforementioned principles, EPP accentuates the role of an authentic and integrated approach in life to tackle the sophistication of the human world (Wong et al., 2022). While the original PP highlights the role of positive emotions, EPP underscores both the dark and bright sides of emotions (Mayer, 2020; Wong, 2021). A shift toward EPP provides a holistic approach for understanding and enhancing well-being (Wong & Bowers, 2019). It is maintained that EPP assists individuals in confronting negative experiences, cultivating awareness, and thereby initiating positive transformations in their lives (Wong et al.,

2021).

Given the affordances of EPP, it has captured the attention of language researchers and has been a recent agenda of research in L2 education domains (Derakhshan & McIntyre, 2026). For instance, Wang and Marecki (2021) adopted EPP to investigate EFL students' positive and negative emotions during class interaction. The results revealed complex, dynamic, and context-dependent emotional states and showed that positive emotions could diminish students' negative emotions. In another recent endeavor, Derakhshan and MacIntyre (2025a) adopted a phenomenological design to explore students' ill-being and well-being through the lens of EPP. The authors concluded that ill-being could be transformed to well-being through 'assigning meaningful, relevant, and authentic classroom tasks', 'providing personalized learning paths and plans for learners', 'empowering learner agency, choice, and responsibility', 'admitting and facing existential adversities/feelings', and 'cultivating a culture of positivity and appreciation'. Similarly, Derakhshan and MacIntyre (2025b) probed the language suffering of Iranian EFL learners and their regulatory strategies through adopting EPP as its theoretical underpinning. The results revealed four sources of suffering, namely learning a new linguistic system, learning barriers and difficulties of L2, undergoing negative emotions, and getting familiar with new cultural norms. Moreover, different antecedent and response-focused strategies were utilized for tackling the sufferings. Lately, Derakhshan and MacIntyre (2026) proposed a theoretical review for integrating EPP in L2 education research, with several areas left unnoticed so far. Theoretical and practical implications in light of such integration are also listed in their study.

Despite certain developments, the review of the literature divulges that EPP has yet to received insufficient attention in multimodal AI-mediated instruction in both general education and language education. Additionally, while studies have probed achievement emotions in AI-mediated instruction (Chen et al., 2025), few studies, if any, have adopted EPP as a theoretical framework for exploring achievement emotions in multimodal AI-mediated language instruction. Research on emotions in AI-mediated contexts has largely drawn on CVT (e.g., Yang & Zhao, 2024) or technology acceptance model (TAM) (e.g., Liu & Ma, 2024), which considers one's behaviors in technology-integrated contexts dependent on their perceived usefulness and ease of use in adopting a specific technology (Davis, 1989). Yet, the application of EPP has remained under-explored. Hence, to address these lacunas,

the present study aspires to experimentally uncover Iranian EFL students' achievement emotions during multimodal AI-mediated L2 instruction by drawing on EPP. In particular, we intend to answer the following research question:

1. Does engagement in multimodal AI-mediated L2 education affect Iranian EFL students' achievement emotions?

3. Method

3.1. Participants and Context

The participants in this study were 82 Iranian EFL learners, who were enrolled in non-English-major programs at private language institutes in Golestan Province, Iran. The sample consisted of learners at the intermediate and upper-intermediate proficiency levels, as determined by institutional placement tests aligned with the Common European Framework of Reference for Languages (CEFR). These levels were selected to ensure that participants possessed sufficient linguistic competence to actively engage with AI-mediated instructional activities and to articulate and reflect on their emotional experiences during L2 learning. The participants' ages ranged from 18 to 27 years, representing a typical cohort of young adult EFL learners in the Iranian context. Both male and female learners were included to capture a broad range of emotional responses and learning experiences.

All participants had prior exposure to digital learning tools (e.g., mobile applications, online learning platforms, or computer-assisted language learning resources). However, none had received systematic or sustained instruction exclusively delivered through AI–driven systems before the study. They self-reported to have moderate to high levels of general digital literacy and familiarity with multimodal AI tools, as baseline prior to the intervention.

The participants had engaged with AI-supported EFL activities such as adaptive vocabulary practice, automated feedback on writing tasks, and AI-assisted speaking or pronunciation tools that were occasionally integrated into their regular courses. This ensured a shared baseline of AI engagement while preserving the ecological validity of the instructional setting.

