**Language Teaching Research Quarterly** **EUROKD**

2026 (54), 362–384
https://doi.org/10.32038/ltrq.2026.54.15

# The Effect of ChatGPT Usage on Foreign Language Enjoyment: The Mediating Role of Learning Effort and the Moderating Effect of Artificial Intelligence Anxiety

Gülten Feryal Gündüz
*Department of Educational Sciences, Istanbul Kültür University, Türkiye*
Kerim Ünal*
*Department of Foreign Language Education, Mersin University, Türkiye*
Cem Özışık
*Department of Foreign Language Education, Istanbul Kültür University, Türkiye*

**Correspondence**
**Email:** kerimunal@mersin.edu.tr

**Abstract**

This study investigated the effects of ChatGPT usage on foreign language learning enjoyment (FLE), the mediating role of foreign language learning effort (FLLE), and the moderating function of AI anxiety. Grounded in the Technology Acceptance Model, Self-Determination Theory, and the Stimulus-Organism-Response framework, a cross-sectional survey was conducted with 880 undergraduate learners in English preparatory programs at three Turkish universities. PLS-SEM with 5,000-resample bootstrapping was used for hypothesis testing. Results showed that ChatGPT usage significantly predicted both FLE and FLLE, with a stronger path to behavioral engagement than to emotional experience. FLLE partially mediated the ChatGPT–FLE relationship and explained approximately 42% of the total effect. Contrary to expectations, AI anxiety positively predicted FLE at the second-order level; however, factor-level analysis revealed that societal-concern factors drove this positive association while interaction-level factors negatively predicted it. AI anxiety moderated the ChatGPT–FLE relationship: the direct emotional benefit disappeared at high anxiety while the indirect pathway through effort remained significant. These findings pinpoint the centrality of purposeful task design and targeted anxiety reduction in AI-assisted FL learning.

**ARTICLE HISTORY**
Received: 24 December 2025
Revised: 18 April 2026
Accepted: 04 May 2026

**KEYWORDS**
ChatGPT Usage, Foreign Language Enjoyment, Learning Effort, AI Anxiety, Moderated Mediation

**How to cite this article (APA 7th Edition):**
Gündüz, G. F., Ünal, K., & Özışık, C. (2026). The effect of ChatGPT usage on foreign language enjoyment: The mediating role of learning effort and the moderating effect of artificial intelligence anxiety. *Language Teaching Research Quarterly*, *54*, 362–384. https://doi.org/10.32038/ltrq.2026.54.15

## Introduction

Language learning environments are filled with complex emotions that may directly or indirectly affect students' foreign language (FL) achievement (Pekrun & Perry, 2014). AI-supported systems also significantly increase foreign language enjoyment (FLE) by providing students with personalized and adaptive learning experiences (Zhang et al., 2024). Another key characteristic in FL learning is learning effort (Özer & Başarır, 2020). Satisfaction experienced during the learning process increases students' motivation and enjoyment in FL learning, thereby enhancing their effort toward FL learning (Liu et al., 2025). Since the use of AI technologies in learning becomes widespread, it has become necessary to examine the anxieties related to these technologies. It can be stated that the effect of AI anxiety on AI use is controversial. While some studies indicate that AI anxiety decreases as the use of AI tools increases (Chen et al., 2024; Kai et al., 2026; Li et al., 2026), others suggest that it may increase (Hopcan et al., 2024).

In the existing literature on AI applications, it can be stated that theoretical frameworks such as TAM are mostly applied, but emotional constructs are often not sufficiently addressed. In research investigating the effects of AI technologies on FL learning processes, it is observed that integrative models explaining through which psychological factors these effects occur are limited. Some studies have looked at how AI-based language learning tools affect FLE (Zhang et al., 2024). However, these studies cover only specific tools. Important questions about which emotional factors mediate this effect and which factors control this relationship have not been answered. While the relationship between FLE and learning effort has been searched in traditional classrooms (Liu et al., 2025), how this relationship is shaped in AI learning environments has not yet been determined. Some studies have looked at the path between AI use and AI anxiety (Cengiz & Peker, 2025; Chen et al., 2024; Schiavo et al., 2024). However, whether AI anxiety moderates the effect of AI use on learning enjoyment has not been clearly studied. Schiavo et al. (2024) documented that the moderating effect of AI anxiety was statistically small. This result shows that more detailed studies with different groups of participants are needed. Given these important needs and gaps, the present study seeks to bridge both the theoretical and practical gaps identified and to recommend meaningful contributions at multiple levels to the field of educational technologies.

## Foreign Language Learning Enjoyment

Dewaele and MacIntyre (2014) define FLE as an experience consisting of overcoming challenges, achieving goals, social interaction, and positive teacher relationships. It can be stated that this definition is based on two main theoretical frameworks. As posited by the Broaden-and-Build Theory (Fredrickson, 2001), FLE is perceived as a positive emotion that can broaden learners' mental structures, facilitate openness to language input, and stimulate language use (MacIntyre & Gregersen, 2012). According to the Control-Value Theory (CVT) of Achievement Emotions (Pekrun, 2006), enjoyment is characterized as an approach-oriented activating affect related to achievement, and it is

stated that this emotion is associated with the learner's situated appraisals of controllability and personal relevance. Research on FLE has supported and further developed these theories. Although the impact of emotions on FL learning has been investigated for many years (Ryan et al., 1990), comprehensive FLE research began after the concept was defined in 2014. Initial studies (Dewaele et al., 2018; MacIntyre & Gregersen, 2012; Piechurska-Kuciel, 2017) revealed that FLE positively affects students' academic achievement and language proficiency levels. In later years, research addressed the relationships between FLE and cognitive factors, contextual factors, and affective characteristics. It was found that FLE influences learning motivation and mediates the relationship between motivation and language proficiency (Zhang et al., 2020), and that it strengthens willingness to communicate (WTC) and speaking skills (Botes et al., 2022; Huang & Zou, 2024). Studies examining its relationship with positive psychological variables (Badiei et al., 2025; Fathi & Hejazi, 2024) show that enjoyment functions not only as an outcome variable but also through mediating and moderating mechanisms within a complex network of relationships. However, the prior research mostly focuses on the direct effects of FLE, and relatively few studies investigate mediating and moderating variables that explain the underlying psychological mechanisms in this relationship.

On the other hand, studies examining the effect of classroom context as a learning environment and teacher behavior on FLE (Dewaele et al., 2025; Li et al., 2020; Zare et al., 2022) emphasize that FLE is closely related to teacher behavior and highlight the importance of a positive classroom atmosphere. Scale development and adaptation studies conducted to measure FLE also indicate that the FLE construct consists of three main factors (personal experiences, social interactions, and teacher-related factors) although these factors may differ according to cultural and contextual differences (Botes et al., 2021; Dewaele & MacIntyre, 2014; Li et al., 2018; Wang et al., 2021). In this context, the differentiation of teacher roles and learning environment dynamics in technology-supported FL learning environments (Wang et al., 2021) makes it necessary to study the factors that may affect FLE in these environments. Research indicates that technology-supported learning environments increase both the individual and social dimensions of learner enjoyment (Tram et al., 2024; Yuan & Liu, 2025; Zhang et al., 2024). Studies conducted on FLE within AI-supported language learning (Dong et al., 2026; Huang & Zou, 2024; Shi et al., 2026; Yamaoka, 2024; Yuan & Liu, 2025; Zhang et al., 2024) have found that AI speaking assistants increase both FLE and WTC. However, the effects of widely used generative AI tools on FLE and the mediating mechanisms in this relationship have not yet been sufficiently investigated. The present study is considered important in that it aims to reveal this unclear relationship.

**The Use of ChatGPT in Foreign Language Education**

In FL teaching, research shows that ChatGPT improves written production, supports critical thinking, enriches vocabulary, and nurtures thinking in the target language

(Karataş et al., 2024; Kazu & Kuvvetli, 2023; Li et al., 2024). In addition, ChatGPT's provision of instant feedback, ease of access (Karataş et al., 2024; Li et al., 2024), personalized responses (Kazu & Kuvvetli, 2023; Li et al., 2024) promote learner autonomy and self-regulated learning (Li et al., 2025). Studies reveal that ChatGPT significantly affects not only cognitive characteristics but also emotional factors such as motivation, self-confidence (Heung & Chiu, 2025), self-efficacy (Tram et al., 2024), enjoyment, willingness, and anxiety (Sun et al., 2026; Zhang et al., 2024; Zhao & Wang, 2026). In contrast, ChatGPT brings important restrictions and risks. Concerns about academic honesty, risks of plagiarism, and the uncritical use of generated content create ethical dilemmas (Barrot, 2024; Mohamed, 2023). Moreover, there are risks such as the production of misinformation, the presence of biased responses, culturally disconnected content, and the development of excessive reliance on technology (Heung & Chiu, 2025; Klimova & Campos, 2024).

