

ARTICLE



The impact of technology-enhanced language learning environments on second language learners' willingness to communicate: A systematic review of empirical studies from 2012 to 2023

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Abstract

Focusing on empirical studies from 2012 to 2023, this systematic review investigates how Technology-enhanced Language Learning Environments (TELLEs) enhance Willingness to Communicate (WTC) in second language (L2) learners. The review identifies key findings demonstrating how the strategic use of TELLEs positively influences learners' WTC through situational, affective, linguistic, and cognitive factors. Situational factors include enriched interactions with content, interlocutors, and teachers, significantly enhancing WTC. Key affective variables, such as self-confidence, L2 anxiety, and enjoyment, are crucial in shaping learners' WTC. Additionally, TELLEs support the expansion of learners' linguistic skills and reduce cognitive load, thereby facilitating WTC. Despite its benefits, challenges such as technical issues, distractions from the novelty of TELLEs, and privacy concerns remain barriers. The review advocates for thoughtful integration of TELLEs, aligning with well-defined pedagogical goals and a nuanced understanding of learners' diverse needs and preferences. Future research should extend beyond English, aiming for a more inclusive and diversified focus to better understand WTC globally.

Keywords: *Willingness to Communicate, Second Language Learning, Technology-enhanced Language Learning*

Language(s) Learned in This Study: *English, Dutch, French, German, Spanish*

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Introduction

Willingness to Communicate (WTC) has been defined as “a readiness to enter into discourse at a particular time with a specific person or persons, using an L2” (MacIntyre et al., 1998, p. 547). It is associated with various factors, including situational, individual, and linguistic aspects, and is a crucial factor affecting learners' success in acquiring and using an L2 (MacIntyre et al., 1998; Peng & Woodrow, 2010). Previous studies have indicated that learners with higher levels of WTC are more likely to participate in communicative activities, leading to improved language proficiency and more frequent use of the target language in various contexts (MacIntyre, 2007; Yashima, 2002). However, engaging students in communicating remains a significant challenge confronting researchers and educators (Blake, 2016). Thus, understanding and promoting WTC is essential for researchers and educators to assist learners in overcoming barriers to communicating and achieving their language learning goals.

The impact of Technology-enhanced Language Learning Environments (TELLEs) on WTC has recently received increasing attention from researchers and educators alike (Zarrinabadi & Alipour, 2020). More

studies on the efficacy of integrating instructional tools to promote WTC have been conducted, providing valuable insights and guidance for implementing technology-enhanced language learning practices (Geng & Wang, 2022; Zarrinabadi & Pawlak, 2021).

Amid the pandemic's uncertainties, heightened uneasiness and tension due to social alienation worsened students' performance in communicating in L2 (Syed et al., 2022). As a result, language educators were encouraged to adopt innovative pedagogical approaches, particularly in transitioning to online and remote learning, to improve teaching effectiveness. This shift underscored the crucial role of TELLEs in shaping language education and promoting WTC. While existing studies have explored the relationship between WTC and the TELLEs, there is still a noticeable gap in achieving a comprehensive understanding. Through a systematic review methodology, this study aims to synthesize recent empirical findings on how TELLEs impact WTC in the L2 language learning process. Acting as a bridge, the synthesis aims to provide an in-depth understanding of the mechanisms linking TELLEs and WTC. The implications derived from the findings may help researchers to further investigate unknown aspects of this area and assist stakeholders in selecting appropriate technologies and design features for future practice.

Literature Review

Willingness to Communicate

WTC, originating from the L1 context as a stable personality trait, was explored by MacIntyre et al. (1998) in L2 as dual characteristics: a trait-level, representing a general communicative tendency rooted in one's personality, and a situated state-level, where communicative intentions vary across time and situations. They proposed a conceptual pyramid-shaped model incorporating psychological, contextual, and linguistic variables influencing WTC, distinguishing between immediate situational factors and enduring influences. The enduring influences at the bottom three layers of the pyramid included: learner personality and intergroup processes, the cognitive, affective, and social contexts, and motivational propensities along with sustained self-confidence. More situated influences appear at the top of the pyramid including situational factors and L2 users' state self-confidence.

