

Investigating the relationship between AI self-efficacy, AI anxiety, and gender among Turkish ELT students

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Suggested citation: Taşçı, S. (2026). Investigating the relationship between AI self-efficacy, AI anxiety, and gender among Turkish ELT students. *Journal of Educational Technology and Online Learning*, 9(2), 273-285.

Highlights

- Pre-service English teachers reported moderate levels of AI self-efficacy and AI anxiety, with significant gender-based differences.
- AI self-efficacy was a strong negative predictor of AI anxiety, explaining a meaningful proportion of variance.
- Findings underscore the need for teacher education programs to strengthen both technical competence and emotional readiness for AI integration.

Article Info: Research Article

Keywords: *AI self-efficacy, AI anxiety, gender, technology integration, teacher education*

Abstract

This study examines how Turkish pre-service English language teachers feel about using artificial intelligence (AI) tools and how these beliefs are linked to their anxiety about AI. It also investigates whether male and female students differ in these perceptions. Participants were 143 undergraduate students enrolled in an English Language Teaching program at a public university. Two validated instruments were used to measure AI self-efficacy and AI anxiety, and the data were analyzed using descriptive statistics, independent-samples t tests, correlation analysis, and simple linear regression. Overall, the students reported medium levels of both confidence and anxiety regarding AI. Male students tended to feel more capable of working with AI and reported lower anxiety compared with their female peers. A moderate negative correlation emerged between AI self-efficacy and AI anxiety, and AI self-efficacy significantly predicted anxiety levels, accounting for a meaningful proportion of the variance. These findings highlight the importance of developing teacher education curricula that enhance both the technical skills and emotional readiness of future English teachers to engage with AI-supported language learning environments.

1. Introduction

In recent years, artificial intelligence (AI) has moved from being a largely experimental technology to a routine part of educational practice, changing how instruction is delivered and how learners engage with digital learning environments (Taşçı & Tunaz, 2024). AI-based systems are now used to generate automated feedback on student work, to tailor learning materials to individual needs, and to support language-related tasks such as translation or text generation (Chan et al., 2024; Iorliam & Ingio, 2024; Poznansky et al., 2025). In English Language Teaching (ELT), tools for automated essay scoring, pronunciation support, and conversational chatbots are becoming increasingly visible in both teacher education and classroom practice. This expansion means that language teachers are expected not only to master pedagogical and linguistic knowledge, but also to develop the technological competence and emotional readiness needed to integrate AI tools into their teaching (Pokrivčáková, 2019; Zou et al., 2025). At the same time, the rapid pace and opaque nature of AI innovations can evoke worry, skepticism, and resistance among educators, making it

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Preliminary findings of this study were presented at 4th International AELTE Conference organized with the cooperation of Kahramanmaraş Sütçü İmam University on October 10-11, 2025.

essential to better understand the psychological factors that shape AI adoption in language education (Alvarez & Lane, 2023; Saidkodirotva, 2025).

Bandura's social-cognitive framework conceptualizes self-efficacy as individuals' judgments about how capable they are of carrying out particular actions or coping with specific challenges. When this idea is applied to AI-supported education, the notion of AI self-efficacy captures how confident teachers and students feel when they interact with AI tools, interpret AI-generated outputs, and incorporate these tools into learning activities (Aca et al., 2025; Wang & Chuang, 2024). Evidence suggests that individuals who feel competent in working with AI are more likely to engage actively with these tools and sustain their involvement over time, whereas low self-efficacy can result in avoidance of using and negative attitudes towards AI tools (Albino et al., 2025; Shi & Zhang, 2025). In contrast, AI anxiety encompasses the uneasiness or concern people may feel when interacting with AI systems or anticipating their outcomes (Terzi, 2020; Wang & Wang, 2022). This anxiety may arise from a lack of familiarity, perceived threats of automation, or fear of losing control. For pre-service teachers, high anxiety can hinder innovation and limit their willingness to integrate AI tools into instruction (Albino et al., 2025; Parviz & Arthur, 2025).

In language education, affective responses to AI are particularly important because teaching and learning languages depend heavily on communication, creativity, and social interaction. Recent studies highlight the predictive role of emotional and cognitive factors in AI-assisted learning. Zhang et al. (2025) found that AI literacy is positively associated with English learners' willingness to communicate, with AI self-efficacy mediating this relationship, while classroom anxiety had a negative effect. Similarly, Yang et al. (2025) showed that AI-supported instruction accompanied by teacher guidance improved students' psychological well-being, emphasizing the value of emotional readiness in AI-enhanced contexts. These findings suggest that educators' confidence and anxiety toward AI can determine whether technology becomes a source of empowerment or stress.

