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The impact of chatbots on emotional intelligence in AI-assisted EFL writing

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Introduction: The increasing integration of technology in language teaching has led to a significant focus on chatbots, which utilize various artificial intelligence models tailored to English as a Foreign Language education. While the effectiveness of chatbots in enhancing language skills is well documented, their influence on emotional intelligence (EI) has not been thoroughly examined. This study explores the impact of chatbot use on EI among sophomore pre-service English language teachers in Istanbul, Türkiye.

Methods: Utilizing the Turkish-adapted version of Bar-On's Emotional Quotient Inventory (EQ-I), quantitative methods were employed to examine the relationship between frequent interactions with ChatGPT and EI levels.

Results: The results indicate a moderate, statistically significant negative correlation, suggesting that increased use of ChatGPT may be associated with lower EI. A slight improvement was noted in adaptability, though this trend should be interpreted cautiously.

Discussion and conclusion: The study highlights the complex and context-dependent role of chatbots in shaping emotional competencies in language education and points to the need for further investigation. The results contribute to ongoing discussions on AI in educational settings by underscoring the importance of carefully balancing potential benefits with challenges to support both language proficiency and emotional development.

KEYWORDS

artificial intelligence (AI), ChatGPT, emotional intelligence (EI), AI-assisted writing, pre-service English language teachers

1 Introduction

Artificial intelligence (AI) stands at the forefront of technological innovation, significantly impacting nearly every facet of human life, including education (Almasri, 2024; Farrokhnia et al., 2024; Fu et al., 2024; Zouhaier, 2023). Among various educational domains, language learning has experienced a substantial transformation through the integration of AI technologies (Rahman et al., 2024; Son et al., 2025; Wei, 2023). These technologies, particularly those utilizing machine learning algorithms and Natural Language Processing (NLP), offer personalized and adaptive learning experiences that enhance educational outcomes (Bayly-Castaneda et al., 2024; Halkiopoulou and Gkintoni, 2024). A notable example of AI technology is chatbots, developed to simulate human conversation (Waghray et al., 2025), have attracted the interest of language education researchers owing to their ability to engage users in the target language (Gökçeşlan et al., 2024; McGrath et al., 2025). Chatbots, also known as chatterbots, offer an interactive language learning environment to the learners by providing a room to practice language skills (Eisenring et al., 2024; Meniado, 2023). Beyond facilitating language practice, previous research has shown that chatbots have a dual impact, enhancing students' language skills

while having the potential to foster their motivation (Ait Baha et al., 2024; Kohnke, 2023; Silitonga et al., 2023). While chatbots are often praised as effective tools for improving language performance and sustaining motivation, their influence is not limited to cognitive outcomes. They also shape the way learners feel and interact during communication, reducing anxiety for some while changing how empathy and self-regulation are expressed (Ortega-Ochoa et al., 2024). These emotional dimensions make emotional intelligence (EI) a particularly useful lens for understanding the impact of chatbot-supported language learning. Bar-On's (1997, 2006) mixed model of EI, for example, highlights competencies such as adaptability, stress management, and interpersonal skills, all of which may be affected by the presence of a chatbot. Chatbots might help students manage stress and adapt more easily to writing tasks by offering a safe, non-judgmental space, yet they could also limit opportunities for developing deeper interpersonal skills that normally emerge through human interaction. Framing chatbot use within established EI theory therefore, can provide a clearer bridge between technological innovation in language education and the broader emotional competencies that are essential for effective teaching and learning.

Due to its multifaceted nature, EI has been defined in various ways across time. Early work by Salovey and Mayer (1990) introduced EI as a subset of social intelligence, describing it as the ability to perceive emotions, integrate emotional information into thought processes, and regulate emotions effectively. They later refined this idea by dividing it into two components: the *emotion* domain, which encompasses moods, feelings, and states such as fatigue or energy, and the *intelligence* domain, linked to human memory, reasoning, judgment, and abstract thought (Mayer and Salovey, 1997). Building on this foundation, Goleman (1995) popularized EI by emphasizing its role in recognizing, understanding, and regulating emotions in oneself and others, highlighting its practical importance for success in personal and professional life. Complementing these perspectives, Bar-On (2006) conceptualized EI as a cross-section of emotional and social competencies that influence how individuals express themselves, relate to others, and cope with environmental demands. Taken together, these frameworks underline the universal relevance of EI across disciplines, but its role in education is particularly critical. Research has consistently shown strong associations between EI and academic performance (Bereded et al., 2025; Chang and Tsai, 2022; Zhoc et al., 2023). Language education, extending beyond simply mastering the language, is highly influenced by emotions (Wang et al., 2024), which makes EI pivotal. Language researchers acknowledge the role of EI in facilitating effective communication (Antonopoulou, 2024), reducing anxiety (Babanoglu, 2025; Jin et al., 2024), increasing motivation (Thao et al., 2023), as well as language skills (Ebrahimi et al., 2018). Therefore, in the context of EFL education, where emotional and social challenges are prevalent, understanding the role of EI is particularly important.

In this context, chatbots, one of the AI-driven tools, serve as facilitators of emotional and social interactions that mirror the components of EI. Among key aspects of EI, chatbots offer language learners a non-judgmental environment that mitigates their anxiety while fostering motivation (Ma et al., 2025). Besides, chatbots stimulate EFL learners' real-life communications, resulting in

promoting empathy (Kim and Hur, 2024), and communication skills (Zhang, 2025), sub-elements of EI (Goleman, 1995). Despite these promising affordances, our understanding of how sustained interaction with chatbots shapes learners' emotional intelligence remains limited. This is particularly significant for pre-service teachers, for whom EI is closely tied to classroom effectiveness and professional wellbeing. Addressing this gap is urgent, as the growing presence of chatbots in education highlights the need to consider not only cognitive outcomes but also emotional competencies (Carter et al., 2025).

2 Literature review

2.1 Chatbots in language education

The increasing development of AI technologies has led to a greater acceptance of chatbot integration in educational environments, especially for language learning (Jeon, 2024; Koç and Savaş, 2025). Chatbots, or conversational agents, facilitate human-computer interaction using natural language, utilizing NLP technology (Das and Das, 2024). Research indicates that they can support language development across speaking, writing, listening, and reading, offering learners opportunities to practice and receive immediate responses at any time (Saeedi and Soltani, 2025). Lin and Mubarak (2021) found that students who engaged with chatbots showed higher levels of communication intensity and activity compared to those who did not interact with them. In a related study, Kim (2019) investigated Indigo, a voice chatbot, over a 16-week period with English language learners of varying proficiency levels. The study revealed that students interacting with the chatbot employed a wider range of negotiation strategies than peers in student-only groups, highlighting the potential of chatbots to diversify communicative tactics. Beyond speaking and negotiation, chatbots also contribute to writing and listening development by offering flexible, 24/7 practice opportunities that allow learners to identify weaknesses and work toward improvement (Winkler and Söllner, 2018). Importantly, they not only provide linguistic input but also emotional and motivational support, functioning as non-judgmental assistants that reduce anxiety and sustain engagement (Huang et al., 2022; Meng and Dai, 2021). Accordingly, these findings illustrate how chatbots extend their impact beyond linguistic gains to include affective benefits that are critical for sustained language learning.

Whereas chatbots offer important benefits for language learning and beyond, they also face notable challenges. Research shows that they struggle to convey empathy or foster emotional connection. Participants in Annamalai et al.'s (2023) study, for instance, reported a lack of emotional attachment during chatbot interactions. Concerns have also been raised about students' potential over-reliance on chatbots, which may hinder the development of critical thinking and problem-solving skills typically cultivated through human interaction (Darwin et al., 2024; Zhai et al., 2024). As Turkle (2016) cautions, digital tools can displace the depth of face-to-face communication, suggesting that the efficiency of

chatbot use may come at the cost of empathy and intimacy in learning.

Overall, while chatbots have demonstrated clear potential for supporting both linguistic and affective aspects of language learning, their limitations highlight the importance of examining not only their instructional benefits but also their implications for learners' EI.

2.2 The role of emotional intelligence in language learning in the digital age

In today's digital world, the ability to manage emotions is increasingly recognized as essential for effective learning and communication. Audrin and Audrin (2023) emphasize that the proliferation of digital technologies requires individuals to cultivate emotional intelligence (EI) to navigate new forms of interaction and maintain wellbeing. Goleman's (1995) framework; self-awareness, self-regulation, motivation, empathy, and social skills, remains central for understanding how learners manage fear, anxiety, motivation, and interpersonal relationships in technology-mediated contexts.

Foreign language education illustrates the critical role of EI in learning outcomes. Language learning is highly emotion-driven, involving both negative and positive affective states. Negative emotions such as anxiety, demotivation, and boredom can hinder cognitive processes including memory, attention, and problem-solving (Mierzwa-Kamińska, 2025). In contrast, positive emotions such as enjoyment, resilience, and motivation strengthen persistence and engagement (Aydin and Tekin, 2023). Learners with higher EI are better equipped to regulate stress, sustain motivation, and adopt adaptive strategies in the face of these challenges (Li et al., 2021). Studies consistently show that EI supports interpersonal communication (Kakarla, 2025) and adaptability. EI has also been associated with performance in specific skills such as reading (Ebrahimi et al., 2018), writing (Ghanbari and Abdolrezaipoor, 2021), speaking (Afshar and Rahimi, 2016), and listening (Valizadeh and Alavinia, 2013). Beyond individual skills, EI predicts willingness to communicate (WTC), as emotional regulation and empathy reduce social anxiety and foster communicative confidence (Guo et al., 2024; Huang et al., 2025). EI also shapes the learning environment: teachers with higher EI tend to manage classrooms more effectively, build stronger relationships, and create supportive spaces that enhance students' emotional wellbeing (Brackett et al., 2011; Li et al., 2021). Learners with stronger EI likewise employ more effective strategies, including planning, monitoring, and evaluating their progress, which promotes persistence and academic success (Oxford, 2011).

Digital tools such as chatbots add another dimension to EI in education. Chatbots reshape communication by providing constant availability and immediate responses, reducing reliance on human support (Ashfaq et al., 2020; Qasem et al., 2023). While these affordances increase accessibility, they also risk diminishing the depth of human connection (Bhuvaneswari and Vijayakumar, 2021). To address this, developers increasingly design empathic and emotionally

intelligent systems that can detect user moods and generate affectively appropriate responses (Følstad et al., 2018). Yet, research shows that users still prefer human interaction when empathy and intimacy are required, and often feel discomfort in chatbot communication (Adam et al., 2021; Rapp et al., 2021). This tension highlights both the promise and limitations of digital agents: while they can scaffold emotional regulation and support learning, they cannot fully replicate human-to-human emotional exchange.

Collectively, this body of research highlights the central importance of EI for both learners and teachers in a foreign language education, as well as the new dynamics introduced by digital tools such as chatbots. These findings highlight the need to consider not only the cognitive but also the emotional dimensions of technology-mediated learning.