Research examining the connections between ChatGPT use and FLE is limited. Most existing studies (Kim et al., 2025; Qu & Wu, 2024; Xu et al., 2024) focus on how enjoyable students find using ChatGPT. They do not directly study FLE and its factors (Çobanoğulları et al., 2025). On the other hand, Song and Song (2023) found that ChatGPT made learning enjoyable only in the context of FL writing. These studies indicate that systematic research examining how generative AI tools such as ChatGPT affect FLE, particularly across all FL skills, is insufficient in the literature. Therefore, systematically exploring the relationship between ChatGPT use and FLE will fill this important gap.

**Learning Effort as a Mediator**

In earlier studies, it was addressed as a one-dimensional construct such as the energy or the effort spent during the learning process (Pintrich et al., 1993; Zimmerman & Risemberg, 1997). In subsequent years, it was conceptualized as a multidimensional construct consisting of procedural, substantive, and non-compliance factors (Bozick,& Dempsey, 2010).

It is observed that the theoretical foundations of learning effort are generally associated with SDT theory and motivation theories. According to these theories, intrinsic motivation and positive attitudes toward the language increase effort (Deci & Ryan, 1985; Gardner, 1985), and the desire to learn transforms over time into goals, intentions, and eventually into concrete effort (Dörnyei & Otto, 1998). In line with this theoretical framework, early studies examined the relationship between learning effort and academic achievement (Carbonaro, 2005; Kelly, 2008; Natriello & McDill, 1986) and also investigated in depth the relationship between learning effort and motivation (Bravo et al., 2016;Karabıyık and Mirici, 2018 ). The majority of studies examining its relationship with motivation have also shown a positive and significant relationship. However, Karabıyık and Mirici (2018) emphasized that students at a similar level of motivation may

display varying degrees of effort, and students who exert the same effort may have different levels of motivation.

In later years, research has also examined the relationship of effort with anxiety (Putra & Hall, 2019), self-efficacy and self-regulatory strategies (Erdel, 2025; Özer & Başarır, 2020), and FLE (Liu et al., 2025). Although there are studies exploring the relationship between learning effort and anxiety and between learning effort and FLE, these studies differ from the present research because they were conducted in traditional classroom settings independently of AI tools.

Studies investigating the role of foreign language learning effort (FLLE) in digital learning environments are quite limited. These studies include digital media involving the Web 2.0-tool usage (Genç & Köksal, 2021), FL learning platforms that use AI as a tool (Ersoy, 2021), and learning management systems through which online courses are conducted (Luan et al., 2025). These studies indicate a positive relationship between learning effort and academic achievement. On the other hand, Luan et al. (2025) stated that AI-supported applications can assign customized tasks according to students' individual English proficiency levels and learning needs, and that this approach can support learners in sustaining continuous effort by providing them with the freedom to explore the target language independently. Based on these studies in the literature, it can be stated that it is not clear through which mechanisms FLLE is shaped in AI-based learning environments and which affective variables are decisive in this process.

**AI Anxiety as a Moderator**

Although AI anxiety is a relatively new concept, foreign language anxiety (FLA) has been an important field of research since the mid-1980s. Throughout the 2000s and 2010s, research focused on the relationship between FLA and performance and motivation, and it was uncovered that anxiety adversely affects students' motivation and their ability to use the FL (Liu & Jackson, 2008; Liu & Huang, 2011). In later years, studies examining the relationship between FLA and FLE showed that there is a negative relationship between them (Botes et al., 2022; Dewaele & MacIntyre, 2014; Zare et al., 2022; Zhang et al., 2024). On the other hand, while some studies found that digital environments reduce FLA (Eysenck & Keane, 2020; Zhang et al., 2024; Yamaoka, 2024), others revealed that they may increase anxiety in students who are not prepared for autonomous learning processes (Zare et al., 2022). Studies investigating the relationship between generative AI as a language learning environment and FLA are quite limited. Yamaoka (2024) stated that students' anxiety levels decreased with AI use; however, it was also emphasized that ChatGPT does not produce the same effect for every student.

Although FLA has been examined relatively comprehensively, the use of AI tools in language learning has introduced a new dimension of anxiety. AI anxiety can be evaluated within the category of situation-specific anxiety (Spielberger, 1972; MacIntyre, 2007),

similar to FLA; however, its source does not stem from the communicative pressure created by FL use, but from the process of interacting with AI technology. Therefore, the present study extends the anxiety–enjoyment relationship indicated in the FLA literature to a technology-mediated learning context and differs in that it investigates how AI anxiety moderates this relationship.

Though research focusing on AI anxiety has rapidly developed in the last decade, approximately thirty years ago the concept of computer anxiety was used to explain individuals' fears and concerns about computer use (Maurer & Simonson, 1984). Today, the autonomy, diversity, and personalization features of AI systems have differentiated the nature and sources of anxiety. Li and Huang (2020) adopted the integrated fear acquisition theory as a theoretical framework by combining Rachman's (1977) and Menzies and Clarke's (1995) fear acquisition theories to explain the sources of AI anxiety. Accordingly, AI anxiety is based not only on directly experienced situations but also on observing others' experiences, indirect information sources such as media and science fiction, and innate concerns related to the unknown nature of AI. AI anxiety is defined by Yang and Sundar (2025) as negative emotions such as tension, worry, and physiological arousal that are experienced when potential negative consequences related to AI are anticipated. The relationship between AI anxiety and technology acceptance and use has produced different findings in various studies. Research has demonstrated that high AI anxiety leads to lower technology acceptance and less intention to use technology (Cengiz & Peker, 2025; Chen et al., 2024; Jiang et al., 2026; Li et al., 2026). In contrast, Schiavo et al. (2024) noted that AI anxiety did not have a significant moderating effect on the way between literacy and acceptance. They also noted that AI anxiety may differ based on geographical and cultural factors. Hopcan et al. (2024) emphasized that the effect of AI knowledge on anxiety is complex and involves many dimensions. When people use AI more, their understanding of it grows. This greater understanding can diminish anxiety in some cases. However, in other cases, becoming more aware of ethical and social issues can increase anxiety. An important question remains about how this multidimensional and context-sensitive effect of AI anxiety on technology acceptance and use is shaped when affective and motivational variables are considered together. Generative AI tools such as ChatGPT are being used more in FL education. However, researchers have not yet studied how AI anxiety moderates the emotional outcomes of using these tools. In this context, the present study had the intention to remedy a notable absence in the field by explaining the effect of ChatGPT use on FLE and revealing the moderating role of AI anxiety and the mediating function of learning effort.

**The Study**

The following hypotheses are derived to explore the pathways between ChatGPT usage and FLE:

**$H_1$.** ChatGPT usage is positively associated with FLE.

**$H_2$.** ChatGPT usage is positively associated with FLLE.

**H3.** FLLE is positively associated with FLE.
**H4.** ChatGPT usage has a positive indirect effect on FLE through FLLE.
**H5.** AI anxiety is negatively associated with FLE.
**H6.** AI anxiety is negatively associated with FLLE.
**H7.** AI anxiety negatively moderates the relationship between ChatGPT usage and FLE.
**H8.** AI anxiety negatively moderates the relationship between ChatGPT usage and FLLE.
**H9.** The positive association between ChatGPT usage and FLLE is stronger at lower levels of AI anxiety than at higher levels of AI anxiety.
**H10.** The positive association between ChatGPT usage and FLE is stronger at lower levels of AI anxiety than at higher levels of AI anxiety.
**H11.** The indirect effect of ChatGPT usage on FLE through FLLE is stronger at lower levels of AI anxiety than at higher levels of AI anxiety.

## Method

*Study Design*

Cross-sectional survey design and PLS-SEM were used to examine the effect of ChatGPT usage on FLE (Figure 1).