Previous findings offer mixed evidence regarding gender-related patterns in AI self-efficacy and AI anxiety, underscoring the need for further inquiry within language teacher education contexts. While some studies indicate that female teachers exhibit higher levels of AI anxiety, particularly in dimensions such as learning and job replacement (Terzi, 2020), others report that gender has little to no predictive power in explaining variations in AI-related beliefs. For instance, Teke (2025) observed no gender-based differences in pre-service teachers' AI-anxiety profiles. Similarly, Asio and Sardina (2025) found that gender did not significantly moderate the relationship between AI self-efficacy, AI anxiety, and AI self-competency. On the other hand, Russo et al. (2025) found that women reported higher AI anxiety and lower positive attitudes toward AI revealing subtle gender-related nuances. Overall, the role of gender in shaping attitudes toward AI appears to vary across settings, indicating that such differences are shaped by contextual rather than universal factors, shaped by cultural norms, academic environment, and individuals' prior exposure to technology. Examining these patterns among Turkish ELT students may yield a more refined understanding of how men and women navigate AI-related emotions and beliefs.

While scholarship on AI in education has grown rapidly, relatively little empirical work has examined how emotional and cognitive responses coexist—particularly within teacher-education contexts. Internationally, most work has examined digital literacy or general technology acceptance, often neglecting how cognitive beliefs and emotional responses interact to shape teachers' readiness for AI integration. Studies that have addressed both constructs (e.g., Chen et al., 2024; Moon, 2024; Albino et al., 2025) largely focus on STEM or general education rather than ELT. In Türkiye, existing studies have mainly investigated AI literacy and attitudes, leaving emotional and cognitive readiness underexplored.

To address these gaps, the present study examines the relationship between AI self-efficacy and AI anxiety among Turkish pre-service English teachers and explores potential gender effect in these constructs. By linking cognitive confidence and emotional readiness, the study contributes to a global understanding of how affective-cognitive mechanisms shape teachers' technological adaptability. In alignment with the Türkiye National Artificial Intelligence Strategy (2021-2025), this research supports the development of psychologically and technologically competent teachers prepared for AI-enhanced language education.

Building on the integrated frameworks of Social Cognitive Theory (Bandura, 1997) and the Control-Value Theory of Achievement Emotions (Pekrun, 2006), the study addresses the following research questions:

1. What are the overall levels of AI self-efficacy and AI anxiety among Turkish ELT students?
2. Are there significant gender differences in AI self-efficacy and AI anxiety?
3. What is the relationship between AI self-efficacy and AI anxiety among Turkish ELT students?
4. To what extent does AI self-efficacy predict AI anxiety among Turkish ELT students?"

By addressing these questions, the study aims to provide empirical evidence on the interplay between cognitive self-beliefs and emotional responses in AI adoption within teacher education, contributing to both national and international discussions on psychological readiness for AI-supported language pedagogy.

2. Literature

2.1. *AI Self-Efficacy in Language Education*

Drawing on social-cognitive principles (Bandura, 1997), AI self-efficacy describes an individual's perceived capability to operate AI systems, interpret outputs, and use them for learning or teaching purposes (Wang & Chuang, 2024). Empirical evidence consistently highlights AI self-efficacy as a key psychological construct influencing both teachers' and learners' readiness to adopt AI-based tools such as automated writing feedback, pronunciation trainers, and conversational chatbots. Hosseini (2025) reported that teachers with higher AI self-efficacy demonstrated greater behavioral intention to integrate AI, both directly and indirectly through perceived usefulness and ease of use, within the Technology Acceptance Model (TAM) framework. Likewise, Suardewa et al. (2024) found that pre-service English teachers' AI self-efficacy significantly predicted their intention to use AI in teaching writing, emphasizing self-efficacy as a major driver of pedagogical adoption.

At the learner level, Asio (2025) showed that AI self-efficacy mediated the relationship between students' attitudes toward AI and their AI literacy, suggesting that self-efficacy acts as a bridge between positive perceptions and actual competence. Within L2 learning, Chen et al. (2024) confirmed that AI self-efficacy positively predicted students' attitudes and actual use of AI tools while reducing anxiety about using them. Similar findings by Wang and Chuang (2024) and Aca et al. (2025) indicate that AI self-efficacy supports teachers' openness to AI-mediated instruction. Additionally, Bergdahl and Sjöberg (2025) demonstrated that teachers' AI self-efficacy depends strongly on prior experience and institutional support, emphasizing the role of professional development in sustaining confidence.

