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The Integration of Digital Technology in English Language Learning: Investigating Information Technology Undergraduates' Perceptions and Engagement

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Abstract: This article investigates the perceptions and engagement of information technology (IT) undergraduates in digital technology-integrated English language learning (ELL) within a Vietnamese tertiary context. The mixed-methods research involved 100 first-year IT students at FPT University's Hoa Lac Campus in Hanoi, Vietnam who completed an online survey, of whom 10 also participated in semi-structured interviews. The survey, developed based on the technology acceptance model (TAM) and engagement theory, examined the perceived usefulness of digital technology, its perceived ease of use, and student behavioral, cognitive, and emotional engagement with it. Quantitative data were analyzed through descriptive statistics, while qualitative data obtained from the interviews were subjected to thematic analysis to provide deeper insights. The findings revealed that the IT undergraduates expressed highly positive perceptions of the integration of digital technology in ELL, emphasizing its usefulness, accessibility, and relevance to their academic and professional goals. They demonstrated strong behavioral and cognitive engagement by actively utilizing digital platforms and online tools to support their learning process. However, their emotional engagement appeared inconsistent, as some participants reported fatigue and reliance on digital support. The article concludes by arguing that while digital integration enhances learner motivation and self-regulation, sustained engagement requires balanced task design, reflective technology use, and continuous institutional support. The findings offer guidance for educators and policymakers in designing pedagogically grounded, human-centered digital learning environments.

Keywords: digital technology integration; English language learning (ELL); student perception; student engagement; information technology (IT) undergraduates.

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1. Introduction

Digital transformation has profoundly reshaped higher education in the twenty-first century, redefining how languages are taught and learned in increasingly technology-rich environments. In English language learning (ELL), digital tools have evolved from supplementary aids into essential pedagogical resources that

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influence instructional design, learner engagement, and educational outcomes. The integration of mobile learning, online applications, and emerging artificial intelligence (AI) technologies has significantly transformed the landscape of English teaching and learning in higher education, fostering more interactive, flexible, and innovative learning environments (Wang and Kabilan 2024).

Over the past decade, technology-enhanced language learning (TELL) has become a prominent approach in higher education rather than a peripheral innovation. Reviews and meta-analyses confirm that the integration of mobile learning and information and communication technology (ICT)-based resources can improve the accessibility and efficiency of English language learning, thereby enriching students' overall proficiency and engagement (Iberahim et al. 2023; Nurmala et al. 2023). However, as studies have shown, technological presence alone does not ensure effective learning. The success of technology integration depends largely on students' perceptions, attitudes, and engagement with digital tools. Research demonstrates that learners' behavioral, cognitive, and emotional involvement plays a crucial role in determining the pedagogical effectiveness of these technologies (Dewi 2022; Yu et al. 2022).

Within this global trend, the Vietnamese higher-education system has also accelerated its digital transformation, emphasizing the integration of technology and AI into curriculum design and foreign language education. Universities such as FPT have become early adopters of digital platforms, blending traditional pedagogy with online and AI-supported learning tools. Yet, while many studies have examined English majors or general English as a Foreign Language (EFL) populations (Sijono et al. 2025; Dewi 2022; Nguyen Thi Xuyen 2024; Pham Nguyen Khanh Thi et al. 2024), there remains limited empirical evidence on how technology-oriented learners, particularly information technology (IT) undergraduates, perceive and engage with digital technology in ELL contexts. This gap is significant because IT students' digital literacy and familiarity with software ecosystems may shape distinct learning attitudes and engagement patterns compared to non-technical learners. Understanding IT students' digital learning behaviors can help educators design more discipline-relevant and balanced English learning experiences, while informing institutional policies that align digital literacy development with communicative and critical-thinking goals.

To capture a holistic view of these dynamics, this study employs a mixed-methods design, combining quantitative and qualitative data to explore both the general trends and contextual depth of students' experiences. Survey data capture overall patterns in IT undergraduates' perceptions of digital technology, while interviews provide the contextual and affective depth needed to understand how these students actually engage with digital tools in practice. Grounded in the technology acceptance model (TAM) (Revythi and Tselios 2019) and engagement theory (Fredricks et al. 2004), the research integrates insights on perception, technology adoption, and multidimensional engagement.

The study makes three key contributions. Theoretically, it extends the TAM by linking perceived usefulness and ease of use to behavioral, cognitive, and emotional engagement outcomes. Methodologically, it demonstrates the value of integrating survey and interview data to capture the complexity of digital learning behavior. Contextually, it provides one of the first empirical analyses of how Vietnamese IT undergraduates

experience digital technology-enhanced ELL in higher education. Accordingly, the study seeks to address two research questions:

1. What are IT undergraduates' perceptions of digital technology integration in ELL?

2. How do IT undergraduates engage in technology-integrated ELL?

By addressing these questions, the article offers both empirical evidence and theoretical insight into how technological expertise shapes language learning in digitally transforming higher-education contexts.