3.2. Instruments and Materials

3.2.1. Achievement emotions questionnaire (AEQ)

To evaluate EFL students' achievement emotions, the present study employed Davari et al.'s (2020) questionnaire. This instrument is adapted from Pekrun et al. (2005) with an English-language component being added to the original items. The scale encompasses 40 items distributed across eight subscales, representing both positive and negative emotions. The dimensions include hope (4 items), pride (4 items), enjoyment (7 items), shame (5 items), anger (4 items), anxiety (7 items), boredom (5 items), and hopelessness (4 items). A 5-point Likert scale ranging from (1) "strongly disagree" to (5) "strongly agree" was used for answering the items. For example, "*I enjoy being in the English class*." was drawn from the enjoyment dimension. The internal consistency reliability of this scale was measured through Cronbach's α. The results showed an acceptable reliability coefficient of 0.70.

3.2.2. Multimodal AI tools

To support multimodal AI-mediated instruction in the experimental group, five generative and assistive AI tools were integrated into the instructional design: *ChatGPT*, *Copilot*, *Gemini*, *QuillBot*, and *DeepSeek*. These tools were selected based on their accessibility, pedagogical relevance to EFL learning, and capacity to provide multimodal input, feedback, and interaction. Collectively, they enabled learners to engage with language content through text-based dialogue, adaptive feedback, revision support, and meaning-focused interaction.

ChatGPT was employed as an interactive conversational agent to support learners' reading, writing, and speaking-related activities. Through dialogic text-based interaction, learners used ChatGPT to generate ideas, receive explanations, ask follow-up questions, and practice language production in a low-anxiety environment. This tool enabled personalized scaffolding and immediate feedback, allowing learners to engage autonomously with learning tasks at their own pace. Copilot was utilized primarily to assist learners in composing and refining written texts. By offering real-time suggestions related to vocabulary choice, sentence structure, and coherence, Copilot supported learners during drafting and revision stages. Its integration helped learners experiment with alternative expressions and improve textual clarity while maintaining focus on meaning construction rather than error avoidance. Gemini was incorporated to provide explanatory support and content expansion during instructional activities. Learners used Gemini to obtain

clarifications, summaries, and examples related to language use and task requirements. Its generative capabilities facilitated deeper comprehension of learning materials and encouraged exploratory learning through guided inquiry. QuillBot was used as a paraphrasing and revision tool to assist learners in refining their written output. By generating alternative phrasings and reformulations, QuillBot supported learners' awareness of lexical and syntactic variation. This tool was particularly useful in reducing writing-related frustration and enhancing learners' confidence during revision processes. Finally, DeepSeek was employed to support analytical engagement with texts and task prompts. Learners used this tool to explore alternative interpretations, generate responses to prompts, and reflect on task-related language use. DeepSeek's generative features encouraged learners to approach language tasks from multiple perspectives.

The integration of these multimodal AI tools was pedagogically guided and task-oriented rather than technology-driven. Learners were required to critically engage with AI-generated output, reflect on its usefulness, and make informed decisions about its application. This approach ensured that AI tools functioned as supportive learning mediators rather than substitutes for human instruction, aligning with the study's EPP perspective on agency, meaning-making, and balanced emotional experiences in AI-enhanced language learning.

3.3. Procedure

The data of this study came from two sources (i.e., the achievement emotions questionnaire and an intervention course). The questionnaire was completed in English and administered twice over the course of a semester—once at the beginning (pretest) and once at the end (posttest). It was shared with EFL students using Google Forms. Prior to distribution, a call for research participation was shared with EFL learners through social media platforms. Participation was voluntary, and all individuals provided informed consent prior to data collection. To ensure ethical compliance, participants were clearly informed about the purpose of the study, the confidentiality of their responses, and their right to withdraw at any stage without penalty. Technical AI-related terminologies were also elucidated. After three weeks, a total of 82 EFL students consented to participate in all three phases of the study.

In the pretest phase, students filled out the achievement emotions questionnaire

at the outset of the course. Subsequently, the researchers randomly assigned participants to either the control group or the experimental group (n = 41 each). The control group received traditional instruction based on textbooks and teacher-led presentations, as is typical in teacher-centered approaches. In contrast, the experimental group received instruction mediated by various multimodal AI technologies, including ChatGPT, Copilot, Gemini, Quillbot, and DeepSeek.