2.3 Chatbot-assisted writing

Writing is one of the most emotionally demanding aspects of foreign language learning, often associated with anxiety, fear of failure, and reduced motivation (Cheng, 2002). Research has shown that learners with higher levels of EI are better able to regulate these emotions, persist in the writing process, and achieve more positive outcomes (Ghanbari and Abdolrezaipoor, 2021). In recent years, AI-assisted writing tools, particularly chatbots, have emerged as potential supports for these challenges (Wang, 2024). Chatbots offer safe and non-judgmental environments for the learners as the learners can take risks with language without embarrassment (Liu, 2024). Besides, Guo and Li (2024) conducted a mixed-methods study showing that self-made chatbots enhanced EFL students' writing motivation by increasing their confidence, clarifying goals, and fostering more positive attitudes toward writing. Besides motivational gains, recent evidence indicates that chatbots also foster learners' writing self-efficacy and self-regulated learning, as students report greater confidence, autonomy, and ability to manage their writing processes when supported by chatbot-assisted instruction (Apriani et al., 2024; Lee et al., 2025). Beyond affective benefits, chatbots also provide linguistic scaffolding by offering instant feedback (Labadze et al., 2023; Xiao, 2024). By providing immediate and non-judgmental feedback, chatbots can alleviate stress, foster adaptability, and scaffold learners' self-regulation (Ortega-Ochoa et al., 2024). In addition to surface-level corrections, chatbots have been found to guide learners in improving textual coherence, vocabulary richness, and stylistic appropriateness (Mills et al., 2025; Song and Song, 2023).

However, while chatbot-assisted writing has been considered highly beneficial, several challenges and limitations have been noted. Studies caution that excessive reliance on automated feedback may reduce opportunities for learners to exercise creativity, critical thinking, and independent judgment in the writing process. Dergaa et al. (2024) describe this risk in terms of AI-Chatbot Induced Cognitive Atrophy (AICICA), whereby disproportionate dependence on chatbots for cognitive tasks, such as generating ideas, problem-solving, or producing creative text, can lead to the underuse and eventual decline

of essential cognitive abilities. Similarly, concerns about the originality of the texts have emerged, as some learners adopt chatbot-generated text without any modification or reflection (Laun et al., 2025). These issues highlight the importance of framing chatbots not as replacements for human instruction, but as supplementary tools that require careful pedagogical integration.

Taken together, while most existing studies have predominantly focused on the linguistic and motivational outcomes of chatbot-assisted writing (Lo et al., 2024), less attention has been given to the learners' emotional dimensions. For example, the study conducted by Mahapatra (2024) showed the potential of the chatbot-assisted writing in helping students overcome anxiety when requesting feedback. However, evidence on how learners experience broader affective states remains scarce. Since EI is closely linked to learners' ability to regulate anxiety, persist in writing tasks, and sustain motivation, examining EI in chatbot-assisted writing contexts offers a valuable perspective. Recent reviews explicitly recommend examining these emotional dimensions more systematically, as emotion plays a critical role in sustaining writing motivation and shaping learners' long-term attitudes toward L2 writing (Albadarin et al., 2024; Deep et al., 2025).

Building on this need to better understand the interplay between artificial intelligence and emotional intelligence in language education, the present study narrows its focus to the influence of chatbots, gender, and technology use on EI. Specifically, we explore the effects of routine chatbot interactions on the emotional intelligence of pre-service English language teachers. Since technology is increasingly embedded in everyday life, its potential influence on the development and expression of EI warrants systematic investigation. In addition, gender-based differences are examined to provide a more nuanced understanding of how individual traits, such as EI and AI competence, may vary across demographic groups. Given the central role EI plays in effective teaching and classroom management, particularly in the emotionally charged context of foreign language education, this study is both timely and relevant. To this end, the study is guided by the following research questions:

RQ1. How does the use of chatbots in EFL instruction impact the different components of emotional intelligence (intrapersonal skills, interpersonal skills, adaptability, stress management, and general mood) in pre-service English language teachers?

RQ2. Does gender influence the use of chatbots and their impact on emotional intelligence dimensions and adaptability?

RQ3. What is the impact of technology use on the development of emotional intelligence?

RQ4. How does artificial intelligence competence influence the emotional intelligence levels of pre-service English language teachers?

By systematically exploring these research questions, this study aims to offer meaningful insights into incorporating AI tools such as chatbots within educational contexts, particularly in EFL instruction.

3 Methodology

3.1 Research design

This study adopts a quantitative research design, chosen for its structured approach to explore the relationship between emotional intelligence and chatbot usage in EFL education (Creswell, 2011). It aims to fill a gap in the literature concerning the effects of chatbots on emotional intelligence within this educational context. The Turkish version of the Bar-On EQ-i, consisting of 88 items, with the final item serving as a self-check statement ("I responded to each question sincerely and accurately"), was employed to assess variations in participants' emotional intelligence (Acar, 2002). Ensuring the accuracy and validity of the findings, it is crucial to use scales translated into the participants' native language (Herdman et al., 1998). This approach ensures that the instruments accurately reflect the intended research objectives (Reichenheim and Moraes, 2007). The translated version of the Bar-On EQ-i was extensively reviewed and validated by field experts, and Acar (2002) reported strong internal consistency for the Turkish adaptation, with a Cronbach's α of 0.92. In the present study, the EQ-i also demonstrated acceptable reliability, with a Cronbach's α of 0.68 for the total scale.

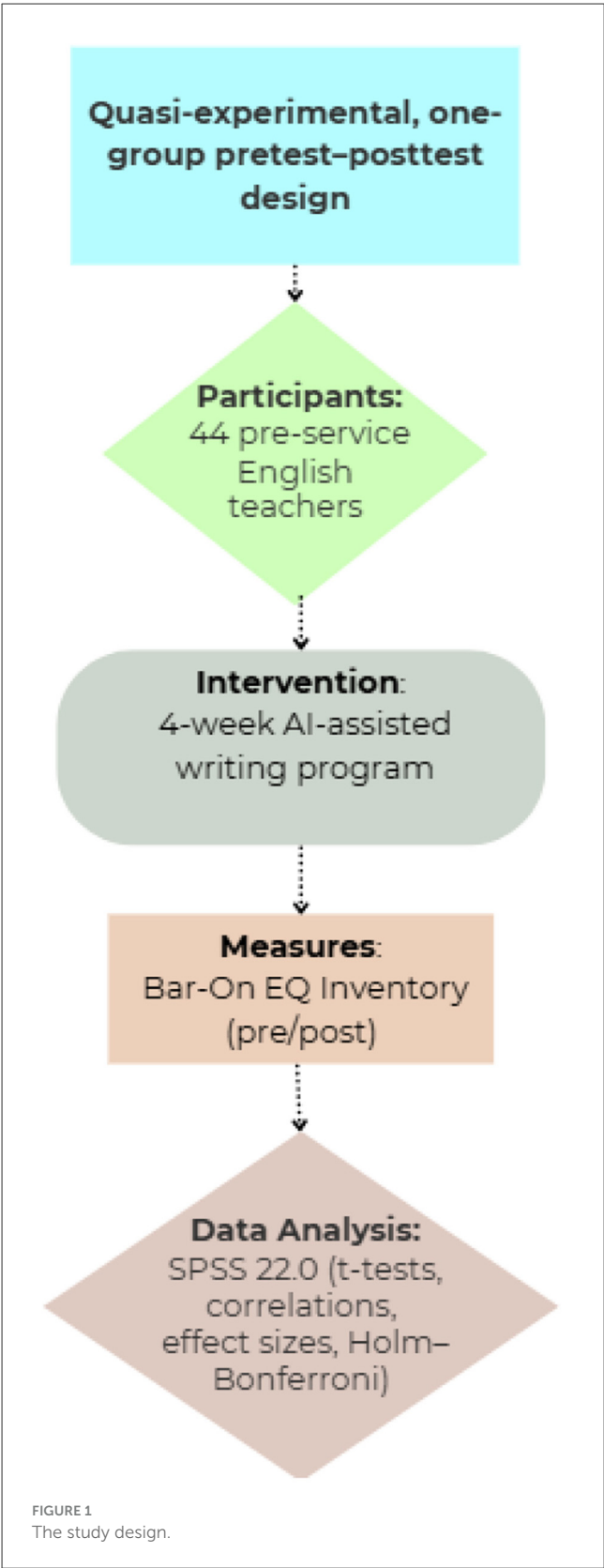
Figure 1 presents the study design, showing the quasi-experimental pretest–posttest structure, participant group, intervention, measures, and data analysis procedures.

3.2 Participants

The participant cohort consisted of pre-service English language teachers enrolled at a state university in Istanbul, Türkiye. A total of 44 participants (see Table 1) were selected as the sample through convenience sampling, based on practical criteria such as ease of access, geographical proximity, availability at a specific time, or willingness to participate (Sedgwick, 2013). A sensitivity analysis conducted in G*Power for a paired-samples *t*-test ($\alpha = 0.05$, two-tailed, power = 0.80) indicated that with $n = 44$, the study was sufficiently powered to detect moderate effect sizes of $d \geq 0.38$. In order to demonstrate that they were voluntarily involved in the research project and that they comprehended the purpose of the research to confirm their voluntary participation in the research project and their understanding of its purpose, participants were asked to submit a written consent document. Furthermore, they were guaranteed that this research endeavor would not impact their academic records or career aspirations. In an effort to enhance ethical adherence, participants were properly briefed on the confidentiality of their data and their entitlement to resign from the study at any given time without facing any consequences.

3.3 Procedure

The study is composed of three stages: pre-test, intervention, and post-test. The seven-step procedure was followed during the intervention which was illustrated in Figure 2. Step 1: participants



completed the Bar-On EQ Inventory. Step 2: A tutorial introduced ChatGPT for creative writing. Steps 3–6: participants engaged in weekly supervised creative writing tasks, each aligned with an

TABLE 1 Analyses of demographic information.

Technology interest level	3.27 ± 0.87 (n = 44)	
Technology skill	3.48 ± 0.85 (n = 44)	
Artificial intelligence proficiency	3.02 ± 1.02 (n = 44)	
Gender	n	%
Female	31	70.5
Male	13	29.5

emotional intelligence (EI) subscale (Week 1 = intrapersonal, Week 2 = interpersonal, Week 3 = stress management, Week 4 = general mood). Step 7: participants completed the Bar-On EQ Inventory again at the end of the program.

3.3.1 Pre-test

- a. Participant Briefing: Before administering the pre-test, participants were provided with information regarding the study’s objective, the importance of giving truthful responses and ensuring the confidentiality of their data. The purpose of this session was to reduce any potential anxiety and help participants feel at ease with the process.
- b. Baseline Assessment: Participants underwent the adapted version of the Bar-On Emotional Quotient Inventory (EQ-I) (Acar, 2002) to evaluate their initial levels of emotional intelligence. The pre-test was conducted in a regulated setting to reduce the impact of external variables. The completion time for the EQ-I was approximately 30–45 min.