Overall, evidence across contexts shows that AI self-efficacy enhances not only the intention and willingness to use AI tools but also the emotional readiness and engagement necessary for effective language learning. In EFL and ELT settings, strengthening AI self-efficacy through training and supportive learning environments is therefore crucial for successful AI integration.

2.2. *AI Anxiety in Language Education*

AI anxiety captures the tension or uneasiness some individuals feel when engaging with AI technologies or anticipating their effects, especially when systems appear complex, autonomous, or difficult to control (Wang & Wang, 2022). Rooted in earlier notions of computer and technophobia, AI anxiety differs in its psychological scope, as it involves anxiety about autonomous decision-making, job replacement, and the loss of human control (Johnson & Verdicchio, 2017; Li & Huang, 2020). Within educational settings, AI anxiety has become a salient affective variable influencing how students and teachers perceive and adopt AI-enhanced tools for teaching and learning (Wu & Li, 2025).

Recent empirical studies have examined the impact of AI anxiety on learners' motivation and behavioral intentions. Wang et al. (2024) found that AI learning anxiety negatively predicted intrinsic motivation, whereas job replacement anxiety exerted a small positive effect on extrinsic motivation, suggesting a complex interplay between anxiety and motivation in AI-related learning. Similarly, Wen et al. (2024), using secondary-school EFL learners, reported that both AI learning anxiety and job replacement anxiety

indirectly and negatively influenced students' behavioral intention to use AI-based EFL tools. These findings indicate that high AI anxiety may inhibit learners' engagement with emerging AI-assisted language applications, such as automated writing feedback or intelligent tutoring systems.

A recent systematic review by Wu and Li (2025) further synthesized 32 empirical studies, identifying AI anxiety as a multidimensional mediator linking perceived control, self-efficacy, and learning outcomes. The review emphasized that high levels of AI-related anxiety may reduce learners' and teachers' sense of control and independence when working in AI-supported instructional environments, particularly when AI tools operate as opaque "black boxes" that reduce human oversight. In line with these findings, research in EFL contexts has shown that learners' AI-related anxiety, especially fears of bias, job loss, or diminished creativity, may lead to avoidance of AI-integrated learning environments (Wen et al., 2024).

Taken together, existing studies show that AI anxiety can limit learners' engagement but may also influence how they regulate their learning in AI-based contexts. While moderate anxiety can stimulate preparedness and motivation (Wang & Wang, 2022), excessive anxiety tends to reduce engagement, self-confidence, and willingness to engage with AI tools. As AI becomes integral to language education, understanding and mitigating AI anxiety through awareness training, transparent system design, and teacher support will be crucial for fostering positive emotional readiness and sustainable AI integration in ELT settings.

2.3. AI Self-Efficacy and AI Anxiety in Language Education

The interaction between AI self-efficacy and AI anxiety has emerged as a critical focus in understanding educators' and learners' psychological readiness for AI-enhanced education. Grounded in Bandura's (1997) Social-Cognitive Theory and supported by the Control-Value Theory of Achievement Emotions (CVT; Pekrun, 2006), these two constructs represent the cognitive and affective dimensions shaping users' engagement with AI tools in learning environments.

Empirical research generally supports an inverse relationship between AI self-efficacy and AI anxiety, indicating that individuals who feel more competent in handling AI tend to experience less apprehension. Albino et al. (2025) found that AI anxiety, particularly in learning and configuration dimensions, significantly predicted lower AI self-efficacy among college students, emphasizing that insufficient confidence and high anxiety can mutually reinforce one another. Similarly, Moon (2024) reported that AI self-efficacy negatively influenced AI anxiety while positively affecting AI trust and acceptance intention toward generative AI, suggesting that self-efficacy not only alleviates anxiety but also fosters more favorable attitudes and openness to AI use.

Recent studies have also revealed bidirectional and moderating effects between these constructs. In a study of in-service teachers, Hsu et al. (2023) found a strong negative correlation between AI learning anxiety and machine-learning self-efficacy, confirming that training interventions can reduce anxiety and strengthen confidence simultaneously. Similarly, Chen et al. (2025) demonstrated that AI self-efficacy moderated the positive association between AI learning anxiety and motivated learning, indicating that learners with higher self-efficacy could transform moderate anxiety into productive motivation, a phenomenon aligning with the facilitative role of achievement emotions proposed by Pekrun's theory.

Within language learning contexts, Chen et al. (2024) provided empirical support for a mediating mechanism where AI self-efficacy reduced AI anxiety and indirectly increased learners' attitudes and actual use of AI tools for second language (L2) learning. These results demonstrate that self-efficacy serves as both a protective and enabling factor, buffering anxiety while promoting sustained engagement with AI-enhanced learning systems.