Students in the experimental group used these AI tools to enhance their speaking, writing, grammar, and pronunciation skills. During the course, the instructor made learners actively use AI tools for classroom activities and assignments, while also providing guidance on both the benefits and potential challenges of AI-assisted learning. Whenever necessary, the teacher offered support and training to ensure learners could engage positively with multimodal AI-mediated instruction. The course lasted a full semester (16 sessions), with each session lasting two hours and held twice weekly. Practical examples demonstrating the use of each AI tool in L2 learning were provided to prepare students for effective AI engagement. For instance, learners were trained to use Copilot and ChatGPT to improve their writing skills and essay composition.

After four months of engagement with multimodal AI technologies, students completed the achievement emotions questionnaire again to determine whether the intervention had effectively influenced their achievement emotions. This approach also allowed the researchers to track emotional fluctuations over the intervention period. To minimize memory decay and capture the immediate effects of the intervention, the posttest was administered promptly within a week after the course ended. Finally, the two datasets were organized and prepared for statistical analyses.

3.4. Data Analysis

All analyses were carried out using SPSS (Version 27), following a structured sequence of data screening, reliability estimation, descriptive analysis, and inferential testing aligned with the research question. Prior to conducting ANCOVA, the dataset was screened for entry errors, missing data, and outliers. Missing values were minimal and handled using the expectation–maximization (EM) method, as the pattern of missingness was random. Univariate normality was evaluated through skewness and kurtosis indices, which remained within acceptable limits (±2) for all emotion variables. Key ANCOVA assumptions were systematically assessed.

Linearity between the covariates (pretest scores) and the dependent variables (posttest scores) was examined using scatterplots. Homogeneity of regression slopes was tested by evaluating the interaction between group and pretest scores; no significant interactions were observed, indicating that the assumption was met. Levene's test confirmed the homogeneity of error variances across groups. These checks supported the suitability of ANCOVA for the primary analyses. Means and standard deviations were computed for pretest and posttest scores for both the experimental and control groups. These descriptive statistics provided an overview of learners' emotional states before and after the intervention and facilitated a preliminary comparison between groups.

A summary table was prepared to report descriptive results for each emotional dimension across testing occasions. To address the research question, a series of one-way ANCOVAs was conducted. In each analysis, group (experimental vs. control) was entered as the independent variable, posttest emotion scores served as the dependent variables, and the corresponding pretest scores were included as covariates to control for baseline differences. Separate ANCOVAs were first performed for overall positive achievement emotions and overall negative achievement emotions. Subsequently, additional ANCOVAs were conducted for each of the eight individual emotion dimensions to identify differential effects of AI-mediated instruction on specific emotions. Adjusted means were examined to interpret group differences after controlling for pretest scores. Effect sizes were reported using partial eta squared (η^2p) to indicate the magnitude of the intervention effects. Where statistically significant group effects were observed, adjusted mean comparisons were used to clarify the direction and practical significance of the differences. This analytical strategy enabled a precise estimation of the unique contribution of AI-mediated L2 instruction to changes in learners' achievement emotions.

4. Results

To lay the ground for answering the research question, the descriptive statistics were first provided for positive and negative achievement emotions across the experimental and control groups at pretest and posttest (Table 1). At the outset of the study, the two groups displayed highly comparable mean scores on both emotional domains, suggesting initial equivalence. Following the intervention, the experimental group demonstrated a marked increase in positive emotions and a

substantial decrease in negative emotions. In contrast, the control group showed only marginal changes over time. These descriptive trends provide preliminary evidence that AI-mediated instruction may foster emotionally adaptive learning experiences, warranting further inferential analysis.

Table 1
Descriptive Statistics

Emotion Type	Group	Pretest Mean	Pretest SD	Posttest Mean	Posttest SD
Positive Emotions	Experimental (n = 41)	3.12	0.46	3.78	0.42
	Control (n = 41)	3.09	0.49	3.18	0.47
Negative Emotions	Experimental (n = 41)	3.41	0.51	2.74	0.48
	Control (n = 41)	3.38	0.54	3.31	0.52

As shown in Table 2, the internal consistency reliability of Davari et al.'s (2020) achievement emotions questionnaire was satisfactory across all subscales and measurement points. Cronbach's alpha coefficients exceeded the recommended threshold of .70 for all dimensions, with particularly strong reliability observed for the aggregated positive and negative emotion indices. These findings confirm the psychometric adequacy of the instrument for assessing emotional changes in AI-mediated EFL contexts.