Drawing on this model, early quantitative empirical studies showed that L2 WTC could be (in)directly predicted by individual variables, such as self-confidence (Clément et al., 2003), motivation (MacIntyre et al., 2003), and international posture (Yashima, 2002). Later, qualitative and mixed-methods studies expanded this understanding by incorporating situational factors, influencing WTC to varying degrees. Cao (2011) discovered that various situational (e.g., interlocutors, task), individual (e.g., self-confidence, motivation), and linguistic factors impacted learners' WTC through observation, stimulated recall interviews, and journals.

More recently, research into WTC, influenced by Complex Dynamic Systems Theory (CDST), has taken dynamic approaches, such as the idiodynamic method, to capture the emergent, dynamic nature of WTC and intricate varying interactions among its underlying factors, including situational, cognitive, affective, and linguistic elements (MacIntyre & Legatto, 2011).

Past Reviews Related to WTC

Several reviews were conducted in the last 10 years, focusing specifically on the conceptualization, development, and factors influencing WTC. Syed et al. (2022) offered a comprehensive review of the evolution and conceptualization of WTC research. They provided direction for future research on WTC, particularly concerning the expansion of research contexts to include digital settings and identification of factors influencing WTC and engagement in virtual intercultural interactions.

Factors influencing WTC have been extensively examined in previous research, with recent synthesized findings (Elahi Shirvan et al., 2019; Jin & Lee, 2022) focusing on WTC's structural relationships and individual dimensions in learning contexts. Notably, three high-evidence factors—learners' self-perceived communicative competence, communication anxiety, and motivation—were found to correlate highly with

WTC. The implication stressed the need for educators to provide diverse and strategic pedagogical support within and beyond the classroom based on these findings. By critically reviewing 35 studies, Zhang et al. (2018) presented a framework that highlighted the learning situation's impact and distinguished subjective from objective situational perceptions. In TELLEs, Shamsi and Bozorgian (2022) reviewed the impact of social media on the emotional and psychological aspects of language learning and highlighted the positive effects of social media on WTC.

Although these reviews insightfully deepen our understanding of the influencing factors of WTC in various contexts, they present an opportunity for a more expansive exploration of diverse factors, particularly the impact of TELLEs on WTC. This study attempts to extend the scope of research on WTC by incorporating recent empirical studies, including digital storytelling (Shen et al., 2023), interactive response systems (IRS) (Chang & Lin, 2019), massive multiplayer online video games (MMOVBG) (Horowitz, 2019), mobile games (Grimshaw & Cardoso, 2018), simulation techniques (Bijani & Abbasi, 2022), video modelling (Zarrinabadi & Alipour, 2020), Automatic Speech Recognition (ASR) (Jiang et al., 2023), and robot and tangible object systems (Hsieh et al., 2023). This expansion not only offers a detailed exploration of both facilitating and obstructive factors but also delves into the underlying learning mechanisms of these technologies, providing crucial insights for educators and activity designers to maximize the affordances of TELLEs in promoting WTC.

Research Questions

RQ1: How do TELLEs positively impact learners' WTC through various influencing factors?

RQ2: How do TELLEs negatively impact learners' WTC through various influencing factors?

Methodology

This study adopts the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) approach to conduct the systematic review (see [Figure 1](#) for the procedural steps). PRISMA is a widely used and reliable set of guidelines designed to assist authors in conducting and reporting systematic reviews and meta-analyses effectively (Moher et al., 2015; Page et al., 2021; Shamsi & Bozorgian, 2022).