Further extending this perspective, Teke (2025) used latent profile analysis with Turkish pre-service teachers and found that AI self-efficacy did not significantly predict membership in AI risk-awareness anxiety profiles, suggesting that anxiety's effects are not uniformly negative and may, under certain conditions, stimulate motivated learning. Complementary findings by Asio and Sardina (2025) also indicated that the two constructs remained significantly related, collectively shaping students' AI self-competency.

Taken together, the literature portrays AI self-efficacy and AI anxiety as interdependent psychological forces that jointly determine individuals' attitudes, motivation, and behaviors toward AI integration in education. In language learning, fostering self-efficacy through targeted AI literacy instruction, hands-on practice, and supportive environments appears essential not only to mitigate anxiety but also to channel it toward constructive engagement. This dynamic balance between confidence and apprehension ultimately shapes teachers' and learners' readiness for effective and emotionally sustainable AI-assisted language education.

2.4. Gender Differences in AI Self-Efficacy and Anxiety

Research on gender differences in AI self-efficacy and AI anxiety yields complex and often context-dependent results. While some studies document clear gender-based disparities, others suggest that these gaps are narrowing as AI becomes more integrated into every day and educational practices.

In the Turkish context, Terzi (2020) validated the Artificial Intelligence Anxiety Scale and reported that female teachers experienced higher anxiety in dimensions such as learning and job replacement, yet no difference emerged in sociotechnical blindness. This indicates that gendered patterns of AI anxiety may be domain-specific rather than universal. Similarly, Asio and Sardina (2025) found that although male university students displayed slightly higher AI self-efficacy and lower AI anxiety, gender did not significantly moderate the relationship between self-efficacy, anxiety, and self-competency, suggesting that gender effects may be perceptual rather than structural. Teke (2025) also observed that gender and AI self-efficacy did not predict pre-service teachers' membership in distinct AI anxiety profiles, implying that when AI literacy and exposure are comparable, gender differences become negligible.

Recent large-scale studies reinforce these conclusions but reveal subtle gender-linked nuances. Russo et al. (2025) examined 335 adults and found that women reported higher AI anxiety, lower positive attitudes toward AI, lower perceived knowledge, and less frequent AI use compared with men. Crucially, gender moderated the relationship between AI anxiety and attitudes: at low anxiety levels, women showed fewer positive attitudes toward AI than men, but at high anxiety levels, this difference disappeared, namely, AI anxiety acted as a "gender difference leveler." This pattern underscores how socialization and stereotypes surrounding technology and STEM fields may shape women's affective responses to AI. Complementary evidence from Albino et al. (2025) indicates that male students typically demonstrate higher AI self-efficacy and lower anxiety, echoing enduring gendered perceptions of technological confidence. Yet, as Wu and Li (2025) note, such disparities often diminish once educational level and AI familiarity are controlled.

Taken together, findings suggest that while female learners may initially exhibit higher AI anxiety and lower confidence, these differences are largely mediated by access, prior experience, and training rather than inherent gender characteristics. Therefore, in EFL teacher education contexts, equitable AI integration should emphasize inclusive training environments that enhance both self-efficacy and affective readiness across genders, thereby fostering balanced engagement with AI-enhanced pedagogy.

3. Methodology

3.1. Research Model/Design

To address the research questions derived from the theoretical framework, a quantitative correlational study was conducted to explore the interplay between AI self-efficacy, AI anxiety, and gender among Turkish pre-service English teachers. Gender was included as a categorical variable to explore potential differences across groups. This design was deemed appropriate for identifying associations between cognitive and affective variables and for testing whether these relationships vary by gender.

3.2. Participants

A total of 143 ELT students (103 female, 40 male) participated in the study on a voluntary basis. The sample included both second-year ($n = 72$) and fourth-year ($n = 71$) students, representing intermediate and advanced levels of teacher education. Participants were selected through convenience sampling based on

course accessibility and willingness to participate. All participants were Turkish native speakers, aged between 19 and 24 years. Before data collection, the purpose of the study was explained to all participants, and written consent was obtained.

3.3. Instruments

AI self-efficacy was measured using the Turkish adaptation of the Artificial Intelligence Self-Efficacy Scale originally developed by Wang and Chuang (2024) and adapted to Turkish by Aca et al. (2025). The scale consists of 19 items across four dimensions: *Comfort with Artificial Intelligence* (6 items), *Anthropomorphic Interaction* (5 items), *Assistance* (4 items), and *Technological Skills* (4 items).

All items were rated using a five-level response format, extending from strong disagreement to strong agreement. Higher scores indicate greater confidence in using and managing AI technologies. Aca et al. (2025) reported high internal consistency and reliability. Cronbach's α value was calculated as .93 in the present study.

