EFL learners' learning involvement and emotions in the integration of technology in their classrooms

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ABSTRACT: It is generally believed that technological infrastructures and teachers' and learners' technology literacy are the main prerequisites for conducting a technology-integrated learning environment. However, empirical evidence in the literature demonstrated that language learners might pursue emotive relief in their technology-integrated educational environments to assuage undesirable feelings. Therefore, the current study investigated the relationship between the integration of technology in English as a foreign language (EFL) learners' classrooms, engagement, and emotions. Drawing upon positive psychology, the specified hypotheses were tested by administering three questionnaires among 1,041 EFL learners in Chinese Universities. The results of the study proposed that about 70 percent of changes in the EFL learners' perceptions of technology integration can be predicted by their engagement and emotions. Furthermore, in contrast to prior studies, the association between emotions and learners' perceptions of technology integration was higher in this research. The discoveries highlighted the requirement for a better understanding of the system and that students' engagement and their emotions influence their perceptions of technology integration positively. Lastly, relevant implications for language education are discussed.
Keywords: learning engagement, technology integration, learners' emotions, positive psychology, technology-integrated environment

Participación y emociones de los estudiantes de EFL en la integración de la tecnología en el aula

RESUMEN: Se cree comúnmente que la infraestructura tecnológica y la alfabetización tecnológica de los profesores y estudiantes son los principales requisitos para implementar un entorno de aprendizaje integrado con tecnología. Sin embargo, la evidencia empírica en la literatura muestra que los estudiantes de idiomas pueden buscar alivio emocional en sus entornos educativos integrados con tecnología para mitigar sentimientos indeseados. En consecuencia, el presente estudio investigó la relación entre la integración de la tecnología en las aulas de EFL, la participación y las emociones. Basándose en la psicología positiva, se probaron las hipótesis específicas mediante la administración de tres cuestionarios a 1041 estudiantes de EFL en universidades chinas. Los resultados del estudio su-

gieren que aproximadamente el 70 por ciento de los cambios en las percepciones de los estudiantes de EFL sobre la integración de la tecnología pueden ser proyectados por su participación y emociones. Además, en contraste con estudios previos, la asociación entre las emociones y las percepciones de los estudiantes sobre la integración de la tecnología fue mayor en esta investigación. Los descubrimientos destacaron la necesidad de comprender mejor el sistema y demostraron que la participación de los estudiantes y sus emociones influyen positivamente en sus percepciones sobre la integración de la tecnología. Finalmente, se discuten las implicaciones relevantes para la educación lingüística.
Palabras clave: participación en el aprendizaje, integración de la tecnología, emociones de los estudiantes, psicología positiva, entorno integrado con tecnología

1. Introduction

While Positive Psychology provides a fitting overarching framework for this study, a more explicit operationalization of its core constructs is necessary—particularly in mapping specific emotional experiences to dimensions of learner engagement. Positive Psychology emphasizes the role of positive emotions such as enjoyment, interest, and hope in enhancing motivation, cognitive processing, and persistence (Seligman & Csikszentmihalyi, 2000). In the context of language learning, these emotions have been linked to distinct facets of engagement: for example, enjoyment is often associated with behavioral engagement (active participation and task completion), interest aligns with cognitive engagement (deep learning and sustained attention), and hope relates to emotional engagement (optimism and resilience during challenging tasks) (Derakhshan & Shakki, 2024).

The widespread use of technology now transcends racial, ethnic, religious, political, and gender boundaries, impacting individuals across all age groups—from toddlers to the elderly—who interact with digital tools on a daily basis (Phan & Pham, 2023; Pishghadam & Shakeebaee, 2020). Technology has become so integral to everyday life that traditional practices—such as manually scheduling appointments, writing shopping lists, using paper maps for navigation, or tracking tasks with handwritten notes—are increasingly replaced by digital alternatives (Ding & Wang, 2024; Khammat, 2022). In educational settings, particularly in EFL classrooms, teachers serve as essential facilitators in guiding students to use technology effectively. This includes integrating digital tools to enhance instruction, support learning outcomes, and stimulate student engagement (Derakhshan et al., 2025; Parker et al., 2021).

Among the many reasons for adopting technology in classrooms, promoting student engagement stands out as a central objective (Arabmofrad & Shakki, 2025; Wang & Kruk, 2024). Recent studies have begun to explore how educational technology influences not only students' cognitive performance but also their emotional and behavioral engagement (Guo & Wang, 2024; Wu et al., 2023). While accessibility and flexibility remain widely recognized benefits (Parker et al., 2021; Pusparini et al., 2024), the overall efficacy of technology integration remains debatable. This is partly because successful implementation is contingent not only on students' digital literacy but also on their emotional reactions and the degree of meaningful engagement they demonstrate. As Shao et al. (2023) argue, technology alone does not enhance learning unless it elicits positive emotional responses and encourages purposeful interaction. Consequently, it is vital to reevaluate the impact of technology integration in terms of how it fosters emotional, cognitive, and behavioral engagement among learners within a Positive Psychology framework.