3.3.2 Intervention

- a. **Introduction to ChatGPT:** Participants received structured instructions on using ChatGPT for writing assignments. The tutorial covered prompting strategies such as requesting feedback, organizing ideas, and generating alternative perspectives. Although participants had prior exposure to ChatGPT, this session ensured a consistent baseline of competence across the group.
- b. **Engagement period:** The intervention lasted 4 weeks, with one supervised session per week, each lasting approximately 60 min. In each session, participants engaged in a writing task aligned with one of the EQ-i dimensions (intrapersonal, interpersonal, adaptability, stress management, general mood). The practical implementation of this process is illustrated in Figure 3, which presents photographs from the classroom sessions alongside examples of student–ChatGPT writing interactions. The writing prompts were designed to gradually increase in complexity: early sessions focused on creative story writing (e.g., imagining themselves as characters in alternate universes), while later sessions emphasized more reflective or problem-solving tasks (e.g., writing dialogues between characters with different stress-management strategies or reflective writing on general mood). Participants interacted with ChatGPT iteratively during these tasks. Typically, they began by submitting an

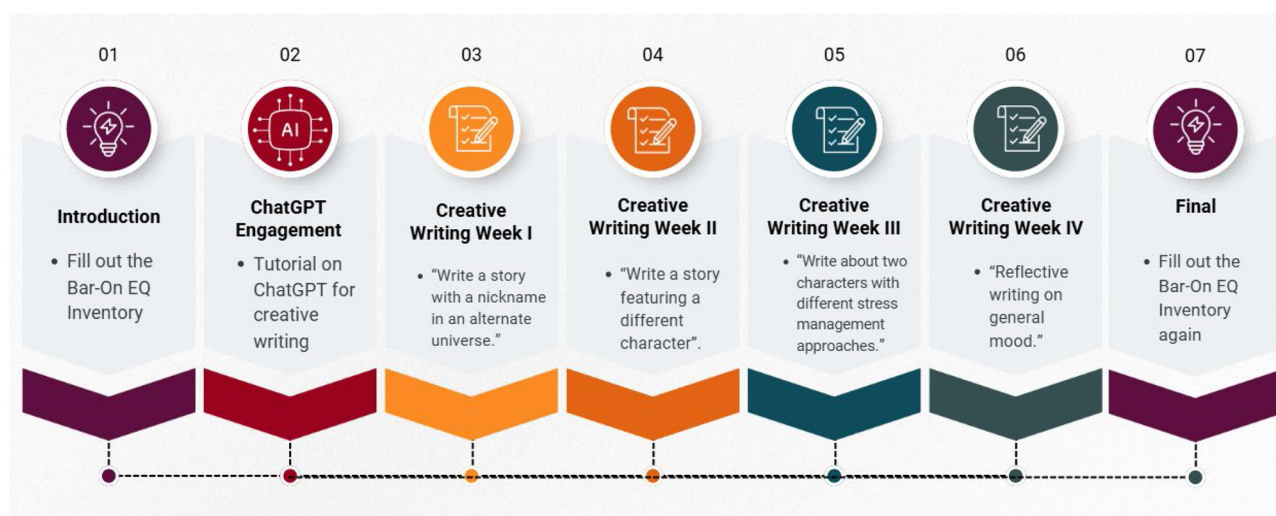


FIGURE 2
Study procedure.

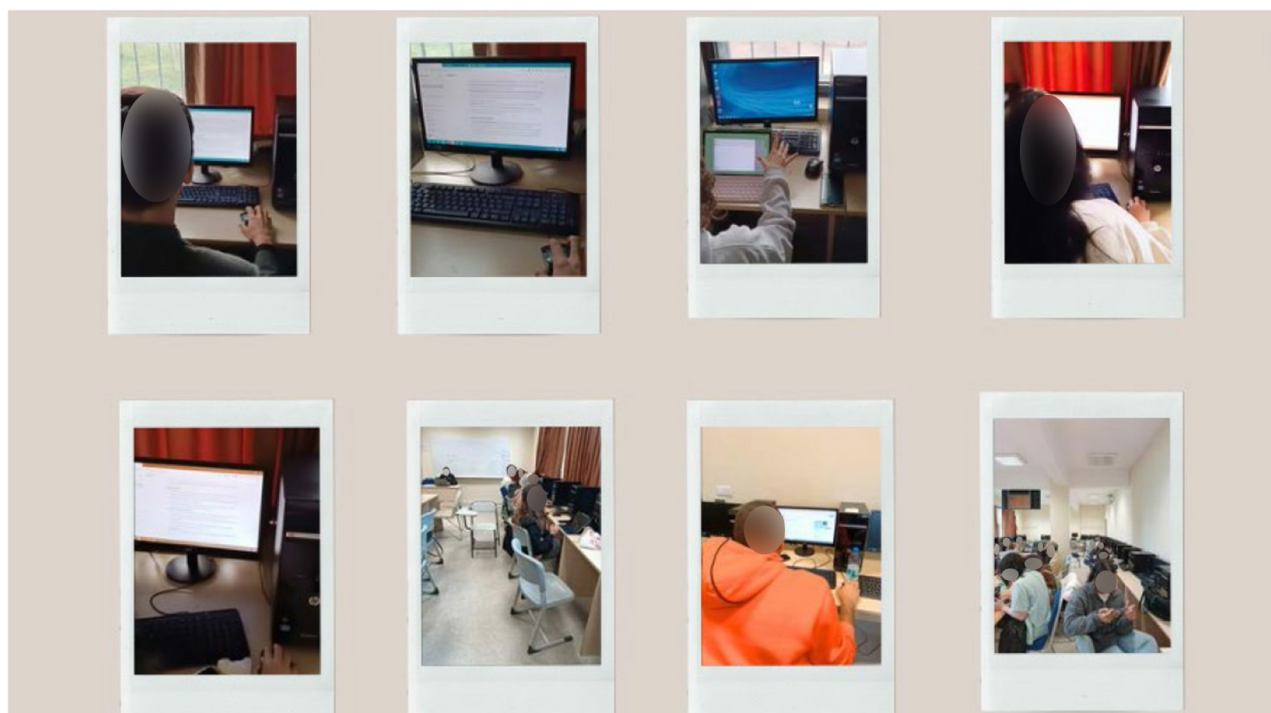


FIGURE 3
Implementation of the AI-assisted writing intervention.

initial prompt (for example, "I am writing a story that takes place in a parallel universe where I am an astronaut... Can you help me create this story?"). ChatGPT then generated narrative continuations, which participants could expand, revise, or redirect through further prompts. Over the course of the sessions, each task included 6–10 interactions, with ChatGPT acting as a co-writer and idea generator rather

than the sole author. On average, each participant produced 300–500 words per task, with the final output reflecting both participant contributions and chatbot-assisted elaboration. All sessions were supervised by the researcher to ensure consistent engagement, troubleshoot technical problems, and safeguard the integrity of the process. Supervision also ensured that ChatGPT was used to stimulate creativity and

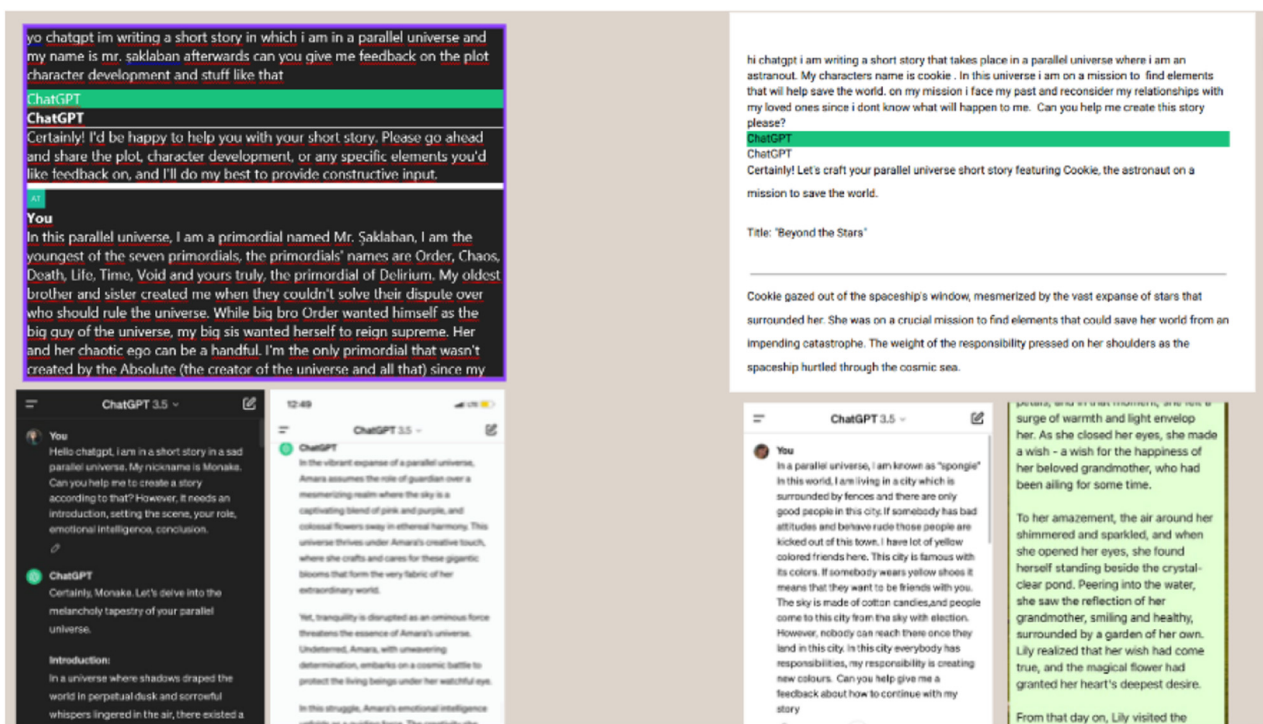


FIGURE 4
The writing tasks of the participants.

provide feedback rather than to replace participants' own writing. The screenshots of writing interactions between participants and ChatGPT during the 4-week intervention were provided in Figure 4.

3.3.3 Post-test

In the final step of the study, participants completed the adapted version of the EQ-I once more to assess any changes in their emotional intelligence levels.