AI anxiety was assessed using the Turkish version of the Artificial Intelligence Anxiety Scale, originally developed by Wang and Wang (2022) and adapted by Terzi (2020) for Turkish participants. The 21-item instrument comprises four dimensions: *Learning* (8 items), *Job Replacement* (6 items), *Sociotechnical Blindness* (4 items), and *AI Configuration* (3 items). Items were rated on a five-point Likert scale from 1 (*strongly disagree*) to 5 (*strongly agree*), with higher scores reflecting greater anxiety toward AI technologies. Terzi (2020) reported overall reliability coefficients ranging from .83 to .90 across subscales, which were similarly acceptable in the current study (Cronbach's $\alpha = .91$).

3.4. Procedure

Data were collected in the fall semester of 2025 using paper-based questionnaires administered during regular class sessions. The purpose of the study was explained, and participants were assured of the anonymity and confidentiality of their responses. Ethical approval was obtained from the Research Ethics Committee of a public university in central Türkiye, and all procedures adhered to the principles of voluntary participation and informed consent.

3.5. Data Analysis

Data were analyzed using SPSS Version 28. Prior to the main analyses, data screening was performed to ensure accuracy and to verify that the assumptions for parametric testing were met. Normality was assessed by examining skewness and kurtosis values, which were found to be within the acceptable range of ± 1.5 . Descriptive statistics (means, standard deviations, and ranges) were calculated to determine overall levels of AI self-efficacy and AI anxiety. Cronbach's alpha coefficients were computed to assess internal consistency of the scales.

Independent-samples t-tests were conducted to examine gender differences in both constructs. Pearson correlation analysis was used to identify relationships between AI self-efficacy and AI anxiety. In addition, a simple linear regression was further conducted to test whether AI self-efficacy significantly predicted AI anxiety, given their theoretically inverse relationship suggested by Social Cognitive Theory and Control-Value Theory. Before performing the regression, the assumptions of linearity, homoscedasticity, and independence of errors were verified. Linearity was confirmed via scatterplots, and the Durbin-Watson statistic was checked to ensure the independence of residuals. The significance level for all statistical analyses was set at $p < .05$ for all analyses.

4. Results

4.1. Descriptive Statistics and Reliability

Pre-analysis screening indicated no substantial deviations from normality or linearity; results were robust to standard assumption checks for the t-tests and correlation/regression analyses. Descriptive analyses were conducted to determine the general levels of AI self-efficacy and AI anxiety among Turkish ELT students. As shown in Table 1, participants reported moderate mean scores for both variables. The overall mean score

for AI self-efficacy was $M = 3.58$ ($SD = 0.61$), while AI anxiety averaged $M = 3.27$ ($SD = 0.65$) on a five-point Likert scale.

Table 1.

Descriptive Statistics for AI Self-Efficacy and AI Anxiety (N = 143)

Variable	M	SD	Min	Max	Cronbach's α
AI Self-Efficacy	3.58	0.61	2.12	4.89	.93
AI Anxiety	3.27	0.65	1.71	4.76	.91

Cronbach's alpha coefficients indicated strong internal consistency for both instruments. The Turkish version of the AI Self-Efficacy Scale showed an overall reliability of $\alpha = .93$, with subscales ranging from .86 (Technological Skills) to .90 (Comfort with AI). The AI Anxiety Scale demonstrated an overall reliability of $\alpha = .91$, with subscale reliabilities between .82 (AI Configuration) and .88 (Learning).

4.2. Gender Differences in AI Self-Efficacy and AI Anxiety

Independent-samples t -tests were conducted to examine gender differences in AI self-efficacy and AI anxiety. As shown in Table 2 below, the results revealed a significant gender difference in AI self-efficacy, $t(141) = 2.82$, $p = .006$, with male students ($M = 3.80$, $SD = 0.55$) scoring higher than female students ($M = 3.50$, $SD = 0.62$). The effect size was Cohen's $d = 0.53$, 95% CI for the mean difference = [0.09, 0.51].

Table 2.

Independent-Samples t -Test Results for Gender in AI Self-Efficacy and AI Anxiety

Variable	Gender	n	M	SD	$t(141)$	p	Cohen's d	95% CI for Mean Difference
AI Self-Efficacy	Male	40	3.80	0.55	2.82	.006	0.53	[0.09, 0.51]
	Female	103	3.50	0.62				
AI Anxiety	Male	40	3.05	0.68	2.23	.028	0.42	[0.04, 0.54]
	Female	103	3.34	0.63				

Note. Means are based on a five-point Likert scale (1 = strongly disagree, 5 = strongly agree). $p < .05$.