**Figure 1**

*The PLS-SEM Model*

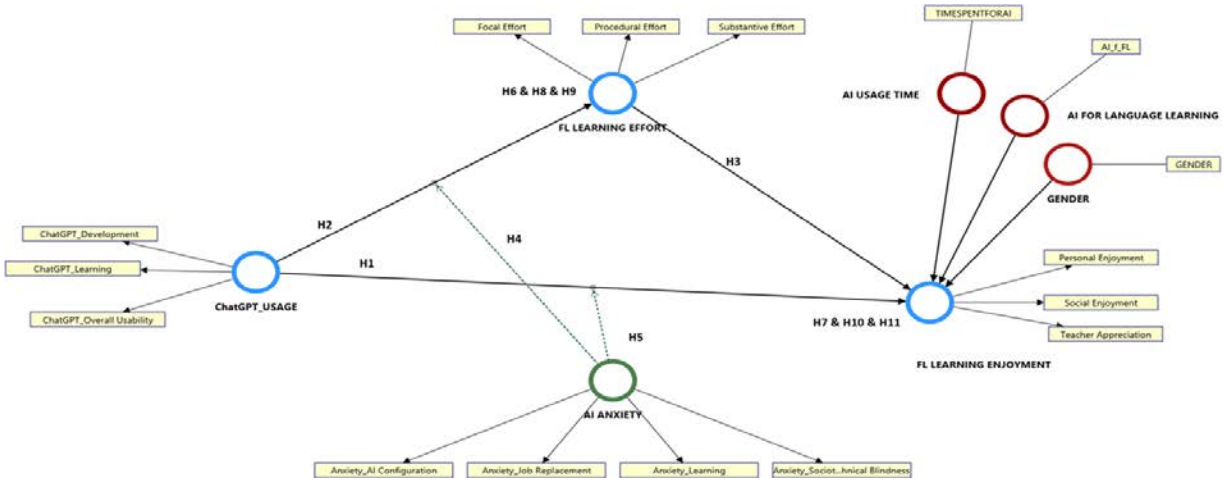


Figure 1 shows a moderated mediation model in which ChatGPT usage predicts FLE directly and indirectly via FLLE, moderated by AI anxiety . Total AI usage time, AI usage for language learning, and gender were control variables in the model.

*Participants*

In total, 903 undergraduate learners enlisted in mandatory English preparatory programs in Türkiye. Before the data analysis, 23 cases were omitted from the data set since they were identified as outliers. Thus, 880 participants' data were accepted for the analysis (Table 1).

**Table 1**

*General Information about the Participants*

| Demographics | | n |
|---|---|---|
| Gender | Female | 501 |
| | Male | 379 |
| Medium of Instruction | %100 English | 262 |
| | %30 English | 579 |
| | Selective | 39 |
| Faculty | Economics and Admin. | 309 |
| | Engineering | 228 |
| | Architecture | 94 |
| | Science & Letters | 72 |
| | Law | 39 |
| | Tourism | 39 |
| | Human and Social Studies | 30 |
| | Fine Arts | 28 |
| | Education | 27 |
| | Maritime | 8 |
| | Medicine | 6 |

| Demographics | | n |
|---|---|---|
| Age | Under 18 | 24 |
| | 18-20 | 707 |
| | 21-23 | 127 |
| | 24-26 | 10 |
| | 27-30 | 6 |
| | 30 + | 6 |
| Foreign Language Level | A1 | 83 |
| | A2 | 442 |
| | B1 | 321 |
| | B2 | 34 |
| Time Spent for AI Usage | Everyday | 267 |
| | A few times a week | 366 |
| | Once a week | 73 |
| | A few times a month | 62 |
| | Rarely | 112 |
| Using AI to learn a FL | Yes | 728 |
| | No | 152 |

501 females (56.9%) and 379 males (43.1%) joined the study. Their ages ranged from under 18 to over 30 years. 80.3% (n=707) of them were between 18 and 20. Furthermore, 82.7% (n = 728) reported that they use AI tools for language learning.

*Measurement Instruments*

Turkish versions of four instruments were employed to test the model . Responses were recorded using the original 5-point format adopted in each instrument.

*ChatGPT usage scale for foreign language learners*

The ChatGPT Usage Scale (Çobanoğulları & Özbek, 2025) measured ChatGPT usage across three factors. Overall Usability (6 items, α = 0.92) assessed general usability. Learning (6 items, α = 0.90) measured direct contributions to language acquisition. Development (6 items, α = 0.91) evaluated support for language enhancement outside traditional activities. CFA confirmed the three-factor structure ($\chi^2$/df = 2.34, CFI = .96, TLI = .95, RMSEA = .054).

*Foreign language learning enjoyment scale*

The 9-item Short Form of the Foreign Language Enjoyment Scale (S-FLES; Botes et al., 2021), originally adapted from Dewaele and MacIntyre's (2014) 21-item scale, was used in its Turkish version validated by Çobanoğulları et al. (2025). The scale comprises three subscales: Teacher Appreciation (3 items, α = 0.789), Personal Enjoyment (3 items, α = 0.704), and Social Enjoyment (3 items, α = 0.793), with an overall α = 0.840.

*Foreign language learning effort scale*

The 17-item scale (Karabıyık & Mirici, 2018) measured effort across four factors (α = 0.85). Non-compliance (4 reverse-coded items, α = 0.80) assessed behaviors hindering effort. Substantive Effort (5 items, α = 0.82) evaluated active learning involvement. Procedural Effort (4 items, α = 0.83) measured fulfillment of classroom demands. Focal Effort (4 items, α = 0.77) assessed classroom attentiveness.

*Artificial intelligence anxiety scale (AIAS)*

The AIAS was developed by Wang and Wang (2019) and was adapted to Turkish by Akkaya et al. (2021). The scale contained 16 items (α = 0.937) across four factors: Learning (α = .948), Job Replacement (α = .895), Sociotechnical Blindness (α = .875), and AI Configuration (α = .950). Goodness-of-fit indices met acceptable ranges ($\Delta\chi^2$ = 260.120, df = 99, $\chi^2$/df = 2.627, NFI = .923, CFI = .950, RFI = .906, IFI = .951, TLI = .940, RMSEA = .078).

*Supplementary measures*

AI experience and AI use for language learning were recorded dichotomously (0=no, 1=yes) And usage frequency was rated on a five-point scale ranging from very rarely to every day. Reasons for AI usage for FL learning were investigated via a checklist, which covers vocabulary learning, speaking practice, homework help, grammar comprehension, reading comprehension, writing development, translation, and other reasons.

*Control variables*

Three variables were used as direct predictors of FLE: gender, frequency of AI usage, and reasons for AI use for FL learning.

*Data Collection*

Data were collected following the Tailored Design Method (Dillman et al., 2014) both face-to-face and online over four weeks in Spring 2025. The research data were collected from three universities in Türkiye, including one public and two private institutions. Informed consent appeared as a mandatory checkbox stating "I would like to participate in the study." Online participants could not proceed without selecting this option. For paper administration, researchers identified willing participants who then checked the consent statement. Ethics protocols were followed during the procedure. The response time of the survey was between 25 and 30 minutes.

Sample adequacy was confirmed through power analysis, Monte Carlo simulations, and the 10 times rule (Cohen, 1988; Schoemann et al., 2014; Hair et al., 2019;). The final sample included 880 participants, exceeding all the required standards. Moreover, a bootstrap method with 5,000 resamples was applied to produce bias-corrected confidence intervals for the indirect effects.

*Data Analysis*

Data were analyzedusing SPSS and SmartPLS 4. Multivariate outliers were identified via Mahalanobis distance ($p < .001$; Hair et al., 2019), resulting in the removal of 23 cases and a final sample of 880 participants. Common method bias was tested using Harman's single-factor test (Podsakoff et al., 2003). Exploratory factor analysis revealed multiple factors , with the first factor explaining only 21.93% of the variance. Therefore, common method bias was not a concern.

Data quality was evaluated following PLS-SEM guidelines (Hair et al., 2019) through reliability (Cronbach's α and ρc), convergent validity (AVE and item loadings), and discriminant validity Fornell-Larcker criterion and HTMT). VIF values confermed the absence of multicollinearity. Most indicator loadings exceeded .70, Cronbach's alpha values were above .70 (most above .90), composite reliability ranged from .823 to .963, and all AVE values were above .50 (range: .538 - .896). Therefore, convergent validity and reliability were supported.

The Fornell–Larcker criterion showed that the square roots of AVE (ranging from .733 to .947) were higher than the correlations between constructs (-.104 to .821), supporting discriminant validity. HTMT ratios were mostly below .85, supporting discriminant validity. The only exceptions was the Sociotechnical Blindness – Job Replacement pair (HTMT = .928), which likely reflects conceptual proximity between the two constructs rather than a lack of discriminant validity. VIF values ranged from 1.24 to 6.18, with some indicators exceeding the accepted limit of 5. However, as no values approached 10 and outer loadings and composite reliability remained acceptable, multicollinearity was not considered a threat to the measurement model (Hair et al., 2019; O'Brien, 2007).