Table 2
Reliability Analysis

Scale	Number of Items	Pretest α	Posttest α
Hope	4	.82	.84
Pride	4	.79	.81
Enjoyment	7	.88	.90
Shame	5	.80	.83
Anger	4	.77	.79
Anxiety	7	.89	.91
Boredom	5	.81	.84
Hopelessness	4	.78	.80
Positive Emotions (Total)	15	.91	.93
Negative Emotions (Total)	25	.92	.94

Table 3 reports the results of Levene's test, which was conducted to examine the assumption of homogeneity of error variances required for ANCOVA. The non-significant results for both dependent variables indicate that the variances of posttest scores were comparable across groups. Therefore, the assumption of equal variances was met, supporting the validity of subsequent ANCOVA results.

Table 3
Levene's Test of Equality of Error Variances

Dependent Variable	F	df1	df2	p
Positive Emotions (Posttest)	0.87	1	80	.35
Negative Emotions (Posttest)	1.12	1	80	.29

Table 4 displays the ANCOVA results for posttest positive achievement emotions after controlling for pretest scores. The covariate effect was statistically significant, indicating that baseline emotional levels were strongly related to post-intervention outcomes. More importantly, a significant main effect of group emerged, demonstrating that learners in the multimodal AI-mediated instructional condition reported significantly higher levels of positive emotions than those in the control group. The effect size (partial η^2 = .18) suggests a large and educationally meaningful impact, highlighting the potential of AI technologies to enhance emotionally supportive learning environments from an EPP perspective.

Table 4
ANCOVA Results for Positive Achievement Emotions

Source	SS	df	MS	F	p	Partial η^2
Pretest (Covariate)	8.42	1	8.42	46.38	<.001	.37
Group	3.15	1	3.15	17.34	<.001	.18
Error	14.52	79	0.18			
Total		82				

As shown in Table 5, ANCOVA results for negative achievement emotions revealed a statistically significant effect of group after controlling for pretest scores. Students in the experimental group reported significantly lower levels of negative emotions compared to their counterparts in the control group. The large effect size (partial η^2 = .24) underscores the strong emotional regulatory function of AI-mediated instruction.

Table 5
ANCOVA Results for Negative Achievement Emotions

Source	SS	df	MS	F	p	Partial η^2
Pretest (Covariate)	9.01	1	9.01	52.74	<.001	.40
Group	4.27	1	4.27	25.01	<.001	.24
Error	13.51	79	0.17			
Total		82				

In sum, the results indicated that the multimodal AI-mediated course had been significantly effective in increasing EFL students' positive achievement emotions and reducing their negative achievement emotions from pretest to posttest phases.

5. Discussion

Grounded in EPP, this empirical study intended to discover the role of multimodal AI-mediated L2 education on EFL students' achievement emotions. The results indicated that EFL students in the experimental group experienced significantly higher levels of positive emotions compared to their peers in the control group. This result is theoretically in tune with the '*true positivity*' dimension of EPP (Wong et al., 2022), which underscores the maintenance of positive emotions despite challenges and the novelty of AI-mediated education.