A significant difference also emerged for AI anxiety, $t(141) = 2.23$, $p = .028$, showing that female students ($M = 3.34$, $SD = 0.63$) reported higher anxiety levels than male students ($M = 3.05$, $SD = 0.68$). The effect size was Cohen's $d = 0.42$, 95% CI for the mean difference = [0.04, 0.54]. These findings suggest that while both groups exhibited moderate levels of confidence and anxiety, male students generally felt more comfortable and less apprehensive when interacting with AI technologies.

4.3. Relationship Between AI Self-Efficacy and AI Anxiety

A Pearson product-moment correlation analysis was performed to examine the relationship between AI self-efficacy and AI anxiety. The analysis revealed a clear inverse relationship between AI self-efficacy and AI anxiety, $r = -.47$, $p < .001$; 95% CI [-.59, -.33], implying that students with higher AI self-efficacy tended to experience lower AI anxiety. Subscale correlations revealed consistent negative associations: Comfort with AI correlated most strongly with Learning Anxiety ($r = -.49$, $p < .001$), followed by Technological Skills and Job Replacement Anxiety ($r = -.42$, $p < .001$).

4.4. Predictive Role of AI Self-Efficacy on AI Anxiety

A simple linear regression analysis was conducted to determine whether AI self-efficacy significantly predicted AI anxiety. Preliminary analyses were performed to ensure there was no violation of the assumptions of normality, linearity, and homoscedasticity. The independence of residuals was confirmed with a Durbin-Watson statistic of 1.89, and multicollinearity was not a concern, as indicated by a Tolerance value of 1.0 and a Variance Inflation Factor (VIF) of 1.0.

The overall regression model in Table 3 below was significant, $F(1, 141) = 39.16$, $R^2 = .22$, (95% CI for $\beta \approx [-.59, -.33]$), explaining 22% of the variance in AI anxiety. AI self-efficacy was a significant negative

predictor of AI anxiety ($\beta = -0.47$, $t = -6.26$, $p < .001$), confirming that higher confidence in using AI tools corresponded to lower anxiety toward their implementation.

Table 3.

Correlation and Regression Analysis between AI Self-Efficacy and AI Anxiety

Variable	1	2	β	t	p
1. AI Self-Efficacy	-	-.47 ***	-0.47	-6.26	< .001
2. AI Anxiety	-.47 ***	-	-	-	-

Overall, Turkish ELT students exhibited moderate levels of both AI self-efficacy and AI anxiety. Significant gender differences were observed, with male students reporting higher confidence and lower anxiety compared to female students. The results also demonstrated a robust negative association between AI self-efficacy and AI anxiety, confirming that confidence in using AI tools serves as a protective factor against anxiety. These findings underscore the importance of developing teacher-training programs that enhance pre-service teachers' self-efficacy to foster more positive and emotionally balanced engagement with AI in language education.

5. Discussion

This study investigated the relationship between AI self-efficacy and AI anxiety among Turkish pre-service English language teachers, with gender examined as a potential factor. The findings revealed three main outcomes: (1) participants reported moderate levels of both AI self-efficacy and AI anxiety; (2) male students exhibited significantly higher self-efficacy and lower anxiety than females; and (3) AI self-efficacy and AI anxiety were negatively correlated, with AI self-efficacy emerging as a significant negative predictor of AI anxiety. These findings provide empirical support for the theoretical assumptions drawn from Bandura's (1997) Social Cognitive Theory and Pekrun's (2006) Control-Value Theory, confirming that cognitive beliefs about competence and affective reactions toward technology are closely intertwined.

5.1. Interpretation of AI Self-Efficacy and Anxiety Levels

The moderate levels of AI self-efficacy and AI anxiety found in this study suggest that Turkish ELT students are developing confidence in using AI tools but still experience uncertainty about their pedagogical applications. This aligns with previous research indicating that pre-service teachers often feel competent in operating digital technologies yet remain cautious about AI-driven tools that alter classroom dynamics (Shi & Zhang, 2025; Wang & Chuang, 2024). From a social-cognitive perspective, these moderate scores reflect transitional efficacy beliefs, sufficient for engagement but not yet strong enough to eliminate emotional apprehension.

Similarly, the moderate AI anxiety levels corroborate Terzi's (2020) findings, where educators expressed concern over learning and job-replacement dimensions of AI. Within the control-value framework, such anxiety can be interpreted as a response to low perceived control over AI tools coupled with high task value, indicating that these future teachers recognize AI's significance yet feel uncertain about mastering it.