3.4 Data analysis

The data underwent analysis using the SPSS 22.0 software package. For continuous data, descriptive statistics were provided, including the mean and standard deviation. The normal distribution of the data was assessed using the Shapiro-Wilk test. To compare the means of two independent samples, the independent-samples *t*-test was employed, while the paired-samples *t*-test was utilized for comparing the averages of two dependent samples. In addition to significance testing, effect sizes were calculated using Cohen's *d* for paired comparisons to provide information on the magnitude of observed differences. The relationship between variables was examined using the Pearson correlation test, and effect sizes were also reported using *r*. Because multiple comparisons were conducted across the five EI subscales, the Holm–Bonferroni procedure (Holm,

1979) was applied to control the familywise error rate at $\alpha = 0.05$. A statistical significance level of 0.05 was set for all analyses.

4 Results

4.1 The impact of chatbot use in EFL instruction on pre-service language teachers' emotional intelligence

The paired sample *t*-test was applied to examine whether there was a difference in the mean scores applied at different times by the same people. Table 2 shows descriptive statistics on pre-test and post-test results obtained from emotional intelligence, intrapersonal, interpersonal, adaptability, stress management, and general mood scales. Shapiro–Wilk tests indicated that both pre-test ($W = 0.969$, $p = 0.283$) and post-test ($W = 0.950$, $p = 0.055$) EQ-i total scores did not significantly deviate from normality, supporting the use of parametric analyses. A paired-samples *t*-test on the EQ-i total scores revealed no significant change from pretest ($M = 285.27$, $SD = 17.07$) to posttest ($M = 286.00$, $SD = 17.22$), $t_{(43)} = -0.20$, $p = 0.839$, 95% CI (-7.91 , 6.45). The effect size was negligible (Cohen's $d = 0.03$), suggesting minimal overall change in emotional intelligence levels.

When Table 3 was examined, it was seen that there was an increase of 0.2809 points in the mean adaptability score. At the uncorrected level, this increase reached statistical significance

TABLE 2 Comparison of pre-test and post-test results paired samples statistics.

Paired variables		Mean	N	Std. deviation	Std. error mean
Pair 1	Pre_intrapersonal	3.1324	44	0.26895	0.04055
	Post_intrapersonal	3.1466	44	0.23542	0.03549
Pair 2	Pre_interpersonal	3.5492	44	0.32465	0.04894
	Pos_interpersonal	3.5267	44	0.31889	0.04807
Pair 3	Pre_adaptability	3.2242	44	0.23629	0.03562
	Post_adaptability	3.5051	44	0.31224	0.04707
Pair 4	Pre_stress_management	3.2325	44	0.44868	0.06764
	Post_stress_management	3.1895	44	0.38735	0.05840
Pair 5	Pre_general_mood	3.3466	44	0.29309	0.04418
	Pos_general_mood	3.3674	44	0.30304	0.04569
Pair 6	Pre_EI	3.2936	44	0.19978	0.03012
	Post_EI	3.3059	44	0.19669	0.02965

TABLE 3 Paired samples test results for EI subscales and overall EI.

Paired variables		Paired differences					t	df	Sig. (2-tailed)	Cohen's d
		Mean	SD	SE	95% confidence interval of the difference					
					Lower	Upper				
Pair 1	Intrapersonal—intrapersonalpost	−0.01411	0.36099	0.05442	−0.12386	0.09565	−0.259	43	0.797	−0.04
Pair 2	Interpersonal—interpersonalpost	0.02250	0.41281	0.06223	−0.10300	0.14801	0.362	43	0.719	0.05
Pair 3	Adaptability—adaptabilitypost	−0.2809	0.36951	0.05571	−0.19319	0.03150	−1.451	43	0.034	−0.22
Pair 4	Stress_management—stresspost	0.04298	0.50377	0.07595	−0.11018	0.19614	0.566	43	0.574	0.09
Pair 5	General_mood—general moodpost	−0.02083	0.42306	0.06378	−0.14946	0.10779	−0.327	43	0.746	−0.05
Pair 6	EI—EIpost	−0.01227	0.25465	0.03839	−0.08969	0.06515	−0.320	43	0.751	−0.05

($p = 0.034$, $d = -0.22$). However, after applying the Holm–Bonferroni correction, the effect did not remain significant and should therefore be interpreted as a trend rather than a robust finding. All other subscales and overall EI showed negligible changes ($|d| < 0.10$).

4.2 Gender influence on chatbot use and its impact on emotional intelligence dimensions

When the Table 4 was examined, it was seen that the mean scores of reality testing, adaptability and stress management during the intervention differed according to the gender variable ($p < 0.05$). While the mean reality testing and adaptability scores of males were statistically significantly higher than females, the mean stress management scores of females were higher than males. In terms of intrapersonal, interpersonal,

and general mood, male and female participants showed similar tendencies.

4.3 The relationship between frequency of chatbot use and changes in emotional intelligence levels in relation to technology interest, skill, and AI competence

Based on the statistics provided in the Table 5, the relationships between various variables were examined. There was no significant relationship found between technology interest level and emotional intelligence ($r = -0.097$, $p > 0.05$). Similarly, no significant associations were observed between technology interest level and interpersonal or intrapersonal emotional intelligence ($r = -, p > 0.05$). However, a significant negative relationship was identified between technology interest level and interpersonal emotional intelligence focused on social responsibility ($r = -0.304$, $p < 0.05$).

TABLE 4 Comparison of emotional intelligence score averages by gender variable.

Variables	Gender	<i>n</i>	Mean	Std. deviation	<i>t</i>	<i>sig</i>
Emotional self awareness	Female	31	3.31	0.49	−1.247	0.219
	Male	13	3.50	0.35		
Assertiveness	Female	31	3.02	0.44	0.639	0.526
	Male	13	2.94	0.29		
Self-regard	Female	31	3.34	0.50	0.060	0.952
	Male	13	3.33	0.62		
Self-actualization	Female	31	3.41	0.43	−0.596	0.554
	Male	13	3.49	0.32		
Independence	Female	31	2.43	0.80	0.274	0.786
	Male	13	2.35	0.78		
Intrapersonal relationship	Female	31	3.13	0.29	−0.254	0.801
	Male	13	3.15	0.21		
Empathy	Female	31	3.68	0.39	0.583	0.563
	Male	13	3.60	0.42		
Interpersonal relationship	Female	31	3.48	0.41	−0.988	0.329
	Male	13	3.62	0.39		
Social responsibility	Female	31	3.53	0.28	0.910	0.368
	Male	13	3.41	0.58		
Interpersonal	Female	31	3.55	0.30	0.085	0.933
	Male	13	3.54	0.39		
Problem solving	Female	31	3.47	0.49	−1.372	0.177
	Male	13	3.69	0.49		
Reality testing	Female	31	2.66	0.43	−3.333	0.002
	Male	13	3.11	0.32		
Flexibility	Female	31	3.35	0.37	0.382	0.705
	Male	13	3.31	0.37		
Adaptability	Female	31	3.16	0.23	−2.845	0.007
	Male	13	3.37	0.18		
Stress tolerance	Female	31	3.42	0.44	1.855	0.071
	Male	13	3.15	0.44		
Impulse control	Female	31	3.24	0.78	1.847	0.072
	Male	13	2.78	0.65		
Stress management	Female	31	3.34	0.44	2.544	0.015
	Male	13	2.98	0.39		
Happiness	Female	31	3.33	0.25	−0.430	0.669
	Male	13	3.38	0.39		
Optimism	Female	31	3.29	0.37	−0.192	0.849
	Male	13	3.34	0.30		
General mood	Female	31	3.39	0.51	−0.459	0.649
	Male	13	3.43	0.75		
EI	Female	31	3.30	0.21	0.094	0.926
	Male	13	3.29	0.19		

Likewise, no significant correlation was found between technology skill level and emotional intelligence ($r = -0.216$, $p > 0.05$), nor between technology skill level and interpersonal or intrapersonal emotional intelligence ($r = -$, $p > 0.05$). There was also no significant relationship between technology skill level and adaptability ($r = 0.003$, $p > 0.05$). However, a notable negative correlation was found between technology skill level and stress tolerance ($r = -0.420$, $p < 0.05$).

Regarding artificial intelligence level, a significant negative correlation was observed with emotional intelligence ($r = -0.408$, $p < 0.01$) and with intrapersonal relationships ($r = -0.521$, $p < 0.01$). Conversely, there were no significant relationships found between artificial intelligence level and interpersonal relationships, adaptability, stress management, or general mood ($p > 0.05$).

5 Discussion

5.1 Impact of chatbots on emotional intelligence in AI-assisted EFL writing

This study examines the effects of chatbot integration on emotional intelligence components (intrapersonal skills, interpersonal skills, adaptability, stress management, and general mood) among pre-service English language teachers. The results indicate that participants consistently demonstrated stronger interpersonal skills than intrapersonal skills, as reflected by the highest scores in the interpersonal dimension and the lowest scores in the intrapersonal dimension, both before and after the intervention. This trend is consistent with foundational models of emotional intelligence, which conceptualize EI as a multidimensional construct encompassing both interpersonal and intrapersonal competencies (Goleman, 1995; Bar-On, 1997). However, recent studies emphasize that AI-mediated chatbots may particularly enhance the socially oriented dimensions of EI. For instance, Herath's (2025) review of 59 studies on emotionally intelligent chatbots in mental health demonstrates that such systems can reduce anxiety, foster emotional self-awareness, and promote supportive social interactions by simulating empathy. At the same time, the review draws attention to unresolved challenges, including cultural bias in emotion recognition and risks of over-dependence on AI, which highlight the need for cautious and ethically grounded integration in educational contexts. Similarly, Lu and Guo (2025) provide empirical evidence that emotionally intelligent chatbots can alleviate loneliness and social anxiety while enhancing social self-efficacy and psychological resilience among college students. Their study with 120 participants using the Replika chatbot over a 5-month intervention showed significant improvements in emotional resilience and social skills compared to a control group. These findings highlight the potential of emotionally intelligent chatbots not only to support social connection but also to strengthen adaptive emotional competencies in educational contexts, making them highly relevant for pre-service teacher training. Building on this, recent empirical research also supports the positive association between chatbot use and EI in educational contexts. Mosleh et al. (2024), in a cross-sectional study of 529 undergraduates in the UAE, found a statistically significant positive correlation between chatbot

utilization and total EI scores. Students who interacted more frequently with chatbots demonstrated higher levels of emotional awareness, sociability, and adaptability, suggesting that consistent engagement with AI-mediated tools may contribute to EI growth in learning environments. These findings highlight not only the potential of chatbots to reduce anxiety and foster social connection, but also their capacity to strengthen core EI competencies when embedded into academic contexts.