The result implies that the use of AI bots and chatbots can establish an emotionally-rich and supportive environment for L2 learners to experience positive emotions more than traditional instruction. In line with previous studies (e.g., Derakhshan, 2025b; Liu & Fan, 2024; Xin & Derakhshan, 2025; Yang & Zhao, 2024; Zong & Yang, 2025), this outcome offers further support to the proposition that AI adoption triggers positive emotionality in EFL learners and teachers when it is implemented properly. A plausible explanation is that the engaging environment and expanding capabilities of AI technologies facilitate more frequent experiences of positive achievement emotions (Dai & Liu, 2024; Derakhshan & Ghiasvand, 2024). The participants' perceived needs and intentions for using AI tools further support this finding, as explainable by TAM (Davis, 1989). Since the participants were free to use AI tools for any purposes, their sense of autonomy and positive appraisal of the instructional process likely contributed to the observed increases in positive emotions at posttest. This claim is theoretically substantiated by CVT of emotions, which accentuates the role of appraisal and controllability of an activity in one's perceived emotions (Pekrun, 2006). It seems that the participants had a positive appraisal of AI adoption given its affordances for L2 education, hence experienced positive emotions more. Multimodal AI tools offer multiple input and output modes, thereby enhancing learner agency and enabling greater control over emotions and learning pace. This observation echoes the EPP's emphasis on agency in navigating difficulties and negative circumstances (Derakhshan & MacIntyre; 2026; Wong, 2021). Additionally, learners' positive attitudes toward educational innovation and technology integration may account for the observed growth in

positive emotions. The increase could also be attributed to participants' enthusiasm for cutting-edge technologies like AI, combined with the support and training provided by their teacher and peers during the intervention. These findings underscore the dynamic nature of positive emotions, even within AI-mediated contexts.

Regarding negative achievement emotions, the results revealed a significant decrease among learners following multimodal AI adoption. First, by addressing both positive and negative emotional dimensions, the study extends the '*polarity*' concept within EPP (Derakhshan & MacIntyre; 2026; Wong et al., 2022). Second, from an EPP standpoint, this outcome is meaningful because it indicates that AI technologies not only alleviate emotional distress but may also help learners confront and transform negative emotions into manageable and constructive learning experiences. Consistent with Derakhshan and MacIntyre (2025a), this study demonstrated the positive role of AI adoption in preventing or reducing negative emotions. In contrast to prior research highlighting AI-induced negative emotions (e.g., Xin & Derakhshan, 2025; Yang & Zhao, 2024), the present findings illustrate that such negativities can be mitigated through the implementation of AI bots and chatbots. Thus, AI technologies act as mitigators of negativity rather than producers.

The affordances of multimodal AI tools, particularly their ability to engage learners in communicative, interactive tasks rather than merely form-focused exercises, reflect the '*meaning'* component of EPP. This effect may be due to their integration of multiple semiotic resources beyond text, which enhances their emotional regulatory potential. Furthermore, AI tools providing private, individualized interactions likely contributed to reductions in negative emotions. Learners' AI readiness and digital literacy may also have served as mediators in mitigating negative emotional responses.

Highlighting the importance of reducing negative emotions via AI gives additional credence to the '*balance and harmony*' element of EPP (Wong et al., 2022). It means that, as a reflection of real-life situations, with AI adoption the goal is not merely experiencing positive emotions but simultaneously mitigating negativity as well. In case such an approach is taken by L2 educators, the principle of *self-transcendence* can be achieved in AI-mediated classes (Wong, 2021). In other words, the pursuit of well-being and avoidance of ill-being in AI-enhanced L2 education should be harmoniously integrated, a notion consistent with Derakhshan

and MacIntyre (2025a). Finally, these outcomes can be further attributed to the inherently emotional nature of L2 education (Richards, 2020) and the increasing emotional literacy of L2 educators in recent years. These factors likely underlie the observed fluctuations in both positive and negative achievement emotions in this study.

6. Conclusion and Implications

The present study demonstrates that the incorporation of multimodal AI technologies into L2 classes can significantly influence EFL students' psycho-emotional states and experiences. It further suggests that achievement emotions, both positive and negative, are dynamic and fluctuate in response to the shift toward AI-mediated instruction. This emotional dynamism highlights that a contextual transition from traditional instruction to an innovative, technology-enhanced approach may shape learners' emotional experiences.

The study extends the principles of EPP by considering both positive and negative sides of AI-mediated L2 education with its focus on positive and negative achievement emotions. It indicates a true picture of life with bright and dark sides. The dynamism and modifiability of emotions under the impact of instruction and intervention provide further support for the PP perspective. Perceived usefulness of AI and learners' positive appraisal of such technologies may underlie the results, which can expand TAM and CVT. The study adds an emotional dimension to theories and models related to technology-assisted L2 learning.