2. Literature Review and Conceptual Framework

2.1. Digital Technology Integration in ELL

The integration of digital technology into ELL has evolved significantly over the past two decades. Foundational work in computer-assisted language learning (CALL) established the pedagogical potential of technology to provide authentic input, interaction, and feedback for learners (Chapelle 2001; Levy and Stockwell 2006). These early frameworks underscored the importance of aligning technological tools with sound instructional principles, forming the basis for subsequent advances in TELL. Recent studies show that learning management systems, mobile applications, and web-based platforms now create interactive, learner-centered environments that enhance motivation, engagement, and communicative competence (Iberahim et al. 2023). These affordances enable learners to access authentic and multimodal input, bridging the gap between classroom instruction and real-world language use. Empirical findings also highlight measurable gains in specific language skills. For example, Rahnavard and Mashhadi Heidar (2017) demonstrated that CALL and web-based instruction significantly improved EFL learners' pronunciation performance. Meta-analytical studies further confirm that digital integration enhances students' proficiency, autonomy, and higher-order thinking through collaborative and intelligent systems (Nurmala et al. 2023).

Wang and Kabilan (2024) also observed increasing research attention to technology-supported ELL. Their bibliometric analysis showed steady growth in publications and shifting themes, reflecting a broader move toward digitally mediated learning. Similarly, Sijono et al. (2025) found that English language majors increasingly hold positive perceptions of digital technology, recognizing it as a motivating and supportive element that enhances engagement, confidence, and autonomy in language learning. Overall, the literature highlights a clear shift: digital tools have moved from supplementary aids to essential components in university-level ELL programs.

2.2. Learners' Perceptions of Digital Technology Integration

Learners' perceptions are a critical determinant of how effectively educational technologies are adopted and sustained in language learning contexts. Within the framework of the TAM, these perceptions can be understood through three interrelated constructs: perceived usefulness, perceived ease of use, and attitude toward technology (Revythi and Tselios 2019).

"Perceived usefulness" refers to the extent to which learners believe that digital tools enhance their language learning efficiency, accuracy, and outcomes. Studies consistently show that when students recognize the instructional value of

technology, they are more motivated to integrate it into their learning practices. Dewi (2022) found that students in project-based writing courses perceived digital tools as useful for promoting creativity, collaboration, and efficient task completion. Similarly, Nguyen Thi Xuyen (2024) reported that Vietnamese English majors viewed AI-based tools such as Grammarly and ChatGPT as highly useful for improving feedback and linguistic accuracy. These findings align with meta-analytical results showing that technology-enhanced environments improve performance and autonomy through collaborative and intelligent systems (Nurmala et al. 2023).

"Perceived ease of use" plays a critical role in determining learners' willingness to engage with technology by shaping their confidence and sense of control in digital learning environments. When students perceive technological tools as intuitive and accessible, they are more likely to persist in using them and to participate actively in learning tasks. Yu (2022) found that user-friendly digital environments can reduce anxiety, strengthen communication confidence, and promote sustained participation among language learners. Similarly, Lo et al. (2024) reported that the perceived usability of AI tools – particularly chatbots and automated feedback systems – directly influences learners' acceptance and satisfaction levels, especially when appropriate guidance and training are provided. Together, these findings underscore the importance of designing supportive, easy-to-navigate digital platforms that foster both engagement and sustained learning outcomes.

Finally, "attitude toward technology" reflects learners' overall emotional and evaluative response to digital integration. Positive attitudes often emerge when students perceive both usefulness and ease of use, leading to sustained motivation and engagement. However, as Nguyen Thi Xuyen (2024) noted, such attitudes may be tempered by concerns about ethical use and dependency on AI-generated outputs. A review by Lo et al. (2024) highlighted this duality: AI tools can increase engagement, yet excessive reliance may reduce critical thinking.

Collectively, these findings demonstrate that learners' perceptions of digital technology are multidimensional and interdependent. Specifically, usefulness and ease of use shape attitudes, which then influence behavioral and emotional engagement. Understanding these relationships within the TAM framework provides a theoretical foundation for analyzing how students accept, value, and sustain technology-enhanced ELL experiences.

2.3. Learners' Engagement in Technology-Integrated Learning

Engagement is one of the most significant outcomes of digital technology integration. Drawing on the framework of Fredricks et al. (2004), engagement is understood as a multidimensional construct encompassing behavioral, cognitive, and emotional dimensions. Numerous studies have confirmed that technology-supported learning can enhance these dimensions of engagement. For example, Yaqoob et al. (2025) demonstrated that digital integration in EFL classrooms promotes motivation, participation, and perseverance. Similarly, Pham Nguyen Khanh Thi et al. (2024) found that e-learning tools in online speaking classes fostered interaction and self-regulated learning, although some learners reported digital fatigue. Mobile-assisted collaborative language learning has also been shown to strengthen both social interaction and emotional engagement

(Yuan et al. 2025). Comparative studies further affirm that TELL methods enhance student participation and academic achievement when compared with traditional instruction (Ortikov 2024).

Additionally, Yu et al. (2022) found that mobile and social media technologies extend engagement by connecting classroom learning with students' daily practices and interests. The recent integration of AI chatbots such as ChatGPT has been associated with increased participation and curiosity, though concerns remain about authenticity and critical thinking (Lo et al. 2024). Taken together, these studies show that technology enriches engagement but also introduces challenges such as overuse, distraction, and dependence. These issues require careful pedagogical management.