While many studies have emphasized the role of students' technology literacy in shaping the instructional effectiveness of technology integration, recent research highlights the growing need to account for learners' emotions in this process. Literature increasingly stresses the importance of incorporating emotional precursors to better understand the dynamics of engagement in technology-integrated learning environments (Acosta-Gonzaga & Ramirez-Arellano, 2021; Kim & Ketenci, 2020; Xu & Lou, 2023). Scholars argue that students' emotional states—such as anger, anxiety, optimism, and hope—can significantly influence their perceptions of and attitudes toward educational technologies (Ding & Wang, 2024; Glazer, 2008; Shakki, 2023). Moreover, technology itself can serve as a medium for emotional expression, support-seeking, and communication, especially when students feel acknowledged, accompanied, and supported in the learning process. Such emotional support can positively shape students' experiences with technology-enhanced education (Chen & Wu, 2021; Cheng et al., 2023; Yang & Zhao, 2024; Zhao & Wang, 2023). Therefore, emotional factors play a crucial role in shaping students' engagement with technology. Although using technology may trigger both positive and negative emotions, the current educational climate tends to favor technology-enhanced learning in language classrooms (Zawodniak et al., 2023; Zhang et al., 2021; Zong & Yang, 2025). As a result, there is a growing need to examine the influence of emotional elements to gain a more comprehensive understanding of technology integration and student engagement (Chau et al., 2023; Derakhshan & Gao, 2025).

The influence of both instructional and emotional factors on students' engagement with technology can be effectively explored through the framework of Positive Psychology (PP), which emphasizes the role of positive emotional and cognitive experiences in supporting human development (Derakhshan, 2022; Kruk, 2022). Although emotional well-being is a key component of effective learning environments, its impact on technology engagement has often been underestimated. Positive Psychology underscores the importance of fostering qualities such as resilience, optimism, joy, and hope—emotional traits that can significantly enhance learners' motivation, perseverance, and willingness to interact with digital tools in educational settings. When students experience positive emotions, they are more inclined to engage with technology in an open, curious, and proactive way, which can deepen their interaction with digital learning resources and boost overall engagement (Du, 2024; Kruk, 2022). Furthermore, technology integration—similar to the function of online communities and social media platforms—can serve as an important channel for social and emotional support (Naylor & Nyanjom, 2021; Phan & Pham, 2023). Digital environments enable university students to exchange not only academic content and instructional materials but also a wide range of emotional experiences, such as anxiety, anger, joy, pride, optimism, and hope (Cheng et al., 2023; Derakhshan & Yin, 2024; Lo, 2023; Volet et al., 2019; Zhang et al., 2021). This capacity for emotional expression and support highlights the importance of further research into how interpersonal interactions in technology-mediated settings influence students' emotional well-being and, in turn, their engagement with technology.

Aligned with the principles of Positive Psychology, this study examines instructional support and emotional support as two key predictors of students' engagement with technology. Instructional support involves providing clear guidance, relevant information, and practical assistance to help learners understand content and solve problems effectively (Berweger et al., 2022; Claffey & Brady, 2019; Han & Geng, 2023). In contrast, emotional support

refers to the reassurance, empathy, and encouragement students receive from instructors and peers, which can help them manage negative emotions and foster deeper emotional engagement. Together, these forms of support serve as essential educational and emotional foundations that influence how students perceive, engage with, and ultimately benefit from technology-enhanced learning.

This study investigates the complex relationship between EFL learners' engagement and their emotional experiences in technology-integrated classrooms. A key innovation of the research is the use of advanced technological tools—such as emotion recognition software and real-time learning analytics—to monitor learners' emotional states and levels of engagement. By situating the findings within the specific context of EFL education, the study contributes not only to the theoretical understanding of the interplay between emotion and cognition, but also offers practical insights for educators aiming to enhance language learning through technology-supported environments.

2. Literature Review

Grounded in Positive Psychology, this study examines how emotional and instructional support influence learner engagement in technology-integrated EFL classrooms. *Emotional support* refers to the extent to which students perceive their teachers and peers as caring, empathetic, and responsive to their emotional needs, fostering a sense of safety and belonging in the learning environment. *Instructional support*, on the other hand, involves the clarity of instruction, timely feedback, scaffolding of learning tasks, and the promotion of higher-order thinking. Both forms of support are central to cultivating positive emotional experiences that enhance motivation and engagement. This research adopts the Control-Value Theory (CVT) (Pekrun et al., 2011), a key framework within Positive Psychology, which posits that students' achievement emotions—such as enjoyment, pride, anxiety, or boredom—are shaped by their perceived control over learning activities and the value they assign to them. CVT provides a useful lens through which to understand how teacher support mechanisms translate into emotional experiences that fuel or hinder engagement.

The widespread use of technology now transcends racial, ethnic, religious, political, and gender boundaries, influencing people of all ages—from toddlers to the elderly—who interact with digital tools daily (Phan & Pham, 2023; Pishghadam & Shakeebaee, 2020). Technology has become so embedded in modern life that many traditional activities—such as scheduling appointments manually, writing shopping lists, or navigating with paper maps—are now digitally managed (Ding & Wang, 2024; Khammat, 2022). In educational contexts, particularly in EFL classrooms, the integration of technology is increasingly guided by pedagogical efforts to foster student engagement through emotional and instructional support (Parker et al., 2021). Enhancing student engagement remains a primary goal in digital learning environments (Wang & Kruk, 2024), and recent research has expanded to include not only cognitive outcomes but also students' emotional and behavioral responses to technology use (Guo & Wang, 2024; Wu et al., 2023). However, as Shao et al. (2023) argue, the effectiveness of educational technology is contingent not merely on access and skill, but on the emotional meaning learners derive from its use—underscoring the relevance of a CVT-based approach that links perceived support, emotions, and engagement outcomes.