The measurement model demonstrated adequate reliability, convergent validity, and discriminant validity. Hypotheses were then tested using a second-order PLS-SEM approach to reflect the multidimensional structure of the constructs. Direct effects were assessed by examining the size, direction, and statistical significance of path coefficients ($|t| > 1.96$, $p < .05$). Mediation was supported when bootstrap confidence intervals excluded zero, with VAF values interpreted following Hair et al. (2019). Moderation was tested via interaction terms, with effect sizes interpreted following Cohen (1988) and model explanatory power assessed via $R^2$ following Hair et al. (2019).

A supplementary first-order analysis was conducted to examine factor-level path coefficients among the factors of ChatGPT usage, AI anxiety, FLLE, and FLE, as second-order constructs may obscure opposing relationships at the factor level (Hair et al., 2019). Only paths exceeding $|\beta| > 0.075$ are reported. This analysis complements the second-order model by clarifying the mechanisms underlying overall effects, particularly the unexpected positive relationship between AI anxiety and FLE.

## Results

The hypothesized model was tested through three sets of analysis: (1) direct effects among ChatGPT usage, AI anxiety, FLLE, and FLE (H1, H2, H3, H5, H6), 2) mediation analysis with learning effort as mediator (H4), and 3) moderation analysis with AI anxiety as a moderator (H7-H11). All hypotheses were evaluated using bootstrapping with 5,000 resamples ($\alpha = .05$ ($|t| > 1.96$).

*Direct Effects*

The structural model tested five hypotheses by examining whether ChatGPT usage and AI anxiety directly predicted FLLE and FLE.

**Table 2**

*Direct Effect Tests Results*

| | Hypothesis Relationships | β | SD | t (\|O/SD\|) | p | $F^2$ |
|---|---|---|---|---|---|---|
| H1 | ChatGPT Usage → FLE | 0.103 | 0.042 | 2.438 | 0.015 | 0.011 |
| H2 | ChatGPT Usage → FLLE | 0.226 | 0.038 | 5.983 | 0.000 | 0.052 |
| H3 | FLLE → FLE | 0.322 | 0.040 | 7.964 | 0.000 | 0.118 |
| H5 | AI Anxiety → FLE | 0.150 | 0.036 | 4.141 | 0.000 | 0.027 |
| H6 | AI Anxiety → FLLE | 0.040 | 0.039 | 1.023 | 0.306 | 0.002 |

The structural path analysis showed partial support for hypothesized direct relationships (Table 2). ChatGPT usage significantly predicted both FL learning enjoyment ($\beta = 0.103$, $t = 2.438$, $p = .015$, $f^2 = 0.011$) and FLLE ($\beta = 0.226$, $t = 5.983$, $p < .001$, $f^2 = 0.052$), thereby supporting H1 and H2. The difference in effect sizes—stronger for learning effort ($\beta = 0.226$) than for enjoyment ($\beta = 0.103$)—implies that ChatGPT primarily affects behavioral engagement rather than emotional experience. Also, FLLE significantly predicted enjoyment ($\beta = 0.322$, $t = 7.964$, $p < .001$, $f^2 = 0.118$), confirming H3. This effect size indicates that learning effort meaningfully predicts of emotional outcomes in AI-assisted learning.

Two unexpected results were found related to AI anxiety. First, AI anxiety positively and significantly related to FL learning enjoyment ($\beta = 0.150$, $t = 4.141$, $p < .001$, $f^2 = 0.027$) contrary to the negative relationship predicted in H5. Second, AI anxiety's relationship with learning effort was non-significant ($\beta = 0.040$, $t = 1.023$, $p = .306$, $f^2 = 0.002$), thus H6 was rejected.

Control variables—gender ($\beta = 0.067$, $t = 1.069$, $p = .285$), AI usage time ($\beta = 0.045$, $t = 1.109$, $p = .267$), and attitudes toward AI for language learning ($\beta = -0.027$, $t = 0.240$, $p = .811$)—showed no significant effects on FL learning enjoyment. These findings suggest that demographic characteristics and prior AI experience did not meaningfully influence the structural relationships in this sample.

*Mediation Effects*

We then examined whether FLLE mediates the relationship between ChatGPT usage and FLE (H4), which reflects the preposition that ChatGPT may influence emotional outcomes partly through increased behavioral engagement (Table 3).

**Table 3**

*Mediation Effect Test Results (H4)*

| | Hypothesis Mediation Path | Direct Effect (β) | Indirect Effect (β) | Total Effect (β) | SD | t | p | VAF (%) | Mediation Type |
|---|---|---|---|---|---|---|---|---|---|
| H4 | ChatGPT Usage → FLLE → FLE | 0.103 | 0.073 | 0.175 | 0.015 | 4.936 | < .001 | 41.7 | Partial |

ChatGPT usage had a significant indirect effect on FLE via FLLE (β = 0.073, SE = 0.015, t = 4.936, p < .001, Table 8). After the mediator was included, the direct effect remained significant (β = 0.103, p = .015) with total effect of β = 0.175 and a VAF of 41.7%, showing partial mediation (Hair et al., 2019). Therefore, H4 was supported.

*Moderation Effects*

In the third phase, AI anxiety was examined as a moderator of the relationship between ChatGPT usage and language learning outcomes. Moderation hypotheses (H7–H8) and differences across anxiety levels (H9–H11) were tested. To evaluate these effects, interaction terms between ChatGPT usage and AI anxiety were included in the structural model for both learning outcomes (Table 4).

**Table 4**

*Moderation Effect Test Results*

| | Hypothesis Moderation Path | β | SD | t | p | $F^2$ |
|---|---|---|---|---|---|---|
| H7 | AI Anxiety × ChatGPT Usage → FLE | -0.101 | 0.033 | 3.097 | 0.002 | 0.022 |
| H8 | AI Anxiety × ChatGPT Usage → FLLE | -0.048 | 0.034 | 1.410 | 0.159 | 0.004 |

The interaction between AI anxiety and ChatGPT usage significantly predicted FLE (β = −0.101, t = 3.097, p = .002), which supports H7, but the effect size was small ($f^2$ = 0.022). Moreover, the positive effect of ChatGPT usage on FLE decreases as AI anxiety increases. In contrast, the moderation effect on FLLE was not significant (β = −0.048, t = 1.410, p = .159), thus H8 was not supported. The effect size was negligible ($f^2$ = 0.004).

*Conditional Direct and Indirect Effects*

Simple slope analysis was performed to better understand the practical meaning of the significant moderation effect. The effect of ChatGPT usage was tested at three levels of AI anxiety: low (−1 SD), mean, and high (+1 SD). Accordingly, H9–H11 were evaluated by contrasting the direct and indirect effects across these levels of AI anxiety (Table 5).

**Table 5**

*Conditional Direct and Indirect Effects of ChatGPT Usage at Levels of AI Anxiety*

| Outcome | AI Anxiety Level | Direct Effect (β) | Indirect Effect via Effort (β) | SD | t | p |
|---|---|---|---|---|---|---|
| FLLE | Low (−1 SD) | 0.275 | – | 0.053 | 5.143 | < .001 |
| | Mean | 0.226 | – | 0.038 | 5.983 | < .001 |
| | High (+1 SD) | 0.178 | – | 0.049 | 3.653 | < .001 |
| FLE | Low (−1 SD) | 0.204 | 0.088 | 0.020 | 4.484 | < .001 |
| | Mean | 0.103 | 0.073 | 0.015 | 4.936 | < .001 |
| | High (+1 SD) | 0.001 | 0.057 | 0.017 | 3.309 | .001 |
| H11 (formal index) | moderated mediation (low vs. high) | — | −0.016 | 0.011 | 1.387 | .166 |

For FLLE (H9), ChatGPT usage had a significant effect at all anxiety levels (all $p < .001$), though the effect weakened as anxiety increased ($\beta = .275$ at low, .226 at mean, .178 at high anxiety). For FLE (H10), at high anxiety the direct effect became non-significant ($\beta = .001$, $p > .05$) while the indirect effect through effort remained significant ($\beta = .057$, $p = .001$), indicating that at high anxiety, ChatGPT usage influenced enjoyment primarily through learning effort. For moderated mediation (H11), although the indirect effect decreased with anxiety, the index of moderated mediation was non-significant ($\beta = -.016$, $p = .166$), and H11 was not supported.

*Supplementary Dimension-Level Analysis*

To illuminate the mechanisms underlying the overall effects, particularly the unexpected positive association between AI anxiety and FLE (H5), factor-level path coefficients exceeding $|\beta| > 0.075$ were examined (Table 6).