2.4. Conceptual Framework

This study adopts an integrated conceptual framework that combines the TAM and engagement theory to investigate IT undergraduates' perceptions and engagement in TELL.

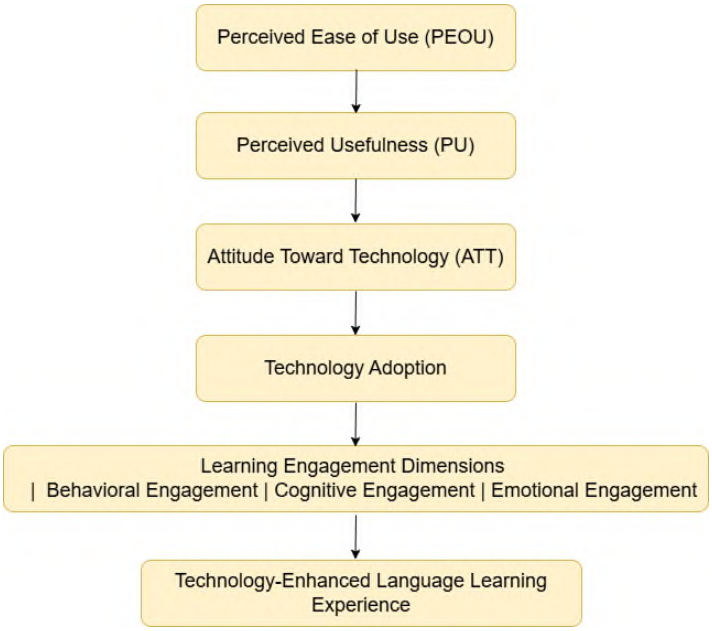
According to TAM, two primary cognitive beliefs – perceived usefulness and perceived ease of use – influence users' attitude to technology, which in turn shape their behavioral intentions and actual technology use (Revythi and Tselios 2019). In this research, TAM guided the development of survey items assessing how students evaluate the relevance, accessibility, and effectiveness of digital tools such as Google Classroom, Padlet, Canva, and AI-assisted applications like Grammarly and ChatGPT.

Complementing the TAM, engagement theory (Fredricks et al. 2004) explains what happens after adoption has occurred – that is, how learners participate, think, and feel during technology-mediated learning. It conceptualizes engagement as a multidimensional construct encompassing behavioral (participation and effort), cognitive (strategic and self-regulated learning), and emotional (interest, motivation, and affective reactions) dimensions. These engagement dimensions informed both the construction of the engagement-related survey items and the coding framework for qualitative interview analysis.

By combining TAM and engagement theory, the study creates a triangulated analytical lens linking technology acceptance with learning engagement. The TAM constructs (perceived use, perceived ease of use, and attitude towards technology) explain why students adopt technology, while engagement theory elucidates how they sustain and deepen participation once technology is integrated into learning. This theoretical integration provides a comprehensive understanding of learners' digital experiences, bridging cognitive, affective, and behavioral processes across both quantitative and qualitative data.

The integration of the two frameworks also shaped the mixed-methods design. The survey measured the TAM and engagement variables, while interviews explored students' subjective experiences, motivations, and emotional responses. This methodological triangulation ensured that quantitative trends were enriched with qualitative depth, allowing for a nuanced interpretation of technology acceptance and engagement in ELL.

Figure 1: *TAM–Engagement theory framework for technology-integrated ELL*



2.5. Research Gap

Although substantial research has demonstrated the benefits of TELL in improving language learning across different educational contexts (Iberahim et al. 2023; Nurmala et al. 2023; Wang and Kabilan 2024), few studies have focused on IT undergraduates—a group uniquely positioned at the intersection of technological expertise and language acquisition. Prior perception studies have focused mainly on English majors (Nguyen Thi Xuyen 2024; Sijono et al. 2025; Yu 2022) or general EFL learners (Dewi 2022). As a result, less is known about how technology-oriented learners perceive and engage with digital integration. Similarly, engagement research has examined mobile, AI, and social-media tools (Lo et al. 2024; Ortikov 2024; Pham Nguyen Khanh Thi et al. 2024; Yaqoob et al. 2025; Yu et al. 2022; Yuan et al. 2025), but rarely among IT undergraduates. This group often adopts digital tools early, yet little is known about how they translate these affordances into meaningful engagement. Addressing this gap, the present article aims to contribute new insights into the perceptions and engagement behaviors of IT students within a Vietnamese higher-education context, thereby enriching the global understanding of digital technology integration in ELL.

3. Methodology

3.1. Research Design

This study adopted a mixed-methods convergent parallel design to address two interrelated research questions: (1) How do IT undergraduates perceive digital technology integration in English language learning? And (2) how do they engage in technology-mediated learning activities? In this design, quantitative and qualitative data were collected concurrently and analyzed separately, with findings later integrated during interpretation to provide a more comprehensive understanding of learners' experiences. The quantitative survey captured generalizable patterns in perceptions and engagement, while the

qualitative interviews offered contextual depth and personal perspectives that clarified and expanded on statistical trends.