2.1. Positive Psychology Model

Among various theoretical models, the Positive Psychology framework was selected as the foundational structure for this review. This choice is based on the model's emphasis—compared to other alternatives—on the role of individual characteristics (e.g., attitudes, perceived behavioral control, and normative beliefs) in shaping behavior (Chen & Shu, 2024; Phan & Pham, 2023; Shao et al., 2023). A technology-integrated learning environment can be seen as a context in which learners' attitudes intersect with technological advancements. Therefore, it is essential to consider factors related to human-computer interaction—such as beliefs, autonomy, and perceived ease of use—when analyzing learner behavior in such environments (Derakhshan & Fathi, 2024).

Thus, positive psychology incorporates human-computer interaction factors to understand behavior in technology-integrated contexts. Overall, positive psychology has become a widely used framework for examining the factors that influence human behavior towards the acceptance or rejection of technology integration (Parker et al., 2021; Shen et al., 2023; Volet et al., 2019). In the context of language classrooms, students are likely to develop a complex intention to use educational technology. This intention depends on whether they believe the technology will enhance their performance or if they feel that using the technology will require minimal effort (Phan & Pham, 2023; Shakki, 2022).

2.2. Learners' Learning Engagement

Learner engagement during classroom instruction plays a crucial role and is one of the key factors in determining students' academic success (Glazer, 2008; Kim & Ketenci, 2020; Kirkpatrick et al., 2025). Student engagement can be defined as the constructive energy and cognitive involvement that learners invest in their academic experiences and instructional activities. When effectively fostered, engagement contributes to a positive classroom atmosphere and provides students with meaningful opportunities to explore and develop their own perspectives (Derakhshan & Azari Noughabi, 2024; Xu & Lou, 2023).

Efforts should be made to enhance students' learning engagement by improving the quality of instruction, teachers' competencies, and the design of learning activities. Advancing student education through effective instructional practices directly impacts learners' retention and ultimately influences both academic outcomes and the overall quality of learning (Liu et al., 2021; Wang, 2023). Zhang et al. (2021) identified six key factors related to student engagement. First, learning engagement should aim to develop students' higher-order and multifaceted skills. Second, it should promote meaningful and responsive relationships between teachers and students. Third, equitable engagement must be ensured across all learners, without bias toward race, religion, gender, social status, or economic background. Fourth, engagement should positively shape students' attitudes toward learning in thoughtful and constructive ways. Fifth, high-quality engagement must address core educational challenges. Finally, engagement should serve as both a clear guide and an evaluative measure that meets the essential needs of learners.

2.3. Learners' Emotions

Feelings play an inevitable role in second language learning and are closely linked to language achievement. Over the past fifty years, researchers have primarily focused on the impact of negative emotions, particularly anxiety, on language learning (Berweger et al., 2022; Derakhshan & Bai, 2025; Ünsal-Görkemoğlu & Akyel, 2024). However, with the rise of positive psychology and its increasing application in language teaching, scholars have shifted their focus from negative emotions to positive emotions, exploring learning-related emotions from a broader perspective (Claffey & Brady, 2019; Estaji & Taghizadeh, 2024).

Recently, the significance of comprehensive emotions in learning has been recognized and explored by researchers from various perspectives. However, there is still a need for a framework to organize and analyze emotions in learning contexts. Achievement emotions (Han & Geng, 2023; Shakki, 2023) are defined as the emotional responses directly linked to academic activities. These emotions typically include positive feelings such as happiness, hope, and pride, as well as negative emotions like anger, anxiety, sadness, and fatigue. Different intensities of emotions can either individually or interactively generate various achievement emotions, which, in turn, influence academic success. For example, low perceived value may lead to fatigue, while high perceived control and high intrinsic value can trigger joy, and low perceived control with high perceived value may cause anxiety (Xin & Derakhshan, 2025). Specifically, positive emotions are likely to improve academic performance by enhancing motivation, interest, and self-regulation, increasing available cognitive resources, and promoting the use of more flexible and deep learning strategies. On the other hand, negative emotions tend to worsen academic performance by decreasing motivation, interest, and self-regulation, reducing cognitive resources, and encouraging the use of rigid and shallow learning strategies in academic settings (Al-Obaydi et al., 2023; Liu et al., 2021; Yang et al., 2025).

In addition, Liu et al. (2021) conducted a qualitative study on Chinese EFL students' achievement emotions and their antecedents in online programs. They found that students experienced a range of emotions, including joy, love, anxiety, guilt, boredom, and frustration. The study identified four key factors that influenced these emotions in online English courses: internet connectivity, external obligations outside the classroom, students' self-regulation of learning behaviors, and the learning environment. Furthermore, Han and Geng (2023), using a mixed-methods approach, collected quantitative data from college students and qualitative data from both college students and instructors. Their findings suggested that different emotions, both individually and interactively, predicted boredom, with more complex relationships between performance and boredom.

The integration of technology in education has significantly transformed teaching and learning practices, especially in the field of EFL (Holzer et al., 2023). Educational psychology research emphasizes the importance of learner engagement in the learning process. According to Lo (2023), engagement is a multifaceted construct that includes behavioral, emotional, and cognitive components. In language learning, engagement is vital for enhancing motivation and active participation—both key to successful language acquisition. Emotional engagement, which refers to students' affective responses to learning activities, plays a particularly important role by influencing their motivation and persistence (Shen et al., 2023).

As technology becomes increasingly embedded in language instruction, understanding its impact on learners' emotional experiences is essential.