Interpersonal skills, such as social awareness, empathy, and relationship management, are often more visible and frequently practiced in social contexts, potentially explaining their higher scores (Mayer and Salovey, 1997). In contrast, intrapersonal skills, which involve self-awareness and self-regulation, require deeper self-reflection and may be more challenging to develop without targeted interventions (Bar-On, 2006). The consistency of this trend across pre-test and post-test results suggests that the intervention may have impacted all areas equally without significantly altering the relationship between these dimensions. This emphasizes the need for future AI-assisted writing programs to integrate strategies that specifically enhance intrapersonal competencies, such as mindfulness training, reflective journaling, and emotional regulation exercises, to ensure a more balanced EI profile (Petrides and Furnham, 2001). Such strategies could complement the socially oriented gains facilitated by chatbot interaction, responding directly to the caution raised in recent reviews regarding over-reliance on AI for social-emotional support. Empirical evidence from Naseer et al. (2025) supports this concern, showing that among 500 educators and health professionals, frequent and extended use of AI was significantly linked to cognitive overload, reduced attention span, and heightened emotional stress. Their findings indicate that while AI can enhance efficiency and emotional engagement, unchecked dependence may compromise well-being and decision-making, reinforcing the importance of balanced and reflective integration in educational contexts.

When Table 3 was examined, it was observed that there was an increase of 0.2809 points in the mean adaptability score. Although this result reached statistical significance at the uncorrected level ($p = 0.034$, $d = -0.22$), it did not remain significant after Holm–Bonferroni adjustment and should therefore be interpreted as a trend rather than a robust effect. Nonetheless, the direction of change is consistent with prior research. For example, Dewi et al. (2025) reported that AI-driven tools improved adaptability in educational research, and Hessari et al. (2024) demonstrated that generative AI tools enhanced employee adaptability while reducing work overload. These studies suggest that adaptability is one of the more malleable components of emotional intelligence, and the trend observed in this study aligns with the possibility that structured AI-mediated interventions may support its development.

5.2 Gender differences in the use of chatbots on emotional intelligence

The results of this study indicate a moderate and statistically significant difference in emotional intelligence (EI) based on

TABLE 5 The relationship between emotional intelligence and technology interest level, technology skill level, and artificial intelligence.

Relationship	r value	p-value	Significant difference ($p < 0.05$)
Technology interest level and emotional intelligence	−0.097	>0.05	No
Technology interest level and intrapersonal EI	-	>0.05	No
Technology interest level and interpersonal EI	−0.304 (social responsibility)	<0.05	Yes
Technology interest level and adaptability	-	>0.05	No
Technology interest level and stress management	−0.310 (stress tolerance)	<0.05	Yes
Technology skill level and emotional intelligence	−0.216	>0.05	No
Technology skill level and intrapersonal	-	>0.05	No
Technology skill level and interpersonal	-	>0.05	No
Technology skill level and adaptability	0.003	>0.05	No
Technology skill level and stress tolerance	−0.420*	<0.05	Yes
Technology skill level and general mood	0.044	>0.05	No
Artificial intelligence level and emotional intelligence	−0.408**	<0.01	Yes
Artificial intelligence level and intrapersonal relationship	−0.521**	<0.01	Yes
Artificial intelligence level and interpersonal relationship	−0.186	>0.05	No
Artificial intelligence level and adaptability	−0.150	>0.05	No
Artificial intelligence level and stress management	−0.168	>0.05	No
Artificial intelligence level and general mood	−0.053	>0.05	No

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

*Correlation is significant at the 0.05 level (2-tailed).

The “-” sign indicates that the r value was not calculated or provided for the specific relationship.

gender. Accordingly, female participants demonstrated greater competence in stress management compared to their male counterparts, consistent with the findings of a study conducted by Gentry et al. (2007). The study revealed that females prefer to employ more effective coping techniques for stress management than males. Similarly, a longitudinal study by Ptacek et al. (1992) investigated gender differences in coping strategies among undergraduate students. In their research, 186 male and female participants provided daily reports over 21 consecutive days. The findings revealed that female participants utilized a broader range of coping strategies compared to men. Furthermore, Graves et al. (2021) found that females are more likely to employ emotion-focused coping strategies. In a similar vein, Gupta et al. (2019) conducted a study to explore coping styles among male and female young adults. While male participants scored detached and avoidance coping styles, having a tendency to ignore stressors, female participants scored higher on emotional coping style with an inclination to manage stress better compared to males. Another study by Watson et al. (2011) indicated that women may have better stress management skills compared to men. However, contrasting findings have emerged in the literature, some studies (Graves et al., 2021; O'Rourke et al., 2022; Thoits, 1995) revealed that no gender differences were found in coping strategies in response to stressors. According to the findings of the study conducted by Thoits (1995) female and male participants employed similar coping patterns during childhood and adolescence. Moreover in a recent study conducted by Vidic (2024), no gender differences

were observed in stress management skills. Apart from these studies, some studies also found non-consistent results with the current study. To illustrate, Hampel and Petermann (2005) also examined potential gender differences in coping styles with stressors, and according to its results female adolescents were found to use maladaptive coping strategies more frequently than male adolescents. Likewise, Al-Bahrani et al. (2013) aimed to investigate how gender influences coping styles and found similar results. According to their findings, female adolescents were significantly more likely to use maladaptive coping styles than male adolescents. This study highlights a moderate and statistically significant difference in emotional intelligence (EI) and stress management, favoring female participants. Supporting evidence from studies such as Gentry et al. (2007), Ptacek et al. (1992), and Gupta et al. (2019) suggests that females employ broader and more effective coping strategies, including emotion-focused approaches. However, contrasting findings from Thoits (1995) indicate no gender differences in coping, while studies by Hampel and Petermann (2005) and Al-Bahrani et al. (2013) suggest females may use maladaptive coping styles more frequently in adolescence. These mixed results highlight the complexity of gender differences in stress management, warranting further exploration.

The findings of this study also revealed that male participants exhibit greater adaptability compared to their female counterparts. The literature has also highlighted similar findings on adaptability among female and male participants. Reed and Reedman (2020) explored how gender influences resilience, adaptability and

reactivity, and according to the findings, males demonstrated higher adaptability compared to their female counterparts. Besides, [Zamarripa \(2020\)](#) has shown that in the COVID-19 environment, women were found to be more stressed and less adaptive compared to men. Besides, several studies also support the notion that males demonstrate higher adaptability than females ([Al-Bahrani et al., 2013](#); [Hampel and Petermann, 2005](#)).

5.3 Influence of technology on emotional intelligence

The study revealed a moderately negative relationship between technology use and interpersonal emotional intelligence, suggesting that a greater interest in technology is associated with lower social intelligence. This finding highlights the potential trade-offs of increased technology use, as excessive time spent on computers and digital devices may reduce opportunities for personal communication and engagement in social activities. This aligns with [Caplan's \(2005\)](#) research, which found that individuals with limited self-presentational skills often prefer online social interaction over face-to-face communication. This preference may stem from the perceived anonymity and reduced social risk of online platforms, which can make them more appealing for individuals who struggle with in-person interactions. Besides, a recent study by [Shanmugasundaram and Tamilarasu \(2023\)](#) reported that excessive use of digital devices and social media is associated with diminished social skills and fewer face-to-face interactions, which is aligned with the findings of [Benvenuti et al. \(2023\)](#). In their study, the impact of technology use on adolescents' behavioral, social, physical, and cognitive development was investigated and they found that the pervasive use of smartphones and tablets among adolescents impacts their social behaviors, physical health, and cognitive development negatively.

Furthermore, there is a notable and statistically significant negative difference between technology and stress management. Consequently, those with a higher level of interest in technology are less likely to effectively manage stress. Those who use technology excessively may suffer from incompetency with stress management ([Moroney et al., 2023](#)). In exploring this dynamic, [Qi and Yang \(2024\)](#) conducted a study and found that higher digital resilience is connected with lower technological stress. Similarly, [Suharti and Susanto \(2014\)](#) suggested that a higher level of technology usage is associated with lower stress management. However, contrasting findings have emerged in the literature ([Jerath et al., 2023](#); [Ladakis et al., 2024](#)). Research conducted by [Jerath et al.](#) showed that smartwatches provide promising avenues for stress management through continuous HRV monitoring and personalized feedback interventions. In a similar vein, [Ladakis et al. \(2024\)](#) highlight the significant potential of virtual reality systems, often incorporating guided imagery and bio-sensing technology, to reduce stress in an immersive environment. On the other hand, [Eisen et al. \(2008\)](#) compared computer-based and traditional face-to-face stress-management interventions and found that while both were effective in reducing stress immediately, there were no significant differences between them in terms of longer-term effectiveness, suggesting that the benefits of technology for stress management may depend

on how it is implemented and used over time. These findings illustrate the complexity of the relationship between technology and stress management, with results depending on the specific technological tool, its application, and the individual's resilience and usage patterns.

A moderate negative correlation was observed between technology interest and interpersonal emotional intelligence, suggesting that higher technology usage might detract from social skills, as supported by [Caplan \(2005\)](#). There is also a negative association between technology interest and effective stress management, indicating challenges in stress handling among those highly engaged with technology.

5.4 Artificial intelligence competence and emotional intelligence

A statistically significant moderate negative correlation was observed between artificial intelligence competence and overall emotional intelligence, suggesting that higher AI proficiency may be associated with lower emotional intelligence. One possible explanation is that as learners devote more attention to technical interaction with AI systems, they may engage less frequently in socially and emotionally rich exchanges with peers or instructors. Alternatively, individuals who are more confident in using AI may rely less on interpersonal support, which could also be reflected in lower EI scores. Our study aligns with the findings of [Annamalai et al. \(2023\)](#), which explored chatbots using the framework of self-determination theory and discovered that participants experienced a lack of emotional connection during their interactions with chatbots. However, contrasting evidence exists. For instance, [Mosleh et al. \(2024\)](#) reported that individuals who regularly engaged with chatbots demonstrated higher levels of emotional intelligence, particularly in dimensions of emotional regulation and adaptability. Their study suggests that chatbots may provide a safe, judgment-free environment that fosters self-reflection and the practice of emotion management strategies, thereby contributing positively to certain aspects of EI. In addition, shyness arises when the proficiency of a language learner in the desired language is impacted by the individual they are interacting with, as explained by [Nunan \(1991\)](#). During such circumstances, students frequently encounter feelings of worry or apprehension when engaging with other individuals. In order to mitigate these adverse sentiments among pupils, chatbots can be utilized. [Hsu \(2022\)](#) conducted a study where participants utilized the NeuroSky Mindwave to collect immediate data on their levels of attention. When interacting with an AI chatbot, their degree of mindfulness is noticeably increased, suggesting a condition of enhanced relaxation.

Despite this, AI has positively impacted adaptability in second language writing, aiding students in adapting to feedback and learning environments, as shown in studies by [Bardzell and Bardzell \(2013\)](#) and [Lin and Chang \(2020\)](#). These studies highlight productivity and skill improvement through AI and chatbot interaction.