A mixed-methods approach was adopted because it appears to offer a more balanced way to capture both the breadth and the contextual nuance of IT undergraduates' ELL experiences. Survey data may reveal general patterns in perceived usefulness, ease of use, and engagement, but these measures are unlikely to capture the situational or affective factors that shape how students actually work with digital tools. The qualitative component therefore provides complementary insight. Interview responses help clarify why certain patterns emerge, may indicate how students negotiate digital tasks in practice, and could reveal issues – such as fluctuating motivation or reliance on AI tools – that are not easily observable through quantitative data alone. Although the interview sample includes 10 participants, this number is likely sufficient for an exploratory study within a relatively homogeneous cohort and provides enough information power for triangulation. Taken together, the two strands could strengthen the interpretive depth of the study. This integration aligns with Creswell and Plano Clark's (2018) view that mixed-methods designs may enhance methodological rigor by combining convergent forms of evidence.

3.2. Participants and Sampling Procedure

A non-probability sampling strategy was employed, combining convenience sampling for the quantitative survey and purposive sampling for the qualitative interviews. The convenience sampling approach was used to recruit 100 first-year IT undergraduates from FPT University's Hoa Lac Campus in Hanoi, Vietnam. This method was considered appropriate given the exploratory nature of the study and the accessibility of participants within a clearly defined institutional context (Etikan et al. 2016). The purpose of the quantitative phase was to map perceptions and engagement patterns rather than to perform inferential modeling, so 100 students provided sufficient variability across a relatively homogeneous cohort. All participants were full-time IT majors enrolled in compulsory English courses that integrated digital platforms such as Google Classroom, Edunext, and Padlet. Based on the university placement test, the majority of these students ranged from intermediate to high-intermediate English language proficiency (B1-B2). The cohort included both male and female students, with a higher proportion of male participants, which reflects the typical gender distribution among IT undergraduates. Regarding digital literacy, students were generally familiar with core online learning platforms and commonly used AI tools. Students from other disciplines, later academic years, or with incomplete responses were excluded. Although convenience sampling limits statistical generalization, it offers an efficient way to gather data from a homogeneous, information-rich group, providing relevant insights into technology-enhanced ELL practices within FPT University.

For the qualitative phase, purposive sampling was applied to select 10 students from the survey respondents, a number appropriate for achieving depth of insight while keeping the dataset manageable for detailed thematic analysis. This sample size also enabled the researcher to probe the mechanisms underlying the quantitative trends without aiming for representativeness. Participants were chosen to ensure diversity in gender, English proficiency, and reported levels of digital engagement. This method allowed for

deeper exploration of individual experiences, focusing on participants capable of articulating reflective and detailed perspectives (Palinkas et al. 2015).

The combined use of convenience and purposive sampling strengthened the overall design: survey data offered a broad understanding of general trends, while interviews provided interpretive depth and contextual richness. All participants were fully briefed about the study's objectives and voluntarily provided informed consent (see Ethical Considerations below).

3.3. Data Collection Instruments

Two instruments were employed for data collection: a structured questionnaire and semi-structured interviews. The survey instrument was adapted from the TAM and engagement theory frameworks. Items measuring perceived usefulness, perceived ease of use, and attitudes toward technology were derived from the TAM (Revythi and Tselios 2019), while behavioral, cognitive, and emotional engagement items were based on the model proposed by Fredricks et al. (2004). The questionnaire comprised 20 items, including 12 items measuring learners' perceptions (perceived use, perceived ease of use, and attitude towards technology) and eight items measuring behavioral, cognitive, and emotional engagement. All items were rated on a five-point Likert scale ranging from 1 ("strongly disagree") to 5 ("strongly agree").

Prior to the main data collection, a pilot test was administered to 20 IT students from a comparable background to evaluate the clarity and internal consistency of the items. Minor wording adjustments were made based on participant feedback. The questionnaire demonstrated high reliability, with a Cronbach's alpha coefficient of 0.91, indicating excellent internal consistency. The final version of the survey was distributed online through Google Forms to ensure accessibility and align with the digital learning context of the participants.

For the qualitative component, semi-structured interviews were conducted to gain deeper insights into students' perceptions and experiences with digital technology in ELL. Each interview lasted approximately 20-30 minutes and was conducted in either English or Vietnamese, depending on participants' language preference. Allowing participants to use their preferred language was intended to minimize language-related constraints and enable them to express their experiences and perspectives more fully. As language choice could influence how participants articulated their experiences, interviews conducted in Vietnamese were analyzed in the original language, and selected excerpts were translated into English for reporting to preserve the intended meaning as closely as possible. The interview guide consisted of six open-ended questions covering students' use of digital tools, perceived ease or difficulty of use, participation and collaboration, use of AI and online resources, emotional responses, and technical or contextual challenges. With participants' consent, all interviews were audio-recorded and later transcribed verbatim for thematic analysis.

3.4. Data Analysis

Quantitative data were analyzed using descriptive statistics including means, frequencies, and standard deviations, which were calculated to identify general trends in students' perceptions of and engagement with digital technology in ELL. Given the exploratory nature of the study and the sample size, more advanced procedures such as ANOVA, correlation analyses, or factor-analytic techniques were not feasible. Nevertheless, such analyses may be appropriate for further research aiming to

test theoretical relationships among TAM and engagement constructs.