**Table 6**

*Factor-Level Path Coefficients*

| Predictor Factors | Outcome Factors | β |
|---|---|---|
| *1) AI Anxiety Factors → FLE and FLLE Factors* | | |
| Sociotechnical Blindness | Teacher Appreciation | 0.196 |
| AI Configuration | Social Enjoyment | 0.159 |
| Sociotechnical Blindness | Personal Enjoyment | 0.117 |
| Job Replacement | Substantive Effort | 0.102 |
| Job Replacement | Focal Effort | 0.085 |
| Learning | Focal Effort | −0.112 |
| AI Configuration | Teacher Appreciation | −0.093 |
| AI Configuration | Substantive Effort | −0.075 |
| *2) ChatGPT Usage Factors → FLE and FLLE Factors* | | |
| Learning | Substantive Effort | 0.243 |
| Learning | Personal Enjoyment | 0.174 |
| Development | Social Enjoyment | 0.160 |
| Learning | Procedural Effort | 0.148 |
| Learning | Focal Effort | 0.146 |
| Learning | Teacher Appreciation | 0.115 |
| Development | Personal Enjoyment | 0.109 |
| Overall Usability | Personal Enjoyment | −0.101 |

Two patterns emerged. First, the positive overall AI anxiety - FLE relationship was driven by societal-concern factors: Sociotechnical Blindness and Job Replacement showed positive paths to FLE and FLLE , whereas Learning and AI Configuration most closely connected to interacting with AI, showed negative paths to FLLE (Table 6, 1), explaining the counterintuitive overall coefficient. Second, ChatGPT usage effects were uneven: the Learning factor was the primary driver of both FLLE and FLE outcomes, while Overall Usability showed a negative path to Personal Enjoyment (Table 6, 2), which suggests that usability alone may not consistently improve affective outcomes.

**Discussion**

ChatGPT usage significantly predicted FLE and FLLE, but, the effect sizes were small. The stronger path to FLLE than to FLE suggests that ChatGPT primarily shapes behavioral engagement rather than emotional experience. This is consistent with SDT's view that technology supports enjoyment indirectly through active involvement rather than through passive exposure (Ryan & Deci, 2000).

Two features of the present sample limit the direct effect. First, ChatGPT was not integrated into classroom instruction at any of the three universities. However, 82.7% of students reported that they use AI tools personally. Self-directed use may hinder the pedagogical scaffolding. Without such guidance, the emotional benefit of technology use can be reduced. Zhang et al. (2024) studied AI speaking assistants built into structured speaking tasks and found stronger links between AI tools and FLE because structured activities provide both purpose and feedback, not found in unguided use. Second, most of the students were at the A2 and B1 levels. At lower language levels, learners may not have the required language skills to use ChatGPT's interactive features effectively. As a result, this will limit the technology's potential to create experiences. Pekrun's (2006) CVT identifies such experiences as the basis of achievement-related enjoyment.

The second-order model identifies this overall pattern, but the factor-level analysis reveals which specific factors of ChatGPT usage account for it. The Learning factor drove nearly all positive associations with both FLLE and FLE factors. In contrast, Overall Usability showed a negative path to Personal Enjoyment. This challenges TAM’s prediction that perceived ease of use improves positive emotional outcomes. Students may find ChatGPT easy to use if they don’t engage in demanding learning tasks. Hence, they may feel less personal satisfaction. SDT's competence need (Ryan & Deci, 2000) highlights this by the fact that enjoyment comes from overcoming challenges rather than effortless interactions. (Dewaele & MacIntyre, 2014).

FLLE significantly predicted FLE. A significant indirect effect on FLE through FLLE was found for ChatGPT usage. Partial mediation is indicated by this result. 41.7% of ChatGPT's total effect on FLE is accounted for by FLLE. The technological stimulus is changed into an emotional response through FLLE. In the SOR framework, FLLE serves as the

organism. FLE is predicted by SDT to be improved through active engagement rather than passive exposure (Ryan & Deci, 2000). This finding is consistent with that prediction. Barriers to FLLE may be lowered by ChatGPT in several ways. Scheduling limits are removed by its constant availability. In addition, error-related frustration is reduced by adaptive feedback (Karataş et al., 2024). Furthermore, task difficulty is adjusted to the learner's level by personalized responses (Li et al., 2024). Although these features may not directly produce enjoyment, they can make sustained effort more achievable, which in turn can lead to enjoyable achievement experiences.

To clarify which type of effort carries this mediation, the factor-level paths were examined. Learning predicted Substantive Effort most strongly. Substantive Effort factor captures active, cognitively demanding involvement in learning. If the effect had been concentrated in Procedural Effort, the motivational interpretation would be weaker. The focus on Substantive Effort suggests that ChatGPT use encourages deep, self-directed investment that SDT connects with intrinsic motivation. Dörnyei and Ottó (1998) described such investment as the behavioral expression of motivational intentions. Liu et al. (2025) found that enjoyment predicted learning effort in traditional classrooms. The present model tests the reverse direction (effort predicting enjoyment) and finds a significant path. Together, these findings suggest a reciprocal relationship between FLLE and FLE, though the cross-sectional design of this study cannot confirm bidirectionality.

The positive association between AI anxiety and FLE directly contradicts the well-established negative relationship between AI anxiety and FLE in the FL literature (Botes et al., 2022; Dewaele & MacIntyre, 2014; Zhang et al., 2024). The path was statistically significant and the effect size, while small, exceeded that of the direct ChatGPT–FLE path. However, the overall coefficient hides opposing patterns that the factor-level analysis reveals.

The positive overall effect was driven mainly by societal-concern factors of AI anxiety. Sociotechnical Blindness showed the strongest positive path to Teacher Appreciation and Personal Enjoyment. Job Replacement anxiety positively predicted Substantive Effort and Focal Effort. In contrast, Learning anxiety negatively predicted Focal Effort, and AI Configuration anxiety negatively predicted Substantive Effort and Teacher Appreciation. The overall positive coefficient therefore reflects the sum of these opposing effects: positive contributions from societal-concern factors outweighed the negative contributions from interaction-level factors.

Scherer's (1999) appraisal theory explains the fact that the emotional outcome of a stimulus depends on how the individual evaluates its relevance and consequences. Societal-level AI anxieties are not caused by the learning interaction itself. Instead, they are driven by how AI's wider social effects are evaluated. These anxieties include concerns about job loss, ethical risks, and technological blindness. The FL classroom may

be viewed as more valuable by students who worry about AI replacing human workers. This is because human relationships are placed at the center of this learning space. The strong positive path from Sociotechnical Blindness to Teacher Appreciation can be explained by this finding. The perceived value of human teachers is increased by concerns about the societal impact of technology. This explanation is supported by the integrated fear acquisition framework of Li and Huang (2020). A distinction is made in this framework between fears that are directly experienced and fears that are gained through indirect sources. These indirect sources include media and cultural narratives. Societal-concern anxieties are mainly indirect, shaped by discourse about AI's future impact rather than by personal negative experiences with AI tools. Such indirectly acquired anxieties may motivate increased engagement rather than avoidance. Students invest more effort in human-centered learning because they see human skills as increasingly important in an AI-driven world. This pattern aligns with Spielberger's (1972) distinction between facilitative and debilitative anxiety. That is, societal-concern factors function as facilitative anxiety that motivates engagement while interaction-level dimensions function as debilitative anxiety that suppresses it. Hopcan et al. (2024) reported a similar pattern, noting that increased AI knowledge can reduce some forms of anxiety while increasing others.

AI anxiety significantly moderated the ChatGPT usage and FLE relationship, though the effect size was small. At low anxiety, ChatGPT usage positively predicted both FLLE and FLE, and the indirect effect through FLLE was the strongest at low anxiety. At high anxiety, the direct effect on FLE became non-significant. The indirect effect through FLLE remained significant but weakened. This means that for highly anxious learners, ChatGPT's emotional benefit depends entirely on the FLLE pathway. The direct emotional benefit disappears.

The asymmetry between the emotional and behavioral pathways can be explained through Pekrun's (2006) CVT. Enjoyment is an emotional response shaped by cognitive appraisals that are sensitive to anxiety; an anxious student may use ChatGPT productively but fail to experience the interaction as enjoyable. Effort, by contrast, is a behavioral investment that is more consciously controlled. That AI anxiety did not significantly moderate the ChatGPT and FLLE path confirms this. Behavioral engagement is more resistant to anxiety than emotional experience. Chen et al. (2024) and Schiavo et al. (2024) found that AI anxiety affects technology acceptance and perceived usefulness — both attitudinal variables closer to the emotional end of the spectrum. The present findings suggest that anxiety's moderating role is domain-specific. It weakens affective pathways while leaving behavioral pathways largely intact.