5.2. Gender Differences in AI Self-Efficacy and Anxiety

Consistent with earlier findings (Albino et al., 2025; Asio & Sardina, 2025), gender differences emerged in both AI self-efficacy and AI anxiety. Male students demonstrated higher confidence in using AI tools, whereas female students reported greater apprehension. These results partially corroborate Terzi (2020), who found that female learners experienced stronger anxiety in the learning and job-replacement dimensions of AI use.

From a social-cognitive perspective, such disparities may reflect unequal opportunities for mastery experiences, the most influential source of self-efficacy (Bandura, 1997). Male students may have accumulated more successful interactions with technology, thereby reinforcing positive self-beliefs and

reducing anxiety. In contrast, limited prior exposure or negative feedback can constrain efficacy beliefs among females, fostering avoidance-oriented emotional patterns.

The Control-Value Theory offers a complementary explanation: lower perceived control over AI tasks can heighten negative achievement emotions such as anxiety, particularly when the perceived value of AI integration is high (Pekrun, 2006). When learners regard AI as important yet feel unprepared to handle it, anxiety intensifies, a pattern evident among female participants. Conversely, higher control appraisals linked to stronger self-efficacy mitigate such emotions.

Beyond statistical significance, the gender differences were of small-to-moderate magnitude (AI self-efficacy: $d = 0.53$; AIA: $d = 0.42$), and the predictive model explained 22% of the variance in AI anxiety. These results demonstrate both practical relevance and room for additional explanatory factors, underscoring the need for equitable AI training experiences that enhance perceived control and reduce affective disparities.

5.3. *The Relationship Between AI Self-Efficacy and AI Anxiety*

The strong negative association between AI self-efficacy and AI anxiety confirms the reciprocal interaction between cognitive control beliefs and emotional responses proposed in Social Cognitive Theory and the CVT of Achievement Emotions. Students with higher AI self-efficacy tended to report lower AI anxiety, suggesting that confidence in one's ability to use AI tools effectively reduces fear, uncertainty, and resistance. This pattern mirrors observations reported in earlier research showing that self-efficacy serves as a psychological buffer against technology-related stress and avoidance (Hsu et al., 2023; Moon, 2024). Similarly, Zhang et al. (2025) found that AI self-efficacy mediated the relationship between AI literacy and willingness to communicate, underscoring its motivational function in language-learning contexts.

From a theoretical standpoint, this pattern exemplifies how beliefs about control and competence shape affective states in technology-mediated learning. As Bandura (1997) explains, high self-efficacy enhances persistence and adaptive coping, while low efficacy magnifies threat perceptions and emotional arousal. In CVT terms, AI self-efficacy functions as a control appraisal that down-regulates negative achievement emotions (anxiety), whereas low perceived control elevates task value under uncertainty and amplifies anxiety, precisely the pattern observed here. Thus, Enhancing learners' sense of control is likely to reduce feelings of anxiety related to AI use.

While the present results highlight a robust inverse relationship between AI self-efficacy and AI anxiety, other unmeasured factors may also contribute. Prior AI exposure, frequency of technology use, digital literacy, personality traits (e.g., openness or neuroticism), and perceived institutional support could moderate or mediate this relationship. Future research incorporating these covariates, along with qualitative data or longitudinal designs, would provide a more comprehensive understanding of how cognitive and affective processes co-evolve in AI-integrated teacher education.

5.4. *Pedagogical Implications*

The findings of this study carry several pedagogical implications for teacher education programs seeking to strengthen pre-service English teachers' readiness for AI integration. To foster sustainable engagement with AI technologies, teacher education should simultaneously target the development of cognitive confidence and the reduction of emotional apprehension. In line with Bandura's (1997) emphasis on mastery experiences as the primary source of self-efficacy, structured and scaffolded practice opportunities with AI tools should be incorporated into ELT curricula. Practical activities such as designing lesson materials with AI applications or analyzing AI-generated feedback can help students build competence and a stronger sense of control over technology use.

From the perspective of the CVT (Pekrun, 2006), anxiety arises when learners attach high value to a task but perceive low control over its outcomes. To mitigate this imbalance, instructors can introduce AI-related activities in exploratory, low-stakes contexts that encourage experimentation and normalize mistakes as part of the learning process. Collaborative work and peer feedback can further reinforce a sense of shared competence and reduce performance-related tension. Addressing the emotional dimension directly is

equally important. Through guided reflection and discussion, students can be encouraged to reinterpret anxiety as a natural and even productive response to new learning challenges, transforming it into a facilitative emotion that promotes engagement rather than avoidance.