Qualitative data were analyzed manually following Braun and Clarke's (2006) six-phase framework for thematic analysis. The author first read and re-read the interview transcripts to become familiar with the data, then generated initial codes inductively to capture recurring ideas and expressions. These codes were subsequently organized into broader themes such as perceived usefulness, learning motivation, digital engagement, and challenges in technology-mediated learning. Throughout the process, the researcher maintained reflexive notes to ensure consistency and analytical rigor.

To enhance validity, interpretive triangulation was employed by integrating quantitative and qualitative findings. The survey results provided a general overview of patterns in students' perceptions and engagement, while interview data offered explanatory depth and contextual insight. This combined analysis provided a holistic understanding of how IT undergraduates experience and engage with digital technology in ELL.

3.5. Ethical Considerations

All participants were informed of the study's aims, procedures, and their rights, including the option to withdraw at any stage without penalty. Informed consent was obtained electronically for both survey and interview participation. To maintain confidentiality, all identifying information was anonymized, and data were securely stored in password-protected digital folders accessible only to the author. All personal identifiers were removed, and pseudonyms were used in the transcription and reporting stages. As the study involved minimal risk and focused solely on students' learning experiences, participants were assured that their responses would not affect their academic standing. Data will be retained for a limited period and securely deleted thereafter. Regarding ethical approval, according to official confirmation from the Office of Science Management, FPT University, this study was exempt from formal institutional ethics review, as the university does not operate an Institutional Review Board (IRB) for anonymous, minimal-risk social science surveys. The researchers adhered to standard ethical principles, including voluntary participation, informed consent, and the protection of participants' privacy.

4. Findings

4.1. Quantitative Findings

The quantitative results revealed that IT undergraduates generally held highly favorable perceptions of the integration of digital technologies into ELL. The survey data demonstrated that students not only accepted but also actively embraced the presence of digital tools in their academic routines. As shown in Table 1, all three dimensions of the TAM – perceived use, perceived ease of use, and attitude towards technology – received mean scores above 4.0 on a five-point Likert scale, indicating a strong level of agreement and consistent endorsement of TELL as an effective approach to English acquisition.

Table 1: *Students' perceptions of digital technology integration*

Dimension	Mean (M)	Standard Deviation (SD)	Interpretation
Perceived usefulness	4.12	0.83	High
Perceived ease of use	4.05	0.79	High
Attitudes toward technology	4.08	0.81	High

Among these dimensions, perceived use achieved the highest mean score (M = 4.12, SD = 0.83), showing that most students believed digital tools such as Google Classroom, Padlet, and ChatGPT improved their learning efficiency and collaboration. Respondents frequently agreed that these tools helped them understand lessons better, complete assignments more effectively, and work collaboratively in real time.

The dimension of perceived ease of use was also positively evaluated (M = 4.05, SD = 0.79). This result suggests that the majority of participants found digital platforms intuitive, convenient, and accessible. Students reported that they could easily navigate learning management systems and use online applications to manage coursework and communication.

Attitude towards technology (M = 4.08, SD = 0.81) was similarly favorable, reflecting enthusiasm for digitalized English lessons and recognition of technology's relevance to academic development and future careers. Despite this positive outlook, some respondents expressed concern about over-reliance on AI tools, distractions during online learning, and insufficient teacher guidance when using digital applications. These findings indicate that while students strongly recognize the pedagogical benefits of digital technology, they are also aware of its limitations when not supported by effective instructional design.

Regarding student engagement, the results were also encouraging though slightly more varied across the three dimensions of engagement: behavioral, cognitive, and emotional. As summarized in Table 2, behavioral engagement recorded the highest mean score, followed by cognitive and emotional engagement.

Table 2: *Students' engagement dimensions in technology-integrated learning*

Dimension	Mean (M)	Standard Deviation (SD)	Interpretation
Behavioral engagement	3.95	0.88	High
Cognitive engagement	3.82	0.91	Moderate to High
Emotional engagement	3.70	0.95	Moderate to High

Behavioral engagement (M = 3.95, SD = 0.88) reflected students' active participation in online discussions, group projects, and collaborative activities. They frequently contributed through digital platforms and demonstrated consistent involvement in technology-mediated coursework.

Cognitive engagement (M = 3.82, SD = 0.91) indicated that many students used deeper learning strategies, such as revising written drafts with AI feedback, consulting online resources, and monitoring their own progress. This reflects that learners are using technology to support self-directed learning and improve performance.

Emotional engagement, however, received a slightly lower mean score (M = 3.70, SD = 0.95). While most students reported enjoyment and motivation when using technology, some also experienced distraction or fatigue during extended online study sessions. These mixed emotional responses suggest that maintaining consistent affective engagement remains more challenging than promoting participation or strategy use.

Overall, the survey data demonstrate a high level of acceptance and active engagement with technology among IT undergraduates at FPT University. Students view digital tools as helpful, accessible, and relevant to their learning. Nevertheless, variations in emotional engagement and reported concerns about over-reliance on AI tools indicate that continued pedagogical support and balanced technology integration are essential for sustaining effective learning experiences.