The index of moderated mediation was not significant. Although the indirect effect decreased from low to high anxiety, the difference did not reach statistical significance. This may reflect limited statistical power to detect a small moderated mediation effect,

or it may indicate that the indirect pathway is genuinely stable across anxiety levels. It is consistent with the finding that AI anxiety did not moderate the ChatGPT and FLLE link.

*Practical Implications*

Since nearly 42% of ChatGPT's effect on FLE is mediated by FLLE, mere access to ChatGPT is insufficient to maximize emotional benefits. Program designers should incorporate tasks that promote active engagement such as text revision, exercise creation, and applying corrective feedback rather than passive information retrieval. The effort pathway is driven by the Learning factor which means that purposeful with a clear learning goal matters more than ease of use alone.

AI anxiety meaningfully moderates ChatGPT's effect on FLE: at low anxiety both direct and indirect pathways are significant, whereas at high anxiety only the indirect pathway through FLLE remains. Reducing anxiety is therefore essential for ChatGPT to function as an emotional tool in FL learning. Orientation programs explaining how generative AI produces language, its limitations, and how to critically evaluate its outputs would directly address Learning and AI Configuration anxieties - the interaction-level factors that suppress FLLE and FLE, thereby weakening their negative effects.

The positive connection between societal-concern anxieties and Teacher Appreciation suggests that educators need not eliminate all AI-related anxiety. Instead, acknowledging societal concerns about AI while positioning the classroom as a space centered on human relationships and communicative competence may strengthen FLE in AI-integrated contexts.

*Limitations and Future Research*

The cross-sectional design may not provide causal inference, as reverse causality is plausible – motivated learners who already enjoy language learning may be more likely to adopt ChatGPT rather than the other way around. Longitudinal designs that measure variables at multiple time points and in both directions can be investigated.

Factor-level analysis showed that AI anxiety factors operate in opposite directions, with societal-concern factors positively and interaction-level factors negatively predicting FLE and FLLE, Therefore, the second-order moderation analysis represents an effect that may hide important differences. Future research should test moderation and mediation at the factor level and examine whether the four AI anxiety factors (Wang & Wang, 2019) constitute a single higher-order construct or independent anxiety types that require separate modeling.

The sample was limited to Turkish university EFL learners, and the AI anxiety scale was developed in an East Asian context (Wang & Wang, 2019); the FLE scale, in Europe (Dewaele & MacIntyre, 2014). Observed factor-level patterns such as the positive

association between Sociotechnical Blindness and Teacher Appreciation, may reflect culturally specific attitudes toward technology and teacher authority that limits generalizability. Replication across culturally and linguistically diverse samples is needed.

## Conclusion

This study shows that ChatGPT's contribution to FLE is modest. The direct emotional impact of ChatGPT use is small. Two-fifth of its influence on FLE passes through FLLE, and this pathway is active to learners at all anxiety levels, yet high anxiety may cause the direct emotional pathway to disappear. These findings suggest that FLE is not directly improved by ChatGPT, but rather ChatGPT creates conditions for FLE to emerge via effortful learning. According to the factor-level analysis, AI anxiety is not a single construct with uniform effects. Although societal-concern anxieties can coexist with and strengthen FLE and FLLE in language learning, interaction-level anxieties suppress them.

## ORCID

https://orcid.org/0000-0001-8096-5598
https://orcid.org/0000-0003-2005-851X
https://orcid.org/0000-0003-2740-6126

## Publisher's Note

The claims, arguments, and counter-arguments made in this article are exclusively those of the contributing authors. Hence, they do not necessarily represent the viewpoints of the authors' affiliated institutions, or EUROKD as the publisher, the editors and the reviewers of the article.

## Acknowledgements

Not applicable

## Funding

Open access funding will be provided by the Scientific and Technological Research Council of Türkiye (TÜBİTAK). No specific funding was received for this study.

## CRediT Authorship Contribution Statement

Gülten Feryal Gündüz: Conceptualization, Literature Review, Methodology, Writing, Review & Editing
Kerim Ünal: Conceptualization, Data Collection, Methodology, Data Analysis, Writing, Review & Editing
Cem Özışık: Data Collection, Literature Review, Writing, Review & Editing

## Generative AI Use Disclosure Statement

Grammarly was used for grammatical errors.

## Ethics Declarations

### World Medical Association (WMA) Declaration of Helsinki–Ethical Principles for Medical Research Involving Human Participants

The study protocol has been approved by İstanbul Kültür University Scientific Research and Ethical Review Board (162579). The study was performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and its following updates and World Medical Association (WMA) Declaration of Helsinki – Ethical Principles for Medical Research Involving Human Participants.

## Competing Interests

No conflict of interest exists for this manuscript for any of the authors.

## Data Availability

Data will be available on request.

## References

Akkaya, B., Özkan, A., & Özkan, H**.** (2021). Artificial intelligence anxiety (AIA) scale: Adaptation to Turkish, validity and reliability study. *Alanya Academic Review Journal, 5*(2), 1125–1146. https://doi.org/10.29023/alanyaakademik.833668

Badiei, G., Azari Noughabi, M., & Amirian, S. K. (2025). Foreign language peace of mind, foreign language enjoyment, and perceived language proficiency: The mediating role of L2 grit. *English Teaching & Learning, 49*, 1–18. https://doi.org/10.1007/s42321-023-00163-8

Barrot, J. S. (2024). ChatGPT as a language learning tool: An emerging technology report. *Technology, Knowledge and Learning, 29*(4), 1151–1156. https://doi.org/10.1007/s10758-023-09711-4

Botes, E., Dewaele, J.M., & Greiff, S. (2022). By the old gods and the new: The effect of the congruence and incongruence of foreign language classroom anxiety and enjoyment on self-perceived proficiency. *The Modern Language Journal, 106*(4), 784–797. https://doi.org/10.1111/modl.12807

Bozick, R. N., & Dempsey, T. L. (2010). Effort. In R. J. Bangser (Ed.), *Noncognitive skills in the classroom: New perspectives on educational research* (pp. 39–68). RTI Press. https://files.eric.ed.gov/fulltext/ED512833.pdf

Bravo, J. C., Intriago, E. A., Holguin, J. V., Garzon, G. M., & Arcia, L. O. (2016). Motivation and autonomy in learning English as a foreign language: A case study of Ecuadorian college students. *English Language Teaching*, *10*(2), 100–113. https://doi.org/10.5539/elt.v10n2p100

Carbonaro, W. (2005). Tracking, students' effort, and academic achievement. *Sociology of Education*, *78*(1), 27–49. https://doi.org/10.1177/003804070507800102

Cengiz, H., & Peker, A. T. (2025). Generative artificial intelligence acceptance and artificial intelligence anxiety among university students: The sequential mediating role of attitudes toward artificial intelligence and literacy. *Current Psychology, 44*, 7991–8000. https://doi.org/10.1007/s12144-025-07433-7

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 Psychologica, 249*, Article 104442. https://doi.org/10.1016/j.actpsy.2024.104442

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Lawrence Erlbaum Associates, Publishers.

Çobanoğulları, F., Çıldır, M., & Koçak, M. (2025). Turkish adaptation and validation of the short form of the Foreign Language Enjoyment Scale. *European Review of Applied Psychology, 75*, Article 100910. https://doi.org/10.1016/j.erap.2023.100910

Deci, E. L., & Ryan, R. M. (1985). *Intrinsic motivation and self-determination in human behavior*. Plenum Press.

Dewaele, J. M., & MacIntyre, P. D. (2014). The two faces of Janus? Anxiety and enjoyment in the foreign language classroom. *Studies in Second Language Learning and Teaching*, *4*(2), 237–274. https://doi.org/10.14746/ssllt.2014.4.2.5

Dewaele, J. M., Saito, K., & Halimi, F. (2025). How teacher behaviour shapes foreign language learners' enjoyment, anxiety and attitudes/motivation: A mixed modelling longitudinal investigation. *Language Teaching Research, 29*(4), 1580–1602. https://doi.org/10.1177/13621688221089601

Dewaele, J. M., Witney, J., Saito, K., & Dewaele, L. (2018). Foreign language enjoyment and anxiety: The effect of teacher and learner variables. *Language Teaching Research, 22*(6), 676–697. https://doi.org/10.1177/1362168817692161

Dillman, D. A., Smyth, J. D., & Christian, L. M. (2014). *Internet, phone, mail, and mixed-mode surveys*: *The tailored design method* (4th ed.). John Wiley & Sons. https://doi.org/10.1002/9781394260645

Dong, S., Wang, H., & Dong, J. (2026). The complex interactions between foreign language emotions and engagement in AI-assisted EFL classrooms. *System, 137*, 103900. https://doi.org/10.1016/j.system.2025.103900

Dörnyei, Z., & Ottó, I. (1998). Motivation in action: A process model of L2 motivation. *Working Papers in Applied Linguistics*, *4*, 43–69.