There was a statistically significant moderate negative correlation between artificial intelligence competence and interpersonal emotional intelligence, which may suggest that

greater reliance on AI is associated with reduced confidence in interpersonal contexts. With regard to adaptability, the findings indicated a small improvement, though the effect size was modest and should be interpreted cautiously. Nevertheless, this tendency aligns with previous research. AI may improve students' ability to adapt to L2 writing by delivering customized feedback, enabling adaptable learning experiences, replicating authentic language usage, providing error analysis and correction recommendations, and enhancing accessibility and flexibility in writing practice. For instance, [Bardzell and Bardzell \(2013\)](#) reported that productivity was the most commonly cited reason for using chatbots, highlighting their value in providing efficient support and information. Building on this functional role, [Lin and Chang \(2020\)](#) demonstrated how a chatbot (Chatbot DD) could also enhance the learning process more directly. In their study, students reported that the chatbot helped them identify weaknesses in their writing and improve as reviewers, with many perceiving noticeable gains in their writing skills. Together, these findings suggest that chatbots not only serve as productivity tools but can also foster adaptability by enabling customized feedback, error correction, authentic language practice, and flexible learning opportunities.

6 Conclusion

This research provides a comprehensive understanding of how chatbots influence emotional intelligence within the realm of English as a Foreign Language education, specifically in the development of AI-assisted EFL writing among pre-service language teachers. Our findings indicate a moderate negative association between chatbot usage and emotional intelligence. This suggests that increased interaction with AI tools might lead to a decrease in certain aspects of emotional intelligence. This trend is especially noticeable in stress management and interpersonal skills, where dependence on technology might lead to fewer face-to-face interactions and a diminished ability to handle difficult interpersonal situations. At the same time, a slight improvement was observed in adaptability, though this effect was modest and should be interpreted with caution. Nevertheless, the tendency aligns with prior research suggesting that AI-enhanced writing models may capture attention and encourage flexible responses to feedback. Accordingly, AI might be considered a powerful tool to foster adaptability in writing environments.

To the best of our knowledge, this study is the first to examine the direct relationship between chatbots and emotional intelligence in language education. The current research enhances our comprehension of human-computer interaction, specifically in the EFL setting, by emphasizing the advantages and potential disadvantages of incorporating artificial intelligence into EFL writing.

The practical implications of our findings are significant for stakeholders in foreign language education. As educational institutions increasingly turn to AI chatbots to supplement or even replace human instructors due to time and space constraints, it is crucial to balance technological integration with strategies to maintain and enhance students' emotional and social skills.

Several limitations of this study should be noted. First, because participants were not explicitly restricted from using chatbots outside the supervised sessions, unsupervised exposure cannot be ruled out and may have influenced the consistency of the treatment. Second, the study involved a single cohort and did not include a control group, reflecting its exploratory design and contextual constraints; as such, causal inferences should be drawn with caution, and maturation effects cannot be excluded. Third, the relatively small, convenience-based sample limits the generalizability of the findings. Future research should address these issues by employing randomized controlled trials, longer intervention periods to account for maturation, larger and more diverse participant groups, and mechanisms to more systematically monitor chatbot use.

In conclusion, while chatbots offer innovative solutions for EFL education, educators must carefully consider their emotional and social impacts on learners to ensure holistic educational development.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Ethics statement

This study was approved by the Yıldız Technical University Social Sciences Ethics Committee (Approval No: 20240302749). All procedures adhered to institutional ethical guidelines. Participation was voluntary, and written informed consent was obtained from all participants, who were assured of anonymity and confidentiality.

Author contributions

SK: Formal analysis, Funding acquisition, Writing – original draft, Methodology, Software, Resources, Supervision, Conceptualization, Data curation, Writing – review & editing, Validation, Project administration. GTÖ: Conceptualization, Writing – review & editing, Project administration, Writing – original draft, Data curation, Investigation, Formal analysis, Visualization, Resources, Software.

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The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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References

- Acar, F. (2002). Emotional intelligence and leadership. *Erciyes Univ. J. Inst. Soc. Sci.* 1, 53–68.
- Adam, M., Wessel, M., and Benlian, A. (2021). AI-based chatbots in customer service and their effects on user compliance. *Electron. Mark.* 31, 427–445. doi: 10.1007/s12525-020-00414-7
- Afshar, H. S., and Rahimi, M. (2016). Reflective thinking, emotional intelligence, and speaking ability of EFL learners: is there a relation? *Think. Skills Creat.* 19, 97–111. doi: 10.1016/j.tsc.2015.10.005
- Ait Baha, T., El Hajji, M., Es-Saady, Y., and Fadili, H. (2024). The impact of educational chatbot on student learning experience. *Educ. Inf. Technol.* 29, 10153–10176. doi: 10.1007/s10639-023-12166-w
- Albadarin, Y., Saqr, M., Pope, N., and Tukiainen, M. (2024). A systematic literature review of empirical research on ChatGPT in education. *Discover Educ.* 3:60. doi: 10.1007/s44217-024-00138-2
- Al-Bahrani, M., Aldhafri, S., Alkharusi, H., Kazem, A., and Alzubiadi, A. (2013). Age and gender differences in coping style across various problems: Omani adolescents' perspective. *J. Adolesc.* 36, 303–309. doi: 10.1016/j.adolescence.2012.11.007
- Almasri, F. (2024). Exploring the impact of artificial intelligence in teaching and learning of science: a systematic review of empirical research. *Res. Sci. Educ.* 54, 977–997. doi: 10.1007/s11165-024-10176-3
- Annamalai, N., Eltahir, M. E., Zyoud, S. H., Soundarajan, D., Zakarneh, B., and Al Salhi, N. R. (2023). Exploring English language learning via Chabot: a case study from a self determination theory perspective. *Comput. Educ. Artif. Intell.* 5:100148. doi: 10.1016/j.caeai.2023.100148
- Antonopoulou, H. (2024). The value of emotional intelligence: self-awareness, self-regulation, motivation, and empathy as key components. *Technium Educ. Humanit.* 8, 78–92. doi: 10.47577/teh.v8i.9719
- Apriani, E., Cardoso, L., Obaid, A. J., Muthmainnah, Wijayanti, E., Esmianti, F., et al. (2024). Impact of AI-powered chatbots on EFL students' writing skills, self-efficacy, and self-regulation: a mixed-methods study. *Glob. Educ. Res. Rev.* 1, 57–72. doi: 10.71380/GERR-08-2024-8
- Ashfaq, M., Yun, J., Yu, S., and Loureiro, S. M. C. (2020). I, Chatbot: modeling the determinants of users' satisfaction and continuance intention of AI-powered service agents. *Telemat. Inform.* 54:101473. doi: 10.1016/j.tele.2020.101473
- Audrin, C., and Audrin, B. (2023). More than just emotional intelligence online: introducing "digital emotional intelligence". *Front. Psychol.* 14:1154355. doi: 10.3389/fpsyg.2023.1154355
- Aydin, S., and Tekin, I. (2023). Positive psychology and language learning: a systematic scoping review. *Rev. Educ.* 11:e3420. doi: 10.1002/rev.3.3420
- Babanoglu, M. P. (2025). Decoding the relationship between emotional intelligence and foreign language anxiety: a systematic review and meta-analysis. *Lang. Teach. Res.* 13621688251345726. doi: 10.1177/13621688251345726
- Bardzell, J., and Bardzell, S. (2013). "What is 'critical' about critical design?" in *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (New York, NY: ACM), 3297–3306. doi: 10.1145/2470654.2466451
- Bar-On, R. (1997). *The Emotional Quotient Inventory (EQ-I): Technical Manual*. Toronto: Multi-Health Systems.
- Bar-On, R. (2006). The Bar-On model of emotional-social intelligence (ESI). *Psicothema* 18(Suppl.), 13–25.
- Bayly-Castaneda, K., Ramirez-Montoya, M. S., and Morita-Alexander, A. (2024). Crafting personalized learning paths with AI for lifelong learning: a systematic literature review. *Front. Educ.* 9:1424386. doi: 10.3389/feduc.2024.1424386
- Benvenuti, M., Wright, M., Naslund, J., and Miers, A. C. (2023). How technology use is changing adolescents' behaviors and their social, physical, and

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cognitive development. *Curr. Psychol.* 42, 16466–16469. doi: 10.1007/s12144-023-04254-4

Bereded, D. G., Abebe, A. S., and Negasi, R. D. (2025). Emotional intelligence and academic achievement among first-year undergraduate university students: the mediating role of academic engagement. *Front. Educ.* 10:1567418. doi: 10.3389/feduc.2025.1567418

Bhuvaneswari, G., and Vijayakumar, S. (2021). Emotional intelligence and values in digital world through emoticons among indian students and faculty. *Int. J. Asian Educ.* 2, 267–276. doi: 10.46966/ijae.v2i2.142

Brackett, M. A., Rivers, S. E., and Salovey, P. (2011). Emotional intelligence: implications for personal, social, academic, and workplace success. *Soc. Personal. Psychol. Compass* 5, 88–103. doi: 10.1111/j.1751-9004.2010.00334.x

Caplan, S. E. (2005). A social skill account of problematic Internet use. *J. Commun.* 55, 721–736. doi: 10.1111/j.1460-2466.2005.tb03019.x

Carter, J. W., Scott, J. T., and Barrett, J. D. (2025). The emotional cost of AI chatbots in education: who benefits and who struggles? *Comput. Hum. Behav. Artif. Humans* 5:100181. doi: 10.1016/j.chbah.2025.100181

Chang, Y., and Tsai, Y. (2022). The effect of university students' emotional intelligence, learning motivation, and self-efficacy on their academic achievement—online English courses. *Front. Psychol.* 13:818929. doi: 10.3389/fpsyg.2022.818929

Cheng, Y. S. (2002). Factors associated with foreign language writing anxiety. *Foreign Lang. Ann.* 35, 647–656. doi: 10.1111/j.1944-9720.2002.tb01903.x

Creswell, J. W. (2011). *Controversies in Mixed Methods Research*. Thousand Oaks, CA: SAGE Publications.

Darwin, D., Rusdin, D., Mukminatien, N., Suryati, N., Laksmi, E. D., and Marzuki (2024). Critical thinking in the AI era: an exploration of EFL students' perceptions, benefits, and limitations. *Cogent Educ.* 11:2290342. doi: 10.1080/2331186X.2023.2290342

Das, S., and Das, D. (2024). "Natural language processing (NLP) techniques: Usability in human-computer interactions," in *2024 6th International Conference on Natural Language Processing (ICNLP)* (New York, NY: IEEE), 783–787.