4.2. Qualitative Findings

Semi-structured interviews with 10 students provided a deeper and more contextualized understanding of how IT undergraduates perceive and engage with digital technology in ELL. Thematic analysis generated four interrelated themes: motivation and confidence, collaboration and participation, over-reliance on AI tools, and technical and contextual barriers. These themes complement the quantitative results and collectively illustrate the behavioral, cognitive, and emotional dimensions of engagement outlined in engagement theory (Fredricks et al. 2004), while reflecting how perceptions of usefulness and ease of use (as defined in the TAM) influence learners' experiences.

To enhance methodological transparency, Table 3 summarizes the coding structure used to organize the interview data into four overarching themes and related sub-themes; participant identifiers (S1–S10) are provided with the interview excerpts.

Table 3: *Summary of the qualitative coding structure*

Theme	Sub-theme	Representative codes
Motivation and confidence	Instant and personalized feedback; increased autonomy; short-term motivation	Immediate error correction; progress tracking; self-regulation
Collaboration and participation	Enhanced peer interaction; real-time co-creation; improved coordination and communication	Equal participation; peer support; co-editing; shared responsibility
Over-reliance on AI tools	Surface-level processing; dependence on automation; need for teacher scaffolding	Uncritical acceptance of AI output; reduced self-checking; reliance on AI; request for guidance
Technical and contextual barriers	Connectivity and device issues; platform overload and cognitive fatigue; unequal digital literacy and guidance	Internet disruption; switching platforms; fatigue; unclear instructions

4.2.1. Motivation and Confidence

A prominent theme emerging from the interviews was the enhancement of motivation and self-confidence through interactive and AI-supported tools. Nearly all participants said that applications such as Grammarly, ChatGPT, and Google Translate helped them improve writing accuracy, vocabulary range, and sentence construction. These tools provided instant, individualized feedback, which students found empowering. One participant reflected that: "When I use ChatGPT or Grammarly, I can see my mistakes and fix them immediately. It's like having a teacher who never gets tired" (S3). Such feedback loops appeared to reinforce self-efficacy and fostered a sense of autonomy in learning. Several participants mentioned that being able to track their progress and evaluate their performance independently made them "feel more in control" of their ELL. For instance, one student noted that: "I can compare my writing before and after using AI tools, and that motivates me to keep improving" (S7).

However, students also acknowledged the emotional cost of constant digital engagement. Many reported experiencing fatigue or declining concentration after prolonged screen time. As one student explained: "After spending many hours doing online activities, my eyes and mind get tired. Sometimes I lose interest even though I like the tools" (S1). This dual effect suggests that while digital tools effectively enhance short-term motivation, sustained emotional engagement requires task variation and balance between online and offline learning modes.

4.2.2. Collaboration and Participation

Another significant theme was collaboration and inclusivity in technology-mediated learning. Students emphasized that digital platforms, particularly Padlet, Canva, and Google Docs, created interactive spaces that encouraged participation and peer connection. One student shared the following view: "When my group works on Padlet, everyone can post ideas instantly. It feels fair because even shy students can contribute without pressure" (S5). These tools fostered behavioral engagement by promoting active participation and social interaction. Group projects completed on digital platforms were often described as more creative and cohesive compared to traditional formats. As another participant observed: "Using Canva or Google Docs makes group work easier and more enjoyable. We can design, edit, and discuss at the same time—it feels like teamwork in real time" (S9).

Participants also highlighted that online collaboration enhanced communication and problem-solving skills. They appreciated the sense of shared ownership that technology afforded. In the words of one participant: "We all see what others are doing, so it's easier to coordinate. It makes me feel responsible to do my part" (S2). However, several students also noted that unequal participation sometimes persisted, especially when certain members were less digitally competent or had connectivity issues. Still, most agreed that digital collaboration reduced hierarchy, encouraged peer learning, and made the learning environment more democratic.

4.2.3. Over-Reliance on AI Tools

While most students expressed enthusiasm toward AI-based applications, several voiced critical awareness of the risks of over-dependence. They recognized that tools such as ChatGPT, Grammarly, and QuillBot often provided correct or convenient answers, but not necessarily

meaningful understanding. One participant admitted that: "Sometimes I copy ChatGPT's suggestions without really thinking why they are correct. It saves time but doesn't help me think" (S8). This theme highlights a tension between cognitive efficiency and depth of learning. While automation enhances productivity, it can discourage analytical reasoning and creative expression if used unreflectively. Another student stated that: "I rely too much on Grammarly. It fixes grammar, but I realize I stop checking my own sentences carefully" (S4).

These reflections resonate with the cognitive dimension of engagement, underscoring that technology-mediated learning is most effective when students are encouraged to reflect on AI-generated feedback rather than merely accept it. Several participants expressed a desire for clearer teacher guidance on how to use AI critically, echoing the quantitative finding that pedagogical mediation is essential to sustain meaningful engagement. As one remarked: "I think AI is great, but teachers should show us how to use it smartly, not blindly" (S10).