Given the observed gender differences in AI self-efficacy and anxiety, teacher education programs should also ensure equitable opportunities for all learners. Gender-responsive instructional strategies, such as inclusive mentoring, balanced participation in AI tasks, and encouragement of collaborative exploration, can help close confidence gaps and promote a more inclusive learning climate. Finally, the cultivation of AI self-efficacy should be complemented by the development of critical and ethical awareness. Encouraging pre-service teachers to reflect on the limitations, biases, and ethical implications of AI systems can foster not only technical competence but also responsible and reflective use. Taken together, these implications emphasize that AI integration in teacher education should be developmental, emotionally supportive, and inclusive, enabling future teachers to approach AI technologies with both confidence and critical insight.

5.5. Limitations and Future Directions

While the present study provides valuable insights into the interplay between AI self-efficacy and AI anxiety among Turkish pre-service English teachers, several limitations should be acknowledged to contextualize its findings. First, the data were collected from a single institution using a convenience sampling method, which may limit the generalizability of the results. Future research could extend this work by including participants from multiple universities or different cultural contexts to capture possible variations in AI-related beliefs and emotions across institutional and socio-educational settings. Cross-national or cross-institutional comparisons would also provide a broader understanding of how educational policies and access to technology influence teacher readiness for AI integration.

Second, the study relied exclusively on self-report data, which, although appropriate for assessing internal beliefs and affective responses, may be influenced by social desirability or common-method bias. Employing mixed-method designs, such as combining survey data with classroom observations, reflective journals, or behavioral measures of AI use, would help triangulate findings and improve construct validity. Similarly, longitudinal research could offer stronger evidence of causal relationships between self-efficacy and anxiety, clarifying whether increases in perceived control led to reductions in anxiety over time or whether the relationship is reciprocal.

Third, several unmeasured covariates may have influenced the observed relationships. Factors such as prior AI exposure, frequency of technology use, general digital literacy, personality traits, and perceived institutional support may moderate or mediate the link between AI self-efficacy and AI anxiety. Incorporating these variables in future models would provide a more comprehensive understanding of the mechanisms underlying affective and cognitive readiness for AI-supported teaching.

Finally, since gender was treated as a categorical variable, future studies should consider testing the measurement invariance of the AI self-efficacy and AI anxiety scales across gender groups to ensure that observed differences truly reflect construct-level variations rather than measurement artifacts. Applying advanced statistical approaches such as multi-group confirmatory factor analysis could further validate the robustness of these instruments. By addressing these methodological and conceptual limitations, future research can build on the present findings to advance a more nuanced and empirically grounded understanding of how teachers' cognitive beliefs and emotional dispositions interact in the evolving landscape of AI-enhanced education.

6. Conclusion

This study examined the relationship between AI self-efficacy and AI anxiety among Turkish pre-service English teachers, with gender considered as a potential differentiating factor. Drawing on Social Cognitive Theory and the Control-Value Theory of Achievement Emotions, the results demonstrated that cognitive control beliefs and emotional responses toward AI are closely intertwined. Participants reported moderate levels of both AI self-efficacy and AI anxiety; male students exhibited higher confidence and lower anxiety

than female peers, and AI self-efficacy negatively predicted AI anxiety, explaining a substantial portion of its variance.

These findings underscore that confidence in one's ability to manage AI tools functions as a psychological safeguard against anxiety and resistance. Strengthening AI self-efficacy through sustained mastery experiences, collaborative practice, and reflective discussion can therefore serve as a key pathway to fostering emotional readiness for AI-enhanced pedagogy. At the same time, ensuring gender-responsive opportunities for practice and mentorship remains essential for promoting equity in technological adaptation.

By integrating cognitive and emotional dimensions of teacher preparedness, this study contributes to a growing understanding of how educators engage with intelligent technologies. Future teacher-education initiatives should design AI literacy programs that balance skill development with emotional scaffolding, enabling pre-service teachers to approach AI critically, confidently, and ethically. In doing so, ELT programs can cultivate technologically competent and psychologically resilient educators equipped to navigate and shape the evolving landscape of AI-mediated language education.

Declaration of generative AI and AI-assisted technologies in the writing process

During the preparation of this research, the authors employed AI tools such as ChatGPT for enhancing the fluency of the text, simplifying complex sentences for better clarity, explaining and justifying complicated constructs, and splitting lengthy sentences into shorter ones to ease comprehension. These applications assisted in ensuring the manuscript's readability while maintaining academic rigor. After using these AI tools, the author(s) reviewed and edited the content as necessary, taking full responsibility for the content of the publication. It's crucial to note that all data and findings come from properly cited sources, not AI-generated. The author(s) fully ensure the research's integrity and accuracy.

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