The integration of technology in EFL classrooms—through tools such as mobile applications, online platforms, and interactive whiteboards—has transformed traditional teaching methods. These technologies enable personalized learning, accommodate various learning styles, and encourage collaborative learning (Qi & Derakhshan, 2024). However, several challenges remain. As Han and Geng (2023) highlight, effective technology integration depends not only on access to resources but also on sufficient training and support for teachers. Additionally, while technology can enhance engagement, it also poses risks of distraction, raising concerns about its effective use in language learning settings. EFL learners' emotional responses in technology-enhanced classrooms have become a topic of increasing interest. Research shows that positive emotions can improve learning outcomes, whereas negative emotions often hinder participation and engagement. As a result, it is essential to understand how technology influences emotions such as anxiety, enjoyment, and confidence in language learning contexts. For example, Lyashevsky et al. (2019) examined the use of gamified learning platforms in EFL education and found that these tools not only boosted learner engagement but also fostered positive emotional responses, ultimately enhancing motivation and academic performance.

Although extensive research has explored engagement and technology integration independently, few studies have examined how learners' engagement, emotional experiences, and the effectiveness of technology integration interact with one another—particularly in EFL contexts. This gap underscores the need for a more integrated understanding of how these factors collectively influence language learning outcomes. As technology continues to play an increasingly prominent role in education, it is essential to investigate how its integration affects both the engagement and emotional states of EFL learners. This study aims to explore these interconnections, offering insights to help educators adopt effective technology strategies that boost EFL learners' motivation, emotional well-being, and academic success. Understanding these dynamics is critical for creating technology-enhanced environments that support both language development and learners' emotional health (Wang, 2023). Based on the above discussion, several key observations can be summarized. First, the majority of existing research has focused on areas outside the field of foreign language learning. Second, among the studies that do address foreign language education, most have concentrated on achievement emotions, often overlooking learners' actual language performance in technology-integrated learning environments. Therefore, building on common themes in the literature and the growing body of research on emotions in second language acquisition (Lo, 2023), the present study aims to investigate the relationship between students' engagement, emotions, and perceptions of technology integration in EFL classrooms. Grounded in this perspective, the current study aims to investigate the psychological and behavioral dimensions of technology use in EFL contexts. Specifically, it seeks to address the following research questions:

RQ1. Is there any significant relationship between EFL students' perceptions of technology integration, their technological engagement, and emotions?

RQ2. To what extent can EFL students' perceptions of technology integration be predicted by their technological engagement and their technological emotions?

3. Method

3.1. Participants

To ensure alignment with the study's focus on technology integration, participants were actively using technology in their classrooms. This ensured that the sample was relevant to the research objectives. Participation was entirely voluntary, and informed consent was obtained after clearly explaining the study's purpose, objectives, and procedures. This approach upheld ethical standards and ensured participants understood their involvement. The participants were EFL learners enrolled in technology-supported language programs, which aligned with the study's central research questions. To minimize sampling bias, a random sampling technique was used to recruit participants. The study aimed to explore how learners' engagement and emotions could predict their perceptions of technology integration. A total of 1,100 EFL learners from various Chinese universities participated in the study. These participants came from different institutions and had diverse English-related majors. They were recruited through professional contacts. Data were collected using three anonymous questionnaires focusing on learners' engagement, emotions, and their perceptions of technology integration. After removing incomplete or invalid responses, 1,041 valid questionnaires remained for analysis. Among the 1,041 participants, 77.52% were female (N = 807) and 22.48% were male (N = 234), with ages ranging from 17 to 41 years. Most participants were sophomores (69.45%; N = 723). The study further examined how learners' attitudes toward technology integration could predict their perceptions of English technology literacy. Before completing the survey, participants were informed that the data would be used solely for research purposes and that their privacy would be protected. Informed consent was obtained before data collection, which was conducted via WeChat using the Wenjuanxing platform. Participant demographics are detailed in Table 1.

Table 1. *Participants' Demographic Information*

Background Information	Number	%
Gender		
Male	234	22.48%
Female	807	77.52%
Academic Qualification		
Freshman	131	12.58%
Sophomore	723	69.45%
Junior	92	8.84%
Senior	23	2.21%
1st year postgraduate	27	2.59%
2nd year postgraduate	32	3.07%
3rd year postgraduate	13	1.25%

3.2. Instruments

3.2.1. Computer Technology Integration Questionnaire

The final version of the survey consisted of 21 items designed to assess learners' perceptions of technology integration in their classrooms. Each item was rated on a five-point Likert scale, ranging from 1 = strongly disagree to 5 = strongly agree. The initial version of the questionnaire contained 38 items. These items underwent expert review and face-validity checks. Following this, Principal Component Analysis (PCA) was conducted to identify the underlying structure of the scale. The PCA results revealed three distinct components: Independence (items 1, 3, 6, 9, 13, 14, and 19), Beliefs (items 2, 7, 10, 11, 16, 20, and 21), and Activities (items 4, 5, 8, 12, 15, 17, and 18). Based on these findings, the questionnaire was refined to a final version of 21 items. This version was piloted with 50 participants from a similar population to ensure its reliability. The internal consistency of the scale, measured using Cronbach's alpha, was found to be acceptable ($\alpha = .87$). The 21 items measured three key aspects: learners' autonomy in technology-integrated learning environments, their beliefs regarding the use of technology-supported materials in language learning, and their attitudes toward classroom activities involving technology integration.

3.2.2. Learners' Emotion Questionnaire

To assess learners' emotions, the Learners' Emotion Questionnaire, adapted from Pekrun et al. (2011), was used. Students were asked to report how they typically felt during classes, while studying, or when taking exams in their university courses. The questionnaire consists of 35 items and includes seven subscales: joy (items 1–5), pride (items 6–11), love (items 12–17), anger (items 18–22), exhaustion (items 23–29), and hopelessness (items 30–35). Participants responded to each statement using a five-point Likert scale, ranging from 1 = strongly disagree to 5 = strongly agree. The purpose of the survey was to measure the emotional states of learners, particularly within technology-integrated learning environments. The questionnaire was piloted with 60 participants from a similar population, and the results demonstrated high internal consistency, with Cronbach's alpha of .92 ($r = .92$).