Erdel, D. (2025). L2 learning effort of students majoring in English language and literature. *Bartın University Journal of Faculty of Education*, *14*(1), 1–12. https://doi.org/10.14686/buefad.1248339

Ersoy, F. (2021). Returns to effort: Experimental evidence from an online language platform. *Experimental Economics*, *24*(3), 1047–1073. https://doi.org/10.1007/s10683-020-09689-1

Eysenck, M. W., & Keane, M. T. (2020). Cognitive psychology: A student's handbook (8th ed.). Psychology Press.

Fathi, J., & Hejazi, S. Y. (2024). Ideal L2 self and foreign language achievement: The mediating roles of L2 grit and foreign language enjoyment. *Current Psychology*, *43*, 10606–10620. https://doi.org/10.1007/s12144-023-05187-8

Fredrickson, B. L. (2001). The role of positive emotions in positive psychology: The broaden-and-build theory of positive emotions. *American Psychologist, 56*(3), 218–226. https://doi.org/10.1037/0003-066X.56.3.218

Gardner, R. C. (1985). *Social psychology and second language learning: The role of attitudes and motivation*. Edward Arnold.

Genç, G., & Köksal, D. (2021). Foreign language learning effort and use of digital media among digital natives: A case study from an urban secondary school. *Novitas-ROYAL (Research on Youth and Language)*, *15*(1), 17–37. https://files.eric.ed.gov/fulltext/EJ1295579.pdf

Hair J. F., Risher J. J., Sarstedt M., & Ringle C. M. (2019). When to use and how to report the results of PLS-SEM. *European Business Review, 31(1), 2–24.* https://doi.org/10.1108/EBR-11-2018-0203

Heung, Y. M. E., & Chiu, T. K. (2025). How ChatGPT impacts student engagement: A systematic review and meta-analysis. *Computers and Education: Artificial Intelligence, 8*, Article 100361. https://doi.org/10.1016/j.caeai.2025.100361

Hopcan, S., Türkmen, G., & Polat, E. (2024). Exploring the artificial intelligence anxiety and machine learning attitudes of teacher candidates. *Education and Information Technologies*, *29*, 7281–7301. https://doi.org/10.1007/s10639-023-12086-9

Huang, F., & Zou, B. (2024). English speaking with artificial intelligence (AI): The roles of enjoyment, willingness to communicate with AI, and innovativeness. *Computers in Human Behavior, 159*, Article 108355. https://doi.org/10.1016/j.chb.2024.108355

Jiang, Z., Guo, H., Kong, K., Zhao, M., & Li, S. (2026). The relation between openness to experience and AI acceptance among university students: The chain mediation role of AI trust and AI anxiety. *Current Psychology, 45*, 540. https://doi.org/10.1007/s12144-026-09041-5

Kai, C., Wang, P., & Jiang, X. (2026). AI anxiety and adoption intention in higher education based on an extended TAM-UTAUT and PLS-SEM analysis. *Scientific Reports, 16*, 3672. https://doi.org/10.1038/s41598-026-35823-9

Karabıyık, C., & Mirici, İ. H. (2018). Development and validation of the Foreign Language Learning Effort Scale for Turkish tertiary-level students. *Kuram ve Uygulamada Eğitim Bilimleri/Educational Sciences: Theory & Practice, 18*(2), 373–395. https://files.eric.ed.gov/fulltext/EJ1201845.pdf

Karataş, F., Abedi, F. Y., Ozek Gunyel, F., Karadeniz, D., & Kuzgun, Y. (2024). Incorporating AI in foreign language education: An investigation into ChatGPT's effect on foreign language learners. *Education and Information Technologies, 29*(15), 19343–19366. https://doi.org/10.1007/s10639-024-12574-6

Kazu, İ. Y., & Kuvvetli, M. (2023). The influence of pronunciation education via artificial intelligence technology on vocabulary acquisition in learning English. *International Journal of Psychology and Educational Studies, 10*(2), 480–493. https://doi.org/10.52380/ijpes.2023.10.2.1044

Kelly, S. (2008). What types of students' effort are rewarded with high marks? *Sociology of Education*, *81*(1), 32–52. https://doi.org/10.1177/003804070808100102

Kim, M., Kim, J., Knotts, T. L., & Albers, N. D. (2025). AI for academic success: Investigating the role of usability, enjoyment, and responsiveness in ChatGPT adoption. *Education and Information Technologies, 30*, 14393–14414. https://doi.org/10.1007/s10639-025-13398-8

Klimova, B., & Campos, V. P. L. de. (2024). University undergraduates' perceptions on the use of ChatGPT for academic purposes: Evidence from a university in Czech Republic. *Cogent Education, 11*(1), 2373512. https://doi.org/10.1080/2331186X.2024.2373512

Li, B., Lowell, V. L., Wang, C., & Li, X. (2024). A systematic review of the first year of publications on ChatGPT and language education: Examining research on ChatGPT's use in language learning and teaching. *Computers and Education: Artificial Intelligence, 7*, Article 100266. https://doi.org/10.1016/j.caeai.2024.100266

Li, C. (2020). A positive psychology perspective on Chinese EFL students' trait emotional intelligence, foreign language enjoyment and EFL learning achievement. *Journal of Multilingual and Multicultural Development, 41*(3), 246–263. https://doi.org/10.1080/01434632.2019.1614187

Li, C., Huang, J., & Li, B. (2020). The predictive effects of classroom environment and trait emotional intelligence on foreign language enjoyment and anxiety. *System*, *96*, Article 102393. https://doi.org/10.1016/j.system.2020.102393

Li, J., & Huang, J. S. (2020). Dimensions of artificial intelligence anxiety based on the integrated fear acquisition theory. *Technology in Society, 63*, Article 101410.. https://doi.org/10.1016/j.techsoc.2020.101410

Li, C., Jiang, G., & Dewaele, J. M. (2018). Understanding Chinese high school students' foreign language enjoyment: Validation of the Chinese version of the foreign language enjoyment scale. *System, 76*, 183–196. https://doi.org/10.1016/j.system.2018.06.004

Li, Y., Sadiq, G., Qambar, G., & Zheng, P. (2025). The impact of students' use of ChatGPT on their research skills: The mediating effects of autonomous motivation, engagement, and self-directed learning. *Education and Information Technologies*, *30*, 4185–4216. https://doi.org/10.1007/s10639-024-12981-9

Li, H., Xu, Y., Brown, C., O'Steen, B., & Luo, Z. (2026). Sustainable AI integration in education: Factors influencing pre-service teachers' continuance intention to use generative AI. *Sustainability, 18*(7), 3291. https://doi.org/10.3390/su18073291

Liu, H., Jiang, Y., Nie, H., & Zhou, X. (2025). Unveiling the effects of enjoyment and hope on students' English learning effort. *Scientific Reports, 15*(1), Article 26630. https://doi.org/10.1038/s41598-025-11904-z

Liu, M., & Jackson, J. (2008). An exploration of Chinese EFL learners' unwillingness to communicate and foreign language anxiety. *The Modern Language Journal*, *92*(1), 71–86. https://doi.org/10.1111/j.1540-4781.2008.00687.x

Liu, M., & Huang, W. (2011). An exploration of foreign language anxiety and English learning motivation. *Education Research International*, *2011*, Article 493167. https://doi.org/10.1155/2011/493167

Luan, L., Jing, B., Hong, J. C., & Lin, P. H. (2025). The mediating effects of online learning engagement on the relationship between Chinese university students' L2 grit and their English language achievement. *System*, *131*, Article 103689. https://doi.org/10.1016/j.system.2025.103689

MacIntyre, P. D. (2007). Willingness to communicate in the second language: Understanding the decision to speak as a volitional process. *The Modern Language Journal, 91*(4), 564–576. https://doi.org/10.1111/j.1540-4781.2007.00623.x

MacIntyre, P. D., & Gregersen, T. (2012). Emotions that facilitate language learning: The positive-broadening power of the imagination. *Studies in Second Language Learning and Teaching, 2*(2), 193–213. https://doi.org/10.14746/ssllt.2012.2.2.4