Deep, P. D., Martirosyan, N., Ghosh, N., and Rahaman, M. S. (2025). ChatGPT in ESL higher education: enhancing writing, engagement, and learning outcomes. *Information* 16:316. doi: 10.3390/info16040316

Dergaa, I., Ben Saad, H., Glenn, J. M., Amamou, B., Ben Aissa, M., Guelmami, N., et al. (2024). From tools to threats: a reflection on the impact of artificial-intelligence chatbots on cognitive health. *Front. Psychol.* 15:1259845. doi: 10.3389/fpsyg.2024.1259845

Dewi, D. S., Siahaan, S., Wilany, E., Adam, A., Ramadhani, R., Saicindo, S. A., et al. (2025). Enhancing adaptability in educational research: the role of AI-driven tools in VUCA environments. *Panicygy Int. J.* 3, 10–17. doi: 10.59965/pij.v3i1.160

Ebrahimi, M. R., Khoshima, H., and Zare-Behtash, E. (2018). The impacts of enhancing emotional intelligence on the development of reading skill. *Int. J. Instr.* 11, 573–586. doi: 10.12973/iji.2018.11339a

Eisen, K. P., Allen, G. J., Bollash, M., and Pescatello, L. S. (2008). Stress management in the workplace: a comparison of a computer-based and an in-person stress-management intervention. *Comput. Hum. Behav.* 24, 486–496. doi: 10.1016/j.chb.2007.02.003

Eisenring, M. A. A., Jamiluddin, J., Hairul, M. A., and Putri, D. (2024). The use of chatbots in English language teaching to promote modern language learning: a literature review. *Int. J. Indones. Educ. Teach.* 8, 127–139. doi: 10.24071/ijiet.v8i1.7321

Farrokhnia, M., Banihashem, S. K., Noroozi, O., and Wals, A. (2024). A SWOT analysis of ChatGPT: implications for educational practice and research. *Innov. Educ. Teach. Int.* 61, 460–474. doi: 10.1080/14703297.2023.2195846

- Følstad, A., Nordheim, C. B., and Bjørkli, C. A. (2018). "What makes users trust a chatbot for customer service? An exploratory interview study," in *Internet Science: 5th International Conference, INSCI 2018*, eds. F. Grasso, P. Jedrejowicz, and D. Cao (Cham: Springer International Publishing), 194–208.
- Fu, Y., Weng, Z., and Wang, J. (2024). Examining AI use in educational contexts: a scoping meta-review and bibliometric analysis. *Int. J. Artif. Intell. Educ.* 35, 1388–1444. doi: 10.1007/s40593-024-00442-w
- Gentry, L. A., Chung, J. J., Aung, N., Keller, S., Heinrich, K. M., and Maddock, J. E. (2007). Gender differences in stress and coping among adults living in Hawaii. *Calif. J. Health Promot.* 5, 89–102. doi: 10.32398/cjhp.v5i2.1235
- Ghanbari, N., and Abdolrezaipour, P. (2021). Using emotional intelligence in an EFL integrated writing assessment. *Stud. Educ. Eval.* 70:101017. doi: 10.1016/j.stueduc.2021.101017
- Gökçeşlan, S., Tosun, C., and Erdemir, Z. G. (2024). Benefits, challenges, and methods of artificial intelligence (AI) chatbots in education: a systematic literature review. *Int. J. Technol. Educ.* 7, 19–39. doi: 10.46328/ijte.600
- Goleman, D. (1995). *Emotional Intelligence*. New York: Bantam Books.
- Graves, B. S., Hall, M. E., Dias-Karch, C., Haischer, M. H., Apter, C., Ulmer, C. M., et al. (2021). Gender differences in perceived stress and coping among undergraduate students. *PLOS ONE* 16:e0255634. doi: 10.1371/journal.pone.0255634
- Guo, J., Asmawi, A., and Fan, L. (2024). The mediating role of emotional intelligence in the relationship between social anxiety and communication skills among middle school students in China. *Int. J. Adolesc. Youth* 29:2389315. doi: 10.1080/02673843.2024.2389315
- Guo, K., and Li, D. (2024). Understanding EFL students' use of self-made AI chatbots as personalized writing assistance tools: a mixed methods study. *System* 124:103362. doi: 10.1016/j.system.2024.103362
- Gupta, P., De, N., Hati, S., Saikia, C., and Karmakar, R. (2019). The relationship between positive psychological capital and coping styles: a study on young adults. *Psychology* 10:1649. doi: 10.4236/psych.2019.1012109
- Halkiopoulou, C., and Gkintoni, E. (2024). Leveraging AI in e-learning: personalized learning and adaptive assessment through cognitive neuropsychology—a systematic analysis. *Electronics* 13:3762. doi: 10.3390/electronics13183762
- Hampel, P., and Petermann, F. (2005). Age and gender effects on coping in children and adolescents. *J. Youth Adolesc.* 34, 73–83. doi: 10.1007/s10964-005-3207-9
- Herath, R. (2025). Emotionally intelligent chatbots in mental health: a review of psychological, ethical, and developmental impacts. *Int. J. Comput. Appl.* 187, 49–56. doi: 10.5120/ijca2025925507
- Herdman, M., Fox-Rushby, J., and Badia, X. (1998). A model of equivalence in the cultural adaptation of HRQoL instruments: the universalist approach. *Qual. Life Res.* 7, 323–335. doi: 10.1023/A:1008846618880
- Hessari, H., Bai, A., and Daneshmandi, F. (2024). Generative AI: boosting adaptability and reducing workplace overload. *J. Comput. Inf. Syst.* 15, 1–14. doi: 10.1080/08874417.2024.2417672
- Holm, S. (1979). A simple sequentially rejective multiple test procedure. *Scand. J. Stat.* 6, 65–70.
- Hsu, L. (2022). To CALL or not to CALL: empirical evidence from neuroscience. *Comput. Assist. Lang. Learn.* 35, 792–815. doi: 10.1080/09588221.2020.1750429
- Huang, H. P., Tien, Y., Lin, Y. C., Yu, I. C., and Chien, N. H. (2025). Effects of empathy mapping and mini-simulation on second-year nursing students' empathy and communication self-confidence: a quasi-experimental study. *BMC Med. Educ.* 25:109. doi: 10.1186/s12909-025-06686-x
- Huang, W., Hew, K. F., and Fryer, L. K. (2022). Chatbots for language learning—are they really useful? A systematic review of chatbot-supported language learning. *J. Comput. Assist. Learn.* 38, 237–257. doi: 10.1111/jcal.12610
- Jeon, J. (2024). Exploring AI chatbot affordances in the EFL classroom: young learners' experiences and perspectives. *Comput. Assist. Lang. Learn.* 37, 1–26. doi: 10.1080/09588221.2021.2021241
- Jerath, R., Syam, M., and Ahmed, S. (2023). The future of stress management: integration of smartwatches and HRV technology. *Sensors* 23:7314. doi: 10.3390/s23177314
- Jin, F., Gu, C., and Li, Y. (2024). Trait emotional intelligence and foreign language performance: associations with academic self-efficacy and foreign language anxiety. *Front. Educ.* 9:1419328. doi: 10.3389/feduc.2024.1419328
- Kakarla, U. (2025). Emotional intelligence in interpersonal communication. *Int. J. Innov. Sci. Res.* 3, 111–121.
- Kim, N.-Y. (2019). A study on the use of artificial intelligence chatbots for improving English grammar skills. *J. Digit. Conver.* 17, 37–46. doi: 10.14400/JDC.2019.17.8.037
- Kim, W. B., and Hur, H. J. (2024). What makes people feel empathy for AI chatbots? Assessing the role of competence and warmth. *Int. J. Hum. Comput. Interact.* 40, 4674–4687. doi: 10.1080/10447318.2023.2219961
- Koç, F. S., and Savaş, P. (2025). The use of artificially intelligent chatbots in English language learning: a systematic meta-synthesis study of articles published between 2010 and 2023. *ReCALL* 37, 4–21. doi: 10.1017/S0958344024000168
- Kohnke, L. (2023). A pedagogical chatbot: a supplemental language learning tool. *RELJ* 54, 828–838. doi: 10.1177/00336882211067054
- Labadze, L., Grigolia, M., and Machaidze, L. (2023). Role of AI chatbots in education: systematic literature review. *Int. J. Educ. Technol. High. Educ.* 20:56. doi: 10.1186/s41239-023-00426-1
- Ladakis, I., Filos, D., and Chouvarda, I. (2024). Virtual reality interventions for stress reduction: a scoping review. *Virtual Real.* 28, 231–247. doi: 10.1007/s10055-024-00943-y
- Laun, M., Puderbach, L., Hirt, K., Wyss, E. L., Friemert, D., Hartmann, U., et al. (2025). Chatbots in education: outperforming students but perceived as less trustworthy. *Contemp. Educ. Psychol.* 81:102373. doi: 10.1016/j.cedpsych.2025.102373
- Lee, Y. F., Hwang, G. J., and Chen, P. Y. (2025). Technology-based interactive guidance to promote learning performance and self-regulation: a chatbot-assisted self-regulated learning approach. *Educ. Technol. Res. Dev.* 73, 2279–2304. doi: 10.1007/s11423-025-10478-x
- Li, C., Huang, J., and Li, B. (2021). The predictive effects of classroom environment and trait emotional intelligence on foreign language enjoyment and anxiety. *System* 96:102393. doi: 10.1016/j.system.2020.102393
- Lin, C. J., and Mubarak, H. (2021). Learning analytics for investigating the mind map-guided AI chatbot approach in an EFL flipped speaking classroom. *Educ. Technol. Soc.* 24, 16–35.
- Lin, M. P.-C., and Chang, D. (2020). Enhancing post-secondary writers' writing skills with a chatbot. *Educ. Technol. Soc.* 23, 78–92.
- Liu, Z. (2024). Second language writing anxiety and ChatGPT adoption as an automated writing evaluation tool. *J. Appl. Res. High. Educ.* doi: 10.1108/JARHE-06-2024-0260
- Lo, C. K., Yu, P. L. H., Xu, S., Ng, D. T. K., and Jong, M. S. Y. (2024). Exploring the application of ChatGPT in ESL/EFL education and related research issues: a systematic review of empirical studies. *Smart Learn. Environ.* 11:50. doi: 10.1186/s40561-024-00342-5
- Lu, X., and Guo, W. (2025). Utilizing artificial intelligence to enhance social connections: the alleviating effect of emotionally intelligent chatbots on loneliness. *Disabil. Rehabil. Assist. Technol.* doi: 10.1080/17483107.2025.2540494. [Epub ahead of print].
- Ma, W., Ma, W., Hu, Y., and Bi, X. (2025). The who, why, and how of AI-based chatbots for learning and teaching in higher education: a systematic review. *Educ. Inf. Technol.* 30, 7781–7805. doi: 10.1007/s10639-024-13128-6
- Mahapatra, S. (2024). Impact of ChatGPT on ESL students' academic writing skills: a mixed methods intervention study. *Smart Learn. Environ.* 11:9. doi: 10.1186/s40561-024-00295-9
- Mayer, J. D., and Salovey, P. (1997). "What is emotional intelligence?," in *Emotional Development and Emotional Intelligence: Implications for Educators*, eds. P. Salovey, and D. Sluyter (New York, NY: Basic Books), 3–31.
- McGrath, C., Farazouli, A., and Cerratto-Pargman, T. (2025). Generative AI chatbots in higher education: a review of an emerging research area. *High. Educ.* 89, 1533–1549. doi: 10.1007/s10734-024-01288-w
- Meng, J., and Dai, Y. (2021). Emotional support from AI chatbots: should a supportive partner self-disclose or not? *J. Comput. Mediat. Commun.* 26, 207–222. doi: 10.1093/jcmc/zmab005
- Meniado, J. C. (2023). The impact of ChatGPT on English language teaching, learning, and assessment: a rapid review of literature. *Arab World Engl. J.* 14, 3–18. doi: 10.24093/awej/vol14no4.1
- Mierzwa-Kamińska, E. (2025). "Positive and negative emotions: Theoretical considerations," in *Foreign Language Enjoyment and Anxiety Among Polish EFL Students: Theory and Practical Implications for Foreign Language Educators* (Cham: Springer Nature), 7–58.
- Mills, N., Hok, H., Dressen, A., and Veillas, Q. (2025). The design and evaluation of an interactive AI companion for foreign language writing. *Foreign Lang. Ann.* 58, 40–69. doi: 10.1111/flan.12790
- Moroney, E., Ghavami, A., Chen, K., Kor, A., Lee, J., Thapar, A., et al. (2023). Digital media use frequency, online behaviors, and risk for negative mental health in adolescents in high-achieving schools. *Clin. Child Psychol. Psychiatry* 28, 237–254. doi: 10.1177/13591045221108834
- Mosleh, S. M., Alsaadi, F. A., Alnaqbi, F. K., Alkhazimi, M. A., Alnaqbi, S. W., and Alsereidi, W. M. (2024). Examining the association between emotional intelligence and chatbot utilization in education: a cross-sectional examination of undergraduate students in the UAE. *Heliyon* 10:e31952. doi: 10.1016/j.heliyon.2024.e31952
- Naseer, A., Ahmad, N. R., and Chishti, M. A. (2025). Psychological impacts of AI dependence: assessing the cognitive and emotional costs of intelligent systems in daily life. *Rev. Appl. Manag. Soc. Sci.* 8, 291–307. doi: 10.47067/ramss.v8i1.458
- Nunan, D. (1991). *Language Teaching Methodology. A Textbook for Teachers*. New York, NY: Prentice Hall.