3.2.3. Language Learners' Engagement

This survey consists of 33 items that reflect indicators of student engagement, adapted from Hart et al. (2011). Participants respond to each item using a five-point Likert scale ranging from 1 = never to 5 = always. Completion of the questionnaires typically takes approximately 35 minutes. As suggested by the original researchers, the Student Engagement in Schools Questionnaire (SESQ) comprises five components: Emotional Engagement – Preference for Learning, Emotional Engagement – Preference for School, Behavioral Engagement – Effort and Persistence, Social Engagement – Extracurricular Activities, and Cognitive Engagement. The questionnaire was piloted with 55 participants from a similar population, and the internal consistency was found to be acceptable, with a Cronbach's alpha of .83 ($r = .83$).

3.3. Data Collection Procedure

From early May to late June 2023, our research team conducted a nationwide questionnaire survey across China with the support of Chinese EFL teachers from a diverse range of colleges and universities. A stratified random sampling strategy was employed to ensure broad representation across geographical regions, institutional types (e.g., key universities vs. non-key institutions), and gender distribution. Within each stratum, participants were randomly selected using institutional mailing lists and classroom rosters provided by cooperating instructors. Inclusion criteria required that participants be full-time Chinese undergraduate students currently enrolled in EFL courses. Students with diagnosed learning disabilities or limited proficiency in Mandarin (which could interfere with reading the translated questionnaire) were excluded to maintain internal validity and consistency.

Data collection proceeded in two structured stages. In the first stage, all research instruments were translated from English to Chinese using the back-translation method. Two bilingual experts independently translated the original English questionnaires into Chinese. A third expert, blind to the original version, then retranslated the Chinese version back into English. Discrepancies were discussed and resolved in consultation with a fourth expert to ensure semantic equivalence and cultural relevance. Additionally, cultural adaptation was performed to ensure that idiomatic and contextual meanings were appropriate for Chinese participants. The finalized Chinese version of the survey was reviewed by four specialists in applied linguistics for conceptual clarity, linguistic accuracy, and cultural appropriateness.

In the second stage, ethical research standards were rigorously followed. Participants were provided with an informed consent form outlining the study's objectives, the voluntary nature of participation, their right to withdraw at any time, and assurances of anonymity and data confidentiality. Only students who electronically signed the consent form were permitted to proceed. The digital questionnaire was distributed via WeChat using the Wenjuanxing platform to 1,100 targeted participants. Data collection was scheduled immediately prior to class sessions to reduce distractions and maximize participant focus. Each survey required approximately 35 minutes to complete. Of the total distributed, 1,041 valid responses were collected and retained for final analysis.

3.4. Data Analysis

First, the reliability, convergent validity, and discriminant validity of the proposed measurement model were assessed to evaluate the model's goodness of fit and construct validity. Following this, the three hypotheses of the structural model were tested using Structural Equation Modeling (SEM), conducted via the Maximum Likelihood (ML) estimation method in AMOS 26. These procedures enabled the evaluation of both the measurement model and the structural model. The raw survey data were carefully examined for incomplete or inconsistent responses. Cases with substantial missing data were addressed either through appropriate imputation methods or by excluding them, depending on the extent and pattern of missingness. Statistical checks were also conducted to detect and manage outliers that might distort the results, thereby ensuring that the dataset accurately reflected the characteristics of the target population. Descriptive statistics were calculated to summarize the data,

including measures of central tendency, dispersion, and frequency distributions. Finally, the data were formatted and validated to ensure they met the assumptions required for the statistical analyses, such as normality and homoscedasticity.

4. RESULTS

To validate the Computer Technology Integration Questionnaire, the Learners' Emotion Questionnaire, and the Language Learners' Engagement Questionnaire, Confirmatory Factor Analysis (CFA) was conducted. Based on prior research and a review of relevant literature, the following measurement models were proposed: a three-factor model for the Computer Technology Integration Questionnaire (21 items), a six-factor model for the Learners' Emotion Questionnaire (35 items), and a five-factor model for the Language Learners' Engagement Questionnaire (33 items). To assess the convergent validity among EFL learners' engagement, their emotional experiences, and their perceptions of technology integration, CFA was performed. The initial model demonstrated a good fit to the data (see Figure 1), and the model's goodness-of-fit indices are reported in Table 2.