Empirical studies were systematically retrieved using a keyword search strategy across four databases: Education Resources Information Centre, Google Scholar, Scopus, and Web of Science. The following combination of keywords was used for the article title, abstract, and keywords fields: "willingness to communicate" AND ["second language" OR "foreign language"] AND ["computer-assisted language learning" OR "CALL" OR "online learning" OR "digital learning" OR "technology" OR "mobile-assisted language learning" OR "MALL"]. A supplementary manual search was also employed to prevent the oversight of any important publications that might have been missed by the initial search strategy. Reference lists of the identified studies were reviewed to ensure a comprehensive search. Considering the drastic evolution of digital technology in recent years, this review provides a contemporary perspective on the impact of TELLEs on WTC from 2012 to 2023.

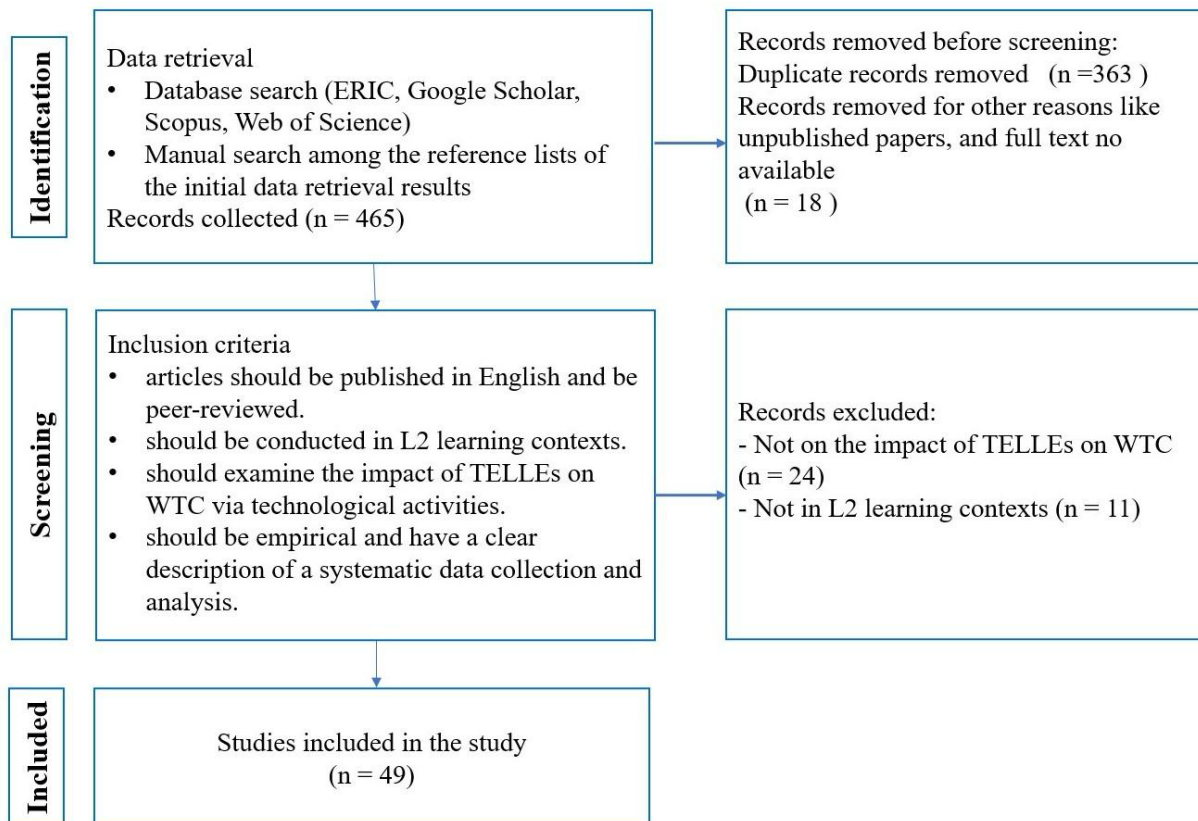
The initial search yielded 84 articles after duplicates were removed, which were then refined with the following inclusion criteria: (a) articles should be published in English and be peer-reviewed, (b) should be conducted in L2 learning contexts, (c) should examine the impact of TELLEs on WTC via technological activities, (d) should be empirical and have a clear description of systematic data collection and analysis. The excluded entries were book chapters, case studies, conference proceedings, descriptive studies, observational inquiries, systematic reviews and meta-analyses, and theoretical studies. At this stage, both authors thoroughly read the full texts of these 84 articles to assess their relevance to this review. This process resulted in the exclusion of 35 articles, leaving 49 for further analysis.