Maurer, M. M., & Simonson, M. R. (1984, January 20–24). *Development and validation of a measure of computer anxiety* (ERIC Document Reproduction Service No. ED243428) [Conference presentation]. Annual Meeting of the Association for Educational Communications and Technology, Dallas, TX, United States. https://files.eric.ed.gov/fulltext/ED243428.pdf

Mohamed, A. M. (2023). Exploring the potential of an AI-based chatbot (ChatGPT) in enhancing English as a foreign language (EFL) teaching: Perceptions of EFL faculty. *Education and Information Technologies, 29*, 3195–3217. https://doi.org/10.1007/s10639-023-11917-z

Natriello, G., & McDill, E. (1986). Performance standards, student effort on homework, and academic achievement. *Sociology of Education*, *59*(1), 18–31. https://doi.org/10.2307/2112484

O'Brien, R. M. (2007). A caution regarding rules of thumb for variance inflation factors. *Quality & Quantity, 41*(5), 673–690. https://doi.org/10.1007/s11135-006-9018-6

Özer, S., & Başarır, F. (2020). The effect of teacher candidates' English self-efficacy beliefs on their perceived success: The mediating role of language learning effort. *OPUS Uluslararası Toplum Araştırmaları Dergisi, 16*, 5704–5731. https://doi.org/10.26466/opus.771847

Pekrun, R. (2006). The control-value theory of achievement emotions: Assumptions, corollaries, and implications for educational research and practice. *Educational Psychology Review*, *18*(4), 315–341. https://doi.org/10.1007/s10648-006-9029-9

Pekrun, R., & Perry, R. P. (2014). Control-value theory of achievement emotions. In R. Pekrun & L. Linnenbrink-Garcia (Eds.), *International handbook of emotions in education* (pp. 120–141). Routledge/Taylor & Francis Group.

Piechurska-Kuciel, E. (2017). L2 or L3? Foreign language enjoyment and proficiency. In J. Mydla, M. Poks, & L. Drong (Eds.), *Multiculturalism, multilingualism and the self* (pp. 97–111). Springer.

Pintrich, P. R., Smith, D. A. F., Garcia, T., & McKeachie, W. J. (1993). Reliability and predictive validity of the Motivated Strategies for Learning Questionnaire (MSLQ). *Educational and Psychological Measurement*, *53*(3), 801–813. https://doi.org/10.1177/0013164493053003024

Podsakoff, P. M., MacKenzie, S. B., Lee, J.-Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies. *Journal of Applied Psychology*, *88*(5), 879–903. https://doi.org/10.1037/0021-9010.88.5.879

Putra, Y. P., & Hall, R. A. (2019). Identifying the relationship between motivation, anxiety and intended effort of learning English: An SEM approach. In R. Rahim, K. Suranata, I. Ifdil, & I. B. Rangka (Eds.), *Proceedings of the 1st International Conference on Technology and Educational Sciences (ICTES 2018)*. European Alliance for Innovation. https://doi.org/10.4108/eai.21-11-2018.2282030

Qu, K., & Wu, X. (2024). ChatGPT as a CALL tool in language education: A study of hedonic motivation adoption models in English learning environments. *Education and Information Technologies, 29*(15), 19471–19503. https://doi.org/10.1007/s10639-024-12598-y

Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist*, *55*(1), 68–78. https://doi.org/10.1037/0003-066X.55.1.68

Ryan, R. M., Connell, J. P., & Plant, R. W. (1990). Emotions in non-directed text learning. *Learning and Individual Differences*, 2(1), 1–17.

Scherer, K. R. (1999). Appraisal theory. In T. Dalgleish & M. J. Power (Eds.), *Handbook of cognition and emotion* (pp. 637–663). John Wiley & Sons Ltd. https://doi.org/10.1002/0470013494.ch30

Schiavo, G., Businaro, A., & Zancanaro, M. (2024). Comprehension, apprehension, and acceptance: Understanding the influence of literacy and anxiety on acceptance of artificial intelligence. *Technology in Society, 77*, Article 102537. https://doi.org/10.1016/j.techsoc.2024.102537

Schoemann, A. M., Miller, P., Pornprasertmanit, S., & Wu, W. (2014). Using Monte Carlo simulations to determine power and sample size for planned missing designs. *International Journal of Behavioral Development*, *38*(5), 471–479. https://doi.org/10.1177/0165025413515169

Shi, L., Zuo, Y., & Wang, Y. (2026). Trajectories of foreign language writing enjoyment in AI-mediated EFL contexts: A latent growth curve modeling study from a complex dynamic systems perspective. *Acta Psychologica, 265*, Article 106717. https://doi.org/10.1016/j.actpsy.2026.106717

Song, C., & Song, Y. (2023). Enhancing academic writing skills and motivation: Assessing the efficacy of ChatGPT in AI-assisted language learning for EFL students. *Frontiers in Psychology, 14*, Article 1260843. https://doi.org/10.3389/fpsyg.2023.1260843

Spielberger, C. D. (1972). Anxiety as an emotional state. In C. D. Spielberger (Ed.), *Anxiety: Current trends in theory and research* (Vol. 1, pp. 24–49). Academic Press.

Sun, F., Wang, J., Mendoza, L., & Li, H. (2026). Exploring the relationships among large language model acceptance, enjoyment, anxiety, and self-efficacy in L2 academic writing. *Acta Psychologica*, *263*, Article 106237. https://doi.org/10.1016/j.actpsy.2026.106237

Tram, N. H. M., Nguyen, T. T., & Tran, C. D. (2024). ChatGPT as a tool for self-learning English among EFL learners: A multi-methods study. *System*, *127*, Article 103528. https://doi.org/10.1016/j.system.2024.103528

Wang, X., Wang, Y., Yang, Y., & Wang, L. (2021). Investigating Chinese university students' enjoyment in a web-based language learning environment: Validation of the Online Foreign Language Enjoyment Scale. *Perceptual and Motor Skills, 128*(6), 2820–2848. https://doi.org/10.1177/00315125211041714

Wang, Y. Y., & Wang, Y. S. (2019). Development and validation of an artificial intelligence anxiety scale: an initial application in predicting motivated learning behavior. *Interactive Learning Environments*, *30*(4), 619–634. https://doi.org/10.1080/10494820.2019.1674887

Xu, S., Chen, P., & Zhang, G. (2024). Exploring the impact of the use of ChatGPT on foreign language self-efficacy among Chinese students studying abroad: The mediating role of foreign language enjoyment. *Heliyon, 10*(10), Article e39845. https://doi.org/10.1016/j.heliyon.2024.e39845

Yamaoka, K. (2024). ChatGPT's motivational effects on Japanese university EFL learners: A qualitative analysis. *International Journal of TESOL Studies, 6*(3), 24–35. https://doi.org/10.58304/ijts.20240303

Yang, H., & Sundar, S. S. (2025). AI anxiety: Explication and exploration of effect on state anxiety when interacting with AI doctors. *Computers in Human Behavior: Artificial Humans, 3*, 100128. https://doi.org/10.1016/j.chbah.2025.100128

Yuan, L., & Liu, X. (2025). The effect of artificial intelligence tools on EFL learners' engagement, enjoyment, and motivation. *Computers in Human Behavior*, *162*, Article 108474. https://doi.org/10.1016/j.chb.2024.108474

Zare, J., Karimpour, S., & Aqajani Delavar, K. (2022). The impact of concordancing on English learners' foreign language anxiety and enjoyment: An application of data-driven learning. *System, 109*, Article 102891. https://doi.org/10.1016/j.system.2022.102891

Zhang, H., Dai, Y., & Wang, Y. (2020). Motivation and second foreign language proficiency: The mediating role of foreign language enjoyment. *Sustainability*, *12*(4), 1302. https://doi.org/10.3390/su12041302

Zhang, C., Meng, Y., & Ma, X. (2024). Artificial intelligence in EFL speaking: Impact on enjoyment, anxiety, and willingness to communicate. *System*, *121*, Article 103259. https://doi.org/10.1016/j.system.2024.103259

Zhao, X., & Wang, D. (2026). The impact of ChatGPT's feedback on L2 Chinese learners' writing outcome, confidence, and emotions: A mixed-method quasi-experimental study. *Assessing Writing*, *68*, Article 101027. https://doi.org/10.1016/j.asw.2026.101027

Zimmerman, B. J., & Risemberg, R. (1997). Self-regulatory dimensions of academic learning and motivation. In G. D. Phye (Ed.), *Handbook of academic learning: Construction of knowledge* (pp. 105–125). Academic Press.