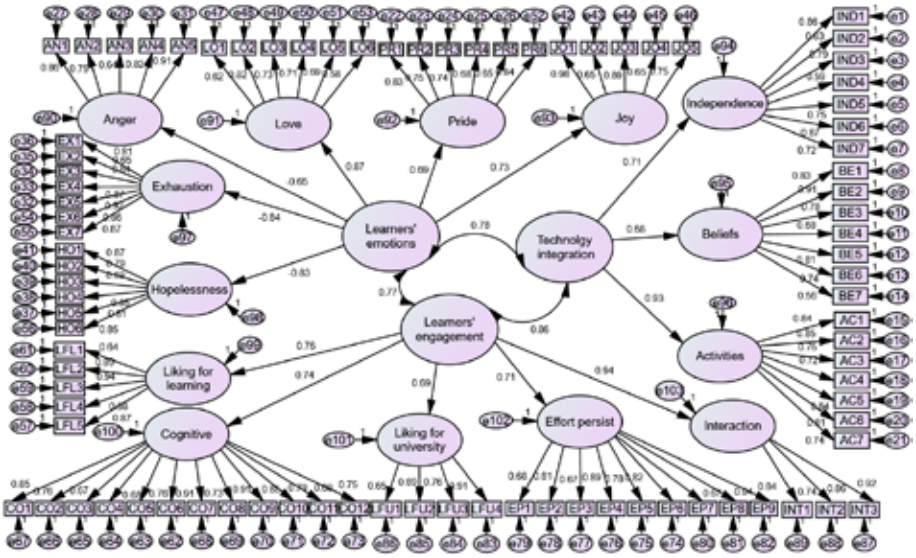


Figure 1. *The Final CFA Model with Standardized Estimates*

The SEM analysis presented in Figure 1 illustrates that positive emotions and external factors—such as technology integration and interactive learning environments—have a significant positive effect on learners' engagement. Positive emotions such as enjoyment, interest, and hope were found to directly enhance behavioral, cognitive, and emotional engagement, aligning with the principles of Control-Value Theory (Pekrun et al., 2011), which posits that emotions shaped by perceived control and task value significantly influence academic

motivation and learning behaviors. In contrast, negative emotions—such as anxiety, boredom, and frustration—were shown to significantly decrease engagement levels, potentially undermining learners' focus, persistence, and willingness to participate. The model further identifies technology integration as a key mediating variable, linking learners' emotional states to their engagement outcomes. This suggests that technology does not function as a neutral tool but rather as an affective and pedagogical amplifier—its effectiveness depends on how well it supports positive emotional and cognitive experiences. These findings underscore the critical importance of designing emotionally supportive and technologically enriched learning environments. Specifically, fostering learner autonomy, reinforcing positive belief systems (e.g., self-efficacy and growth mindset), and encouraging active participation serve to strengthen the positive effects of technology on engagement. Ultimately, the results highlight the need for holistic, emotionally informed instructional strategies that harness technology not only to deliver content, but also to promote meaningful, emotionally resonant learning experiences.

Table 2. *Evaluation of the CFA Goodness of Fit*

		Threshold			
Criteria		Terrible	Acceptable	Excellent	Evaluation
CMIN	9899.658				
DF	3459				
CMIN/DF	2.862	> 5	> 3	> 1	Acceptable
RMSEA	.069	> 0.08	< 0.08	< 0.06	Acceptable
GFI	.939	< 0.9	> 0.9	> 0.95	Acceptable
CFI	.921	< 0.9	> 0.9	> 0.95	Acceptable
PNFI	.647	< 0.5	> 0.5		Acceptable
TLI	.951	> 0.9	> 0.9	> 0.95	Acceptable

In Table 2, the outcome demonstrated that five determiners are the proportion of CMIN-DF, decency of-fit record (GFI), near fit file (CFI), Tightfisted Normed Fit List (PNFI), Exhaust Lewis File (TLI), and root mean square mistake of estimation (RMSEA). The model fit lists are all inside particulars. Accordingly, CMIN/DF is 2.862 (spec. ≤ 3.0), GFI = 0.939 (spec. > 0.9), CFI = .921 (spec. > 0.9), PNFI = 0.647 (spec. > 0.5), TLI = 0.951 (spec. > 0.9), and RMSEA = 0.069 (spec. < 0.080).

Table 3. *Composite Reliability and Discriminant Validity of the Factors*

	CR	AVE	MSV	MaxR(H)	Technology	Emotions	Engagement
Technology	0.873	0.971	0.250	0.829	**0.984**		
Emotions	0.924	0.883	0.250	0.980	0.620	**0.936**	
Engagement	0.836	0.912	0.235	0.993	0.531	0.595	**0.953**

The reliability and validity analysis presented in Table 3 confirms that the constructs of Technology, Emotions, and Engagement exhibit strong composite reliability (CR > 0.70) and acceptable convergent validity (AVE > 0.50). Discriminant validity is also established, as the square root of the AVE for each construct is greater than its corresponding inter-factor

correlations. The moderate positive correlations among Technology, Emotions, and Engagement suggest that while these constructs are interrelated, they remain theoretically and empirically distinct. For example, Technology is positively correlated with Emotions (r = 0.620) and Engagement (r = 0.531), and Emotions also show a significant positive relationship with Engagement (r = 0.595). These results provide strong support for the reliability and validity of the measurement model, confirming that the constructs are appropriate for further structural equation modeling (SEM) and hypothesis testing.

Table 4. *Standardized regression weights of the variables*

			Standardized Regression Weights	S.E.	C.R.	P
Technology integration	↔	Learners' emotion	.782	.081	12.122	.001
Learners' engagement	↔	Learners' emotion	.773	.076	10.324	.002
Technology integration	↔	Learners' engagement	.864	.073	3.768	.001

Note: S.E.: Standard Error; C.R.: Critical Ratio; P: Probability Value

The analysis in Table 4 reveals significant positive relationships among the latent variables. Specifically, technology integration is strongly and positively associated with learners' engagement (r = 0.864, p = 0.001) and learners' emotions (r = 0.782, p = 0.001). In addition, learners' engagement is positively correlated with learners' emotions (r = 0.773, p = 0.002). These standardized regression weights indicate that technology integration plays a crucial role in enhancing both learners' emotional experiences and their level of engagement. Furthermore, the strong relationship between learners' emotions and engagement emphasizes the close connection between affective and behavioral dimensions in learning environments. These findings highlight the importance of effectively integrating technology into educational settings to promote both emotional well-being and active participation. The robustness of these associations is supported by significant critical ratios and low standard errors.