4.2.4. Technical and Contextual Barriers

Despite their generally positive attitudes, students encountered technical and contextual challenges that affected both engagement and learning outcomes. The most common issue was unstable internet connectivity, which disrupted online collaboration and reduced motivation. As one participant put it: "When the connection drops during a group task, it's hard to stay focused or finish on time" (S6). Other recurring problems included limited device access, software compatibility, and unclear teacher instructions on how to use digital tools effectively. One student noted that: "Sometimes we are told to use a new platform, but we don't receive enough guidance. It's confusing and time-consuming" (S3).

These barriers not only interrupted behavioral participation but also weakened emotional engagement, leading to frustration and disengagement. Moreover, contextual inequities – such as differences in home internet quality or digital experience – created disparities among students. The findings thus emphasize that institutional infrastructure, teacher training, and digital inclusivity are crucial for ensuring equitable and sustainable technology use in ELL.

5. Discussion

The following discussion interprets the findings through the dual theoretical frameworks of the TAM and engagement theory, which together provide a coherent and extended lens for understanding IT undergraduates' perceptions and engagement in TELL. While the TAM explains why students adopt digital tools, engagement theory elucidates how they interact, think, and feel during the learning process.

5.1. Perceptions of Digital Technology Integration

Findings from the first research question posed at the beginning of this article (What are IT undergraduates' perceptions of digital technology integration in ELL?) revealed that IT undergraduates engage with technology from a comparatively elevated baseline of digital fluency. This prior competence appears to shape how they interpret usefulness and ease of use, suggesting that the TAM may function in a compressed form for this cohort. Rather than progressing gradually from ease of use to usefulness and then to attitude formation, acceptance seems to occur almost

immediately, driven by students' familiarity with technological ecosystems and their routine interaction with digital tools. In this light, the high perceived usefulness score (M = 4.12) does not simply show that tools such as Google Classroom, Padlet, or ChatGPT are effective. It may also indicate that students evaluate usefulness through a technologically oriented lens, one already informed by their software experience and expectations of efficiency. This interpretation aligns with research showing that technology-enhanced environments can strengthen motivation, autonomy, and communicative competence when pedagogically grounded (Iberahim et al. 2023; Nurmala et al. 2023).

Perceived usefulness and perceived ease of use therefore interact differently in this population compared with more general EFL learner groups. For digitally fluent IT students, familiarity with software ecosystems reinforced their readiness to integrate technology into ELL. Yet, qualitative data extended the TAM's scope: despite high acceptance, some students acknowledged over-dependence on AI and a need for clearer pedagogical guidance—echoing the work of Lo et al. (2024) and Nguyen Thi Xuyen (2024). These nuances demonstrate that technology adoption alone does not guarantee deep learning. Instead, reflective teacher mediation and structured digital pedagogy are necessary to transform acceptance into critical engagement and sustainable learning habits.

5.2. Learner Engagement in Technology-Integrated Learning

Quantitative and qualitative results revealed that students exhibited strong behavioral engagement, which is demonstrated through active participation in collaborative projects, online discussions, and peer learning activities. This finding corroborates earlier studies emphasizing that interactive tools enhance student participation, collaboration, and sustained involvement (Yaqoob et al. 2025; Yuan et al. 2025). Digital platforms like Padlet and Canva appeared to promote inclusivity and creativity, allowing learners to engage more equally and productively.

Cognitive engagement was also evident through students' use of AI tools and online resources to revise drafts, cross-check language, and improve accuracy. These strategies reflect a self-regulated learning process, consistent with Ortikov's (2024) findings that technology integration can strengthen learners' metacognitive skills when supported by clear guidance. However, rather than simply reinforcing learning efficiency, the interviews suggest that cognitive engagement operates as a double-edged mechanism. While students benefited from rapid feedback and convenient revisions, their tendency to accept AI-generated suggestions without deeper evaluation points to a weakening of analytical reasoning, echoing concerns raised in previous research (Dewi 2022; Lo et al. 2024). Emotional engagement, however, emerged as the most variable dimension. While many participants reported increased motivation, confidence, and enjoyment when using digital tools, others described fatigue and distraction during extended online sessions. As Fredricks et al. (2004) argue, affective engagement is highly sensitive to contextual influences such as cognitive load, task design, and instructional clarity. Similar observations were made by Pham Nguyen Khanh Thi et al. (2024), who found that students' motivation fluctuates when e-learning lacks novelty or adequate teacher feedback. In the present study, emotional disengagement appears to emerge when digital tasks become repetitive or

insufficiently scaffolded, suggesting that emotional engagement may serve as an early indicator of digital fatigue in technology-rich learning environments.

5.3. Theoretical Integration

The integration of the TAM and engagement theory provides a process-oriented explanation of technology-mediated learning. The TAM captures the cognitive drivers of adoption – usefulness and ease of use – while engagement theory elucidates the affective and behavioral mechanisms that sustain learning once adoption occurs. Quantitative results confirmed that favorable perceptions predict initial acceptance, whereas qualitative findings revealed how these perceptions evolve into behavioral, cognitive, and emotional engagement, ultimately influencing persistence and self-regulation.