The data analysis was primarily guided by the theoretical framework proposed by MacIntyre et al. (1998), which distinguishes between individual trait-like and situational state-like influences on WTC. However, given that the pyramid model was one-dimensional and did not adequately describe the interrelationship

between the various factors (MacIntyre, 2020), we also referred to the study by Cao (2011), which identified interrelationships between individual, situational, and linguistic factors that influenced WTC for analysis and interpretation. Following the methodology proposed by Braun and Clarke (2006), the data were coded using NVivo (Release 1.7.1). A thematic analysis was conducted through an iterative process, where situational influences (e.g., teachers, interlocutors, and technology use), individual influences (e.g., self-confidence and emotions), and linguistic and cognitive factors directly informed the categorization of structural codes. In addition, in texts presenting multiple themes, each theme was coded individually. For instance, "Blogs provide an environment in which they have high perceived confidence and find like-minded people" was categorized as "self-confidence" under the theme "affective factors" and "learner-interlocutor interaction" under the theme "situational factors".

Figure 1

Publication Identification and Selection Process



The following subdimensions were considered during the coding: countries, target languages, technological tools, and influencing factors of WTC. Using NVivo's node functionality, researchers first assigned codes to specific attributes by labelling the discrete influencing factors of WTC present in the data (see Table 1). Subsequently, structural coding was employed to investigate the relationships and interconnections between the utilization of TELLEs and learners' WTC (see Table 2). A subsequent round of analysis was conducted within NVivo to iteratively recode, categorize, or eliminate codes as deemed necessary. Codes with similar themes and subthemes were amalgamated into analytical categories. The initial coding of these categories underwent comparison across the reviewed studies to identify recurring concepts and supporting evidence, facilitating the cross-validation of the emergent categories (Saldaña, 2021). To ensure the reliability and

validity of the data analysis, the researchers independently coded the data, compared their codes, discussed any discrepancies, and reached agreements on the final coding structure and categorization. The final thematic framework served as the basis for interpreting findings in relation to the research question and existing studies.

Table 1

Attribute Coding Examples

Attribute Codes	Examples of coded strings
Technological tools	online role-playing games, social media, virtual communities, digital games, the virtual world of Second Life (SL), online multiplayer video games, and simulated environment
Key features	social interaction, multilingual interaction, authentic interaction, real-time chatting, multimodal immersive web environments, controlling the pace and content
Learner-content interaction	EFL learners engage in various digital activities using English, the tool offered learners... the opportunity to play with language
Learner-interlocutor interaction	finding friends in different countries using social media peer stimuli and peer encouragement
Learner-teacher interaction	teachers... keep learners engaged teacher support, applying motivational strategies

Table 2

Structural Coding Examples

Structural Codes	Examples of coded strings
Impact of TELLEs on WTC through situational factors	through their interests, they <u>make friends on social media</u> and this opportunity allows them to <u>foster their WTC</u>
Impact of TELLEs on WTC through affective factors	providing careful, <u>empathetic support</u> to learners might be effective in <u>enhancing their willingness to communicate</u>
Impact of TELLEs on WTC through linguistic and cognitive factors	this emphasizes the role of <u>cognitive factors</u> and cognitive load <u>effect in WTC</u>

Note. The underlined parts indicate the structural relationships between factors and WTC.