Figure 2. *The final measurement model*

The model presented in Figure 2 illustrates the dynamic and reciprocal relationship among learners' emotions, engagement, and technology integration. Specifically, positive emotions—such as love, pride, and joy—are shown to significantly enhance various dimensions of learner engagement, including behavioral involvement, cognitive investment, and emotional attachment to the learning process. These findings are consistent with Positive Psychology frameworks, particularly the Broaden-and-Build Theory, which posits that positive emotions broaden individuals' thought-action repertoires and build enduring personal and academic resources. In contrast, negative emotions—such as anxiety, shame, or frustration—are shown to constrict attention, reduce motivation, and hinder engagement, leading to more passive or disengaged learning behaviors. Technology integration emerges as a critical mediating factor that links learners' emotional states and external contextual influences—such as learner autonomy, belief systems, task design, and peer interaction—with engagement outcomes. This suggests that technology is most effective when embedded within emotionally supportive and pedagogically sound environments. The model emphasizes that technology alone cannot foster meaningful engagement unless learners feel emotionally secure, cognitively challenged, and socially connected. Therefore, educators and policymakers should prioritize the creation of emotionally enriching learning spaces that promote autonomy, meaningful interaction, and confidence in using technology. Structured, interactive activities that support both emotional well-being and purposeful technology use are essential not only for increasing engagement but also for cultivating long-term academic motivation and digital competence.

Table 5. *Structural model assessment*

Parameter	Estimate	Lower	Upper	P
Technology integration	.594	.345	.789	.002

The structural model assessment reveals that technology integration has a significant positive effect on the dependent variable (Estimate = 0.594, P = 0.002). The 95% confidence interval (0.345 to 0.789) confirms that this effect is consistently positive, supporting the robustness of the relationship. These findings underscore the critical role of technology integration in improving learning outcomes within the educational context. They provide strong evidence for its importance in promoting positive learner experiences and engagement. In other words, approximately 59% of the variation in students' perceptions of technology integration can be explained by the combined influence of their motivation and engagement. This highlights the substantial role these psychological and behavioral factors play in shaping how students perceive and interact with technology in educational settings. Therefore, fostering higher levels of motivation and engagement among students could directly enhance their perceptions of technology integration, leading to more meaningful and effective learning experiences.

5. Discussions

All hypotheses were statistically supported by the empirical results, confirming that Positive Psychology serves as a valid framework for understanding students' perceptions of technology integration in EFL contexts, consistent with prior research (Han & Geng, 2023). The study found that greater learner engagement predicted more positive perceptions of

technology integration ($\beta = 0.823$, $p < 0.001$), which contrasts with the findings of Naylor and Nyanjom (2021), who reported no significant relationship. This discrepancy may reflect differences in sample characteristics or contextual factors, suggesting that learner engagement's predictive role may vary across settings. Moreover, EFL students' positive emotions also showed strong and significant positive relationships with both their perceptions of technology integration ($\beta = 0.768$, $p < 0.001$) and their engagement ($\beta = 0.774$, $p < 0.001$). These effect sizes surpass those reported by Zhao and Wang (2023) and Volet et al. (2019), where the corresponding regression weights were notably lower (e.g., 0.467 in Volet et al., 2019), indicating a possible strengthening of the emotion–engagement nexus in contemporary technology-enhanced environments.

One plausible explanation is that technology-integrated learning environments expose language learners to a wider range of emotional experiences than traditional classrooms (Acosta-Gonzaga & Ramirez-Arellano, 2021). Consistent with Cheng et al. (2023), negative emotions tend to undermine students' engagement with course material, whereas positive emotions foster sustained attention and motivation. Therefore, even when learners perceive technology-enhanced instruction as suboptimal, their positive emotional states may still favorably influence their attitudes toward such integration by enabling better emotional regulation. Furthermore, as positive emotions toward adapting to technology-rich environments increase (Holzer et al., 2023), so too does learner engagement, reinforcing the reciprocal relationship between affective experience and behavioral involvement. These findings build on existing knowledge by emphasizing the critical role of emotional processes in mediating the success of technology use.

The results also highlight that both learners' emotions and engagement contribute positively to their perceptions of technology integration, as detailed in Table 6. Notably, engagement exhibited a larger effect size than emotions, suggesting that learners' motivation and active participation are primary drivers of favorable perceptions of technology-enhanced learning environments. While the emotional effect size was smaller, it remained statistically significant, underscoring the importance of addressing students' emotional challenges alongside cognitive and behavioral factors. This aligns with Liu et al. (2021), who emphasize that technology integration outcomes are shaped by both engagement and emotional experiences. The findings partially replicate earlier studies linking engagement to improved course content quality, learner performance, and instructional philosophy (Lo, 2023; Liu et al., 2021). However, the current study extends prior work by elucidating the indirect role of emotional support mechanisms that do not target course-specific issues directly but help students manage negative emotions. This is evidenced by the significant negative relationship observed between negative emotions and both perceptions of technology integration and learner engagement (Figures 1 and Table 3), consistent with Cheng et al. (2023) and Kruk (2022).

Moreover, the inverse correlation between emotional support and technology integration corroborates prior findings that anxiety and other negative emotional states influence learners' acceptance or rejection of educational technology (Kim & Ketenci, 2020; Parker et al., 2021). Although anxiety shares some features with other negative emotions, extant literature argues these are distinct constructs with unique impacts on technology use. This study's emphasis on learners' perceptions aligns with Han and Geng (2023), who advocate shifting the focus from mere technology literacy to students' subjective experiences as key

indicators of successful integration. The results reinforce arguments by Sung (2023) and Volet et al. (2019) that engagement and emotional responses must be considered when evaluating technology's educational impact.