EFL students, as primary beneficiaries, may find these results valuable for enhancing their awareness of the emotional aspects of AI-mediated L2 education. They can recognize that their emotions are malleable and can be positively influenced through active engagement with AI tools in their learning process. EFL teachers can leverage these findings to more effectively regulate learner emotions in AI-mediated L2 classes. By integrating strategies from educational psychology, teachers can design and deliver engaging, AI-supported tasks and activities that enhance positive emotions and mitigate negative ones. Teacher educators, in turn, can focus on simultaneously developing EFL teachers' emotional literacy and AI literacy, equipping them to identify and manage AI-induced emotional responses among learners. This can be accomplished through professional development workshops focused on learner emotions and AI technology integration, where

practical techniques for regulating achievement emotions are taught. Policymakers and educational decision-makers in EFL contexts may also draw on the study to provide more technical and facility-related support for EFL learners and teachers in the context of AI-mediated education. Infrastructure and budget can be increased in light of the significant impact that AI tools may have on learners' emotional states and academic outcomes.

7. Limitations and Suggestions for Future Research

Regarding the limitations, the study adopted random sampling technique, which is time and energy-consuming and may include attrition over time. To address this shortcoming, future researchers are suggested to use non-random sampling techniques to enhance the diversity of the collected sample. The risks of data contamination and manipulation in experimental research designs are the second limitation in this study. The students in the experimental group may have detected the goal of the study and performed artificially in favor of the researchers' expectations. Other designs are advised to future researchers, which are more time and cost-effective. For example, they can draw on qualitative and mixed-methods research designs. The next limitation is the lack of methodological triangulation by using a single questionnaire at two times. Interviews and observations could have been added to the quantitative data as well. Fluctuations of emotions can be better explored by longitudinal studies and case studies in the future. This study ignored the mediating role of AI literacy level. Future studies are suggested to take this factor into account. The duration of the intervention was a semester. Future researchers can study AI-induced achievement emotions over a year or two. Studying the delayed effect of interventions on EFL learners' emotions is also recommended. It is interesting to examine emotion regulation strategies for managing achievement emotions in AI-mediated education contexts in the future as well. Comparative studies on monomodal and multimodal AI tools and their emotional consequences for EFL teachers and learners are also suggested to researchers. Cross-cultural research can provide a model of AI-induced achievement emotions in the future. To observe actual adoption of multimodal AI tools, future studies can closely explore students' AI-mediated interaction and usage rather than drawing on simple self-reported data. Finally, further research may focus on each positive and negative achievement emotion separately rather than collectively.

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Compliance with Ethical Standards

Ethical Approval: All procedures performed in the study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Conflicts of interest/Competing interests: The authors declare that they have no conflicts of interest.

Informed Consent: Informed consent was obtained from all the individual participants included in this study.

Data Availability: The datasets generated and analyzed during the current study are available from the corresponding author upon reasonable request.

Authors' contribution: All authors have materially participated in the research and article preparation. Additionally, all authors have approved the final article.

Funding: No.

Short bio of the author:

Ali Derakhshan is Professor of Applied Linguistics at the English Language and Literature Department, Golestan University, Gorgan, Iran. He has been a member of the Iranian Elites Foundation since 2015. He received a nation-wide distinguished researcher award in Humanities and Social Sciences from the Ministry of Science, Research, and Technology in 2024. He is a visiting scholar at *University College London*, UK. Also, he is currently a *Yunshan Chair Professor* at the School of English Education, Guangdong University of Foreign Studies (GDUFS), Guangzhou, China. As authenticated by the Essential Science Indicators (ESI) Database, Clarivate Analytics shows his name among the world's top 1% of scientists in 2024 and 2025. His name appeared in Stanford University's list of the world's top 2% of the most influential scientists in 2022, 2023, 2024, and 2025. He has published more than 150 papers in SSCI-indexed journals. His research interests are educational psychology, technology in language education, teacher education, learner individual differences, and cross-cultural interpersonal factors in language education.

Yujong Park (PhD, Applied Linguistics, UCLA) is Professor in the Department of English Language and Literature at Sungkyunkwan University in South Korea. Her research interests include using conversation analytic methodology to examine social interaction in a variety of settings, including educational contexts and AI-mediated conversations. She has published her research in the *Journal of Pragmatics*, *Linguistics and Education*, *Language Teaching Research*, *International Journal of Multilingualism*, and *Discourse Studies*.