Findings

This section first reports the geographic and target language distribution of the reviewed studies, then presents contextual information from these studies to reflect the diverse settings of learning within TELLEs. It concludes with the positive and negative impacts of TELLEs on WTC through various influencing factors.

The 49 studies collected provide a global snapshot of current research on the impact of TELLEs on WTC. Among them, 12 were from Iran, 7 from Taiwan, 6 from mainland China, 4 from South Korea, 3 from the USA, 2 each from Hong Kong SAR, Turkey, Japan, and Poland, as well as 1 each from the Czech Republic, Indonesia, New Zealand, Sweden, Thailand, the UK, Kazakhstan, and Vietnam. One study remains

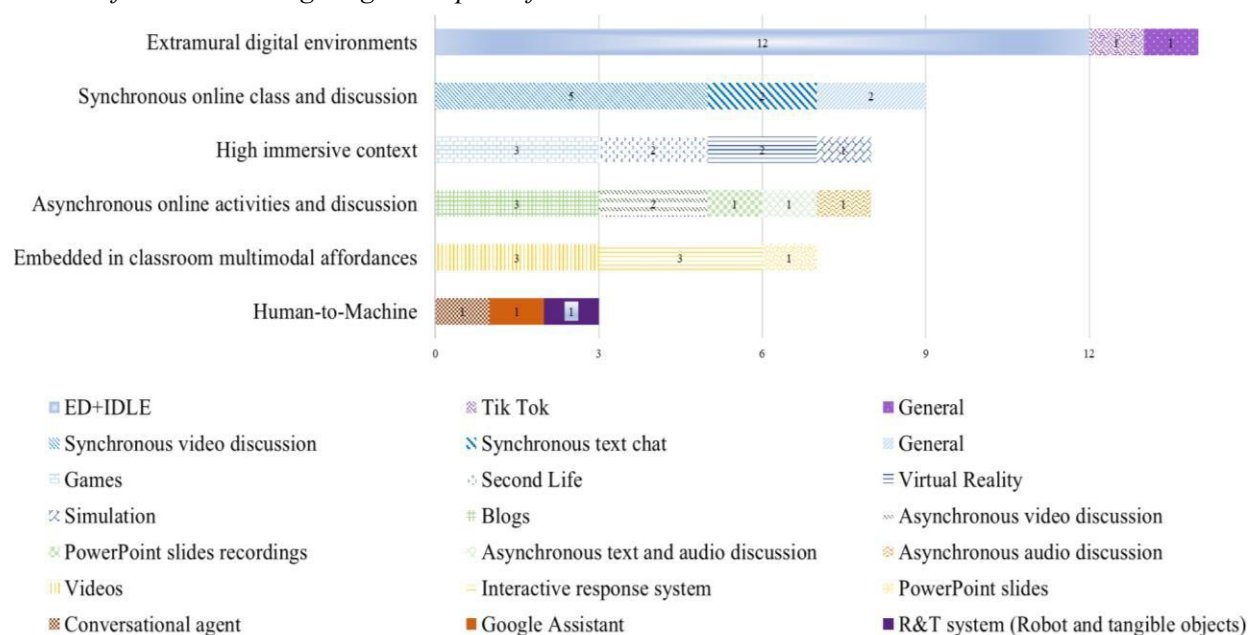
unknown.

As for the target languages investigated in these publications, most studies (43 out of 49) emphasize English as an L2. The remaining six studies focus on other languages: Dutch, French, German, Spanish, and one that examines a diverse set of languages.

The diverse TELLEs employed in the reviewed articles can be broadly divided into six categories based on the real-time nature of communication (synchronous or asynchronous), the learning environment (extramural digital settings, classroom, and high immersive context), and the interaction interlocutor (human or machine) (see Figure 2). While there is some overlap among these categories due to the complex nature of TELLEs, they mostly reflect the diverse and targeted use of instructional tools in L2 teaching and learning (see Appendix).