It is important to note that technology adoption often occurs in contexts where participation is compulsory, limiting immediate insight into emotional or educational benefits. As Shen et al. (2023) argue, voluntary participation and motivation are critical for assessing true technology integration success. Accordingly, this study suggests that emotional engagement and active learner involvement serve as more valid indicators of success than mere usage metrics. Students satisfied with their technology experiences tend to achieve more sustained learning outcomes, corroborating findings by Zawodniak et al. (2023).

This research also contributes to the literature by highlighting the demand side of technology integration—students' experiences and perceptions—whereas many prior studies (Han & Geng, 2023; Kim & Ketenci, 2020) have focused primarily on supply-side factors such as accessibility and infrastructure. The results demonstrate that Positive Psychology provides a robust theoretical foundation for understanding how emotional and engagement factors shape learners' perceptions of technology integration, explaining approximately 64% of variance in engagement and 79% in emotions. These findings emphasize that technology integration is not merely an educational tool but a psychosocial experience where learners' affective states and participation are critical.

Surprisingly, while educational technology research often centers on functional capabilities, this study supports Sung's (2023) call for addressing students' psychological needs within technology-enhanced environments. The distinct patterns between engagement and emotions have practical implications: higher education institutions should incorporate student perceptions into technology implementation decisions to ensure alignment with learners' educational and emotional needs. For educators, fostering emotional support—through empathy, connection, and attention—is vital, especially in online or high-stress contexts where technology use alone cannot guarantee success. Finally, for technology developers, improving human-computer interfaces to support emotional expression and social interaction could mitigate challenges posed by limited face-to-face contact, enhancing engagement and emotional support in digital learning environments. Interactive features that facilitate student communication and emotional sharing may lead to deeper engagement and more effective technology use.

6. Conclusion

The study explored how emotional and educational antecedents influence students' perceptions of technology integration. The findings reveal that students' engagement and emotions play a significant role in shaping these perceptions. Unlike previous studies in broader contexts, this research confirmed that engagement and emotions are more influential than technology literacy in technology-integrated learning environments. These results enhance our understanding of students' perceptions of technology integration and emphasize the importance of combining emotional support with educational support to encourage greater technology use, especially in environments with negative emotions. It is important to interpret the findings and implications of this study with caution, as the data were col-

lected in China, which may limit the generalizability of the results. However, we argue that China's extensive use of technology serves as a typical example of a technology-integrated environment, characterized by advanced technology infrastructure but limited face-to-face interaction. Additionally, the findings of this study have broad implications for understanding technology integration in other countries with similar characteristics. For countries with different attributes, we believe the results of this study can still be applicable, although further empirical research is needed. The study's findings also confirm the significant role of students' emotions in technology integration. Future research should focus on examining the impact of negative emotions more extensively and across diverse educational settings.

Theoretically, this study contributes to the growing body of literature that integrates emotional and engagement-based constructs within the context of technology-enhanced language learning, particularly through the lens of Positive Psychology. The findings confirm that both emotional experiences and behavioral engagement play crucial roles in shaping EFL learners' perceptions of technology integration. The strong positive relationships observed between technology integration, learners' engagement, and emotions indicate a dynamic interaction between affective and behavioral factors. This supports the theoretical view that successful technology adoption in education requires more than just focusing on cognitive outcomes. It aligns with Positive Psychology's focus on learners' well-being, optimism, and emotional fulfillment as key elements for effective learning. Additionally, the study provides empirical evidence that emotions and engagement together account for over half of the variance in students' perceptions of technology integration, underscoring their significant predictive role in educational technology research. Practically, the findings provide valuable insights for educators, curriculum designers, and policymakers aiming to create more engaging and emotionally supportive learning environments through technology. The strong connections observed in the study suggest that improving students' emotional experiences and engagement can significantly enhance their acceptance and use of educational technologies. Therefore, educators should focus not only on the functional aspects of technology but also on designing learning activities that promote positive emotions, such as joy, curiosity, and a sense of accomplishment. Teacher training programs should include strategies for providing emotional support and motivation within digital learning environments. Furthermore, institutions should invest in user-friendly, emotionally responsive platforms that encourage social interaction and minimize frustration, ultimately improving learner satisfaction and educational outcomes. By emphasizing the crucial role of emotions and engagement, this study highlights the importance of adopting a more holistic, learner-centered approach to technology integration in EFL classrooms.

Despite its significant contributions, this study has several limitations that should be acknowledged. First, the research relied solely on self-reported questionnaire data, which may be subject to social desirability bias or inaccuracies in participants' perceptions of their own engagement and emotional responses. Future studies could adopt a mixed-methods approach by incorporating classroom observations, interviews, or digital trace data to triangulate findings and provide a more comprehensive understanding of learners' experiences. Second, the sample was limited to Chinese EFL learners enrolled in technology-supported language programs, which may limit the generalizability of the results to other cultural or educational contexts. Future research should include cross-cultural comparisons to examine

whether the relationships between technology integration, engagement, and emotions vary across different socio-cultural settings. Third, the study assessed learners' perceptions at a single point in time, which limits insights into how these constructs may evolve over time with prolonged exposure to technology-enhanced learning environments. Longitudinal studies are recommended to explore causal relationships and the longitudinal effects of technology integration on learner engagement and emotional development. Finally, the emotional dimensions explored in this study were broad and general; future research could benefit from examining specific emotions (e.g., enjoyment, anxiety, pride) and their distinct effects on engagement and perceptions of technology use in the classroom.

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