Themes such as motivation and confidence reflected emotional engagement; collaboration and participation represented behavioral involvement; over-reliance on AI tools highlighted cognitive tension between efficiency and depth; and technical and contextual barriers exposed environmental constraints. Taken together, these themes show that engagement is not simply an outcome of acceptance but a multidimensional process shaped by learners' prior digital fluency, the affordances and constraints of specific tools, and the pedagogical structures surrounding their use.

5.4. Novel Findings

The novel contribution of this study lies in its focused exploration of IT undergraduates in Vietnam – an underrepresented population in ELL research. Unlike English majors or general EFL learners, IT students possess advanced digital literacy and strong expectations for technology-driven learning, shaping their perceptions and engagement in distinctive ways. The findings reveal a duality: while these learners enthusiastically adopt digital tools and demonstrate high motivation and collaboration, their technological fluency also increases risks of over-reliance on AI, surface-level processing, and reduced critical reflection.

By integrating quantitative survey data with qualitative insights, this research advances a nuanced perception-engagement-outcome framework that extends the TAM beyond initial adoption to sustained learning quality. This dual-theoretical approach not only fills a conceptual gap but also provides practical guidance for educators and institutions aiming to design reflective, balanced, and human-centered digital learning environments.

6. Implications and Recommendations

6.1. Teacher-Level Implications

Teachers play a central role in transforming students' positive perceptions into sustained, meaningful engagement. The findings showed that acceptance alone does not guarantee deep learning, especially when some learners tend to rely heavily on AI tools. To address this, instructors may incorporate structured activities that require students to justify or critique AI-generated suggestions, thereby promoting reflection and critical thinking rather than surface-level adoption. Educators can also vary task types to maintain emotional engagement, alternating between digital collaboration, offline discussion, and reflective writing to reduce fatigue. Continuous professional development remains essential, particularly training focused on AI literacy and ethical,

pedagogically informed integration of digital tools.

6.2. Institutional-Level Implications

At the institutional level, universities should focus on developing a coherent and pedagogically aligned digital learning ecosystem. Standardizing core platforms and ensuring that students encounter consistent digital workflows across courses can reduce confusion and support sustained engagement. Institutions should also provide clearer instructional guidelines for technology-enhanced tasks so that learners understand the purpose and expectations behind each tool they are required to use. Training that targets AI integration, ethical technology use, and digital pedagogy can help educators design balanced and reflective learning activities that move beyond tool adoption. Institutions should also implement monitoring mechanisms, such as review cycles based on the Plan-Do-Check-Act (PDCA) model, to evaluate the effectiveness of digital practices and make data-informed adjustments.

6.3. Policy-Level Recommendations

At the policy level, the findings underscore the need for clearer guidance on ethical AI integration, responsible digital literacy, and data-informed decision-making. Enhancing critical digital literacy—especially the ability to evaluate and use AI responsibly—can help mitigate risks such as dependency or reduced autonomy. Policymakers may also consider strengthening partnerships between universities and technology providers to support equitable access and informed implementation. Data-driven governance, supported by systematic monitoring, can help institutions identify challenges early and adjust policies to ensure learner-centered digital transformation.

7. Conclusion

This study explored Vietnamese IT undergraduates' perceptions and engagement in TELL, framed by the TAM and engagement theory. The findings revealed that students generally held highly positive perceptions of digital tools, recognizing their usefulness, accessibility, and relevance to academic and professional growth. Learners' strong digital readiness may also shape how these perceptions form, potentially accelerating the acceptance process typically described in the TAM and influencing how usefulness and ease of use are interpreted. Behavioral and cognitive engagement were strong, while emotional engagement fluctuated due to fatigue, distraction, or overexposure to online activities. This pattern suggests a possible misalignment between technological perceptions and affective responses, a nuance that earlier TELL frameworks have tended to underrepresent. The study's main contribution lies in highlighting IT undergraduates as a distinct learner group within the TELL context – one that demonstrates both high digital readiness and vulnerability to over-reliance on automation.

However, certain limitations should be acknowledged. The study was conducted with a convenience sample of first-year IT students from a single university, which limits the generalizability of findings to other disciplines or institutions. The cross-sectional design also restricts the ability to observe changes in perceptions and engagement over time. Furthermore, self-reported data may carry bias related to social desirability or recall accuracy. Future research could address these limitations by employing longitudinal and multi-

institutional approaches, comparing technology-oriented and non-technology majors, or exploring discipline-specific variations in digital engagement. Experimental studies could also examine the impact of AI-assisted learning tasks on critical thinking and creativity, while qualitative investigations might focus on teachers' roles in shaping reflective and ethical technology use.

In conclusion, the article reaffirms that digital technology has become an integral part of ELL, particularly for students in technology-driven environments. Yet, meaningful learning outcomes may depend less on technological novelty and more on pedagogical alignment, emotional balance, and critical digital literacy. This perspective underscores that future digital transformation efforts should remain attentive to human-centered aspects of learning in order to achieve sustainable impact.

Declaration of AI Use

During the preparation and revision of this work, the author used ChatGPT to improve the readability and language of the manuscript. After using this tool, the author reviewed and edited the content as needed and takes full responsibility for the content of the publication.

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