Figure 2

Number of Studies Investigating the Impact of TELLEs on WTC



The analysis showed that over the past decade, studies on the impact of TELLEs on WTC identified situational, affective, cognitive, and linguistic factors. Previous research, particularly through the CDST lens, highlighted WTC's dynamic nature as a result of intertwined contextual, affective, linguistic, and cognitive influences (Alimorad & Akbarzadeh, 2022; MacIntyre & Legatto, 2011; Syed et al., 2022). This complexity underscored the need for a holistic approach to understanding WTC's various determinants (MacIntyre & Gregersen, 2021; Nematizadeh, 2021). For clarity, these elements were analyzed separately in further discussions.

RQ1: How do TELLEs positively impact learners' WTC through various influencing factors?

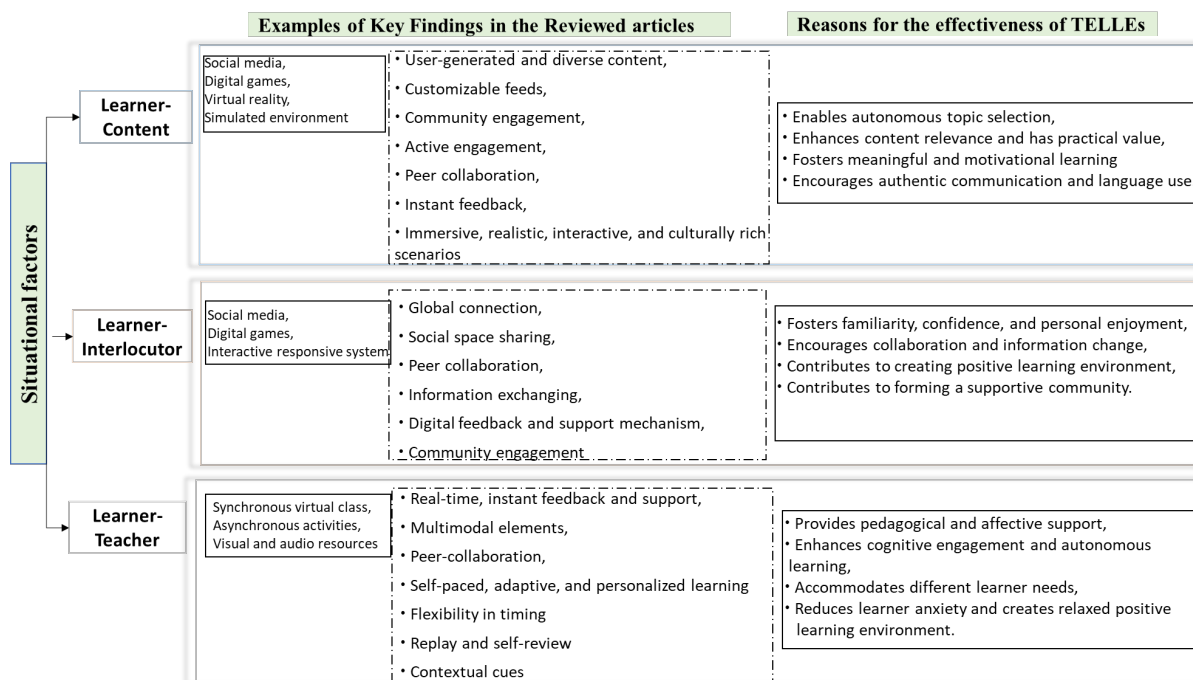
Situational factors

The analysis indicated that situational factors emerged as a predominant theme, appearing more than 23 times either directly as 'situation' or through synonymous terms in 39 out of the 49 reviewed articles. Drawing from insights in eLearning theories on interaction as explored by Keaton and Gilbert (2020) and Moore (1989), the analysis identified three implicit orientations of the situational factors: interaction between learner-content, learner-interlocutor, and learner-teacher (see Figure