- O'Rourke, T., Chung, J., Zhang, Y., Walsh, E. C., and Rieger, S. (2022). The impact of coping styles and gender on situational stress: a meta-analytic review. *Front. Psychol.* 13:913125. doi: 10.3389/fpsyg.2022.913125
- Ortega-Ochoa, E., Pérez, J. Q., Arguedas, M., Daradoumis, T., and Puig, J. M. (2024). The effectiveness of empathic chatbot feedback for developing computer competencies, motivation, self-regulation, and metacognitive reasoning in online higher education. *Internet Things* 25:101101. doi: 10.1016/j.iot.2024.101101
- Oxford, R. L. (2011). Strategies for learning a second or foreign language. *Lang. Teach.* 44, 167–180. doi: 10.1017/S0261444810000492
- Petrides, K. V., and Furnham, A. (2001). Trait emotional intelligence: psychometric investigation with reference to established trait taxonomies. *Eur. J. Pers.* 15, 425–448. doi: 10.1002/per.416
- Ptacek, J. T., Smith, R. E., and Zanas, J. (1992). Gender, appraisal, and coping: a longitudinal analysis. *J. Pers.* 60, 747–770. doi: 10.1111/j.1467-6494.1992.tb00272.x
- Qasem, F., Ghaleb, M., Mahdi, H. S., Al Khateeb, A., and Al Fadda, H. (2023). Dialog chatbot as an interactive online tool in enhancing ESP vocabulary learning. *Saudi J. Lang. Stud.* 3, 76–86. doi: 10.1108/SJLS-10-2022-0072
- Qi, C., and Yang, N. (2024). Digital resilience and technological stress in adolescents: a mixed-methods study of factors and interventions. *Educ. Inf. Technol.* 29, 19067–19113. doi: 10.1007/s10639-024-12595-1
- Rahman, A., Raj, A., Tomy, P., and Hameed, M. S. (2024). A comprehensive bibliometric and content analysis of artificial intelligence in language learning: tracing between the years 2017 and 2023. *Artif. Intell. Rev.* 57:107. doi: 10.1007/s10462-023-10643-9
- Rapp, A., Curti, L., and Boldi, A. (2021). The human side of human-chatbot interaction: a systematic literature review of ten years of research on text-based chatbots. *Int. J. Hum. Comput. Stud.* 151:102630. doi: 10.1016/j.ijhcs.2021.102630
- Reed, D. E., and Reedman, A. E. (2020). Reactivity and adaptability: applying gender and age assessment to the Leader Resilience Profile®. *Front. Educ.* 5:574079. doi: 10.3389/feduc.2020.574079
- Reichenheim, M. E., and Moraes, C. L. (2007). Operationalizing the cross-cultural adaptation of epidemiological measurement instruments. *Rev. Saúde Pública* 41, 665–673. doi: 10.1590/S0034-89102006005000035
- Saeedi, Z., and Soltani, M. (2025). Developing an AI chatbot for language pragmatics instruction: from algorithms to dynamic assessment in an EFL context. *Comput. Assist. Lang. Learn.* 1–22. doi: 10.1080/09588221.2025.2532014. [Epub ahead of print].
- Salovey, P., and Mayer, J. D. (1990). Emotional intelligence. *Imagin. Cogn. Pers.* 9, 185–211. doi: 10.2190/DUGG-P24E-52WK-6CDG
- Sedgwick, P. (2013). Convenience sampling. *BMJ* 347:f6304. doi: 10.1136/bmj.f6304
- Shanmugasundaram, K., and Tamilarasu, S. (2023). The impact of digital technology, social media, and artificial intelligence on cognitive functions. *Front. Cogn.* 2:1203077. doi: 10.3389/fcogn.2023.1203077
- Silitonga, L. M., Hawanti, S., Aziez, F., Furqon, M., Zain, D. S. M., Anjarani, S., et al. (2023). "The impact of AI chatbot-based learning on students' motivation in English writing classroom," in *Innovative Technologies and Learning: 6th International Conference, ICITL 2023*, eds T.-C. Huang, M. Chang, and D. Gamboa (Cham: Springer Nature Switzerland), 542–549.
- Son, J. B., Ružić, N. K., and Philpott, A. (2025). Artificial intelligence technologies and applications for language learning and teaching. *J. China Comput. Assist. Lang. Learn.* 5, 94–112. doi: 10.1515/jccall-2023-0015
- Song, C., and Song, Y. (2023). Enhancing academic writing skills and motivation: assessing the efficacy of ChatGPT in AI-assisted language learning for EFL students. *Front. Psychol.* 14:1260843. doi: 10.3389/fpsyg.2023.1260843
- Suharti, L., and Susanto, A. (2014). The impact of workload and technology competence on technostress and performance of employees. *Indian J. Commer. Manag. Stud.* 5, 1–7.
- Thao, L. T., Thuy, P. T., Thi, N. A., Yen, P. H., Thu, H. T. A., and Tra, N. H. (2023). Impacts of emotional intelligence on second language acquisition: English-major students' perspectives. *SAGE Open* 13:21582440231212065. doi: 10.1177/21582440231212065
- Thoits, P. A. (1995). Stress, coping, and social support processes: where are we? What next? *J. Health Soc. Behav.* 35, 53–79. doi: 10.2307/2626957
- Turkle, S. (2016). *Reclaiming Conversation: The Power of Talk in a Digital Age*. New York, NY: Penguin.
- Valizadeh, M. R., and Alavinia, P. (2013). Listening comprehension performance viewed in the light of emotional intelligence and foreign language listening anxiety. *Engl. Lang. Teach.* 6, 11–26. doi: 10.5539/elt.v6n12p11
- Vidic, Z. (2024). Gender differences on coping, stress, resilience and mindfulness within an academic course intervention with a mindfulness meditation component. *Curr. Psychol.* 43:28241. doi: 10.1007/s12144-024-06395-6
- Waghay, N. J., Rajasundaram, A., Johnson, W. M. S., and Waghay, A. (2025). Chatbot in anatomy learning and recapitulation: prototype and review. *Med. J. Armed Forces India* 81, 386–390. doi: 10.1016/j.mjafi.2023.10.009
- Wang, C. (2024). Exploring students' generative AI-assisted writing processes: perceptions and experiences from native and nonnative English speakers. *Technol. Knowl. Learn.* 30, 1–22. doi: 10.1007/s10758-024-09744-3
- Wang, P., Ganushchak, L., Welie, C., and van Steensel, R. (2024). The dynamic nature of emotions in language learning context: theory, method, and analysis. *Educ. Psychol. Rev.* 36:105. doi: 10.1007/s10648-024-09946-2
- Watson, S. B., Goh, Y. W., and Sawang, S. (2011). Gender influences on the work-related stress-coping process. *J. Individ. Differ.* 32, 217–224. doi: 10.1027/1614-0001/a000033
- Wei, L. (2023). Artificial intelligence in language instruction: impact on English learning achievement, L2 motivation, and self-regulated learning. *Front. Psychol.* 14:1261955. doi: 10.3389/fpsyg.2023.1261955
- Winkler, R., and Söllner, M. (2018). "Unleashing the potential of chatbots in education: A state-of-the-art analysis," in *Academy of Management Proceedings*, Vol. 2018 (Briarcliff Manor, NY: Academy of Management).
- Xiao, Y. (2024). An exploratory study of EFL learners' use of ChatGPT for language learning tasks: experience and perceptions. *Educ. Inf. Technol.* 29, 4567–4583.
- Zamarrripa, J. (2020). Adaptability to social distancing due to COVID-19 and its relationship to perceived stress. *Salud Ment.* 43, 275–279. doi: 10.17711/SM.0185-3325.2020.037
- Zhai, C., Wibowo, S., and Li, L. D. (2024). The effects of over-reliance on AI dialogue systems on students' cognitive abilities: a systematic review. *Smart Learn. Environ.* 11:28. doi: 10.1186/s40561-024-00316-7
- Zhang, J. (2025). Integrating chatbot technology into English language learning to enhance student engagement and interactive communication skills. *J. Comput. Methods Sci. Eng.* 25, 2288–2299. doi: 10.1177/14727978241312992
- Zhoc, K. C., King, R. B., Chung, T. S., Chen, J., and Yang, M. (2023). Emotional intelligence promotes optimal learning, engagement, and achievement: a mixed-methods study. *Curr. Psychol.* 42, 10387–10402. doi: 10.1007/s12144-021-02294-2
- Zouhaier, S. (2023). The impact of artificial intelligence on higher education: an empirical study. *Eur. J. Educ. Sci.* 10, 17–33. doi: 10.19044/ejes.v10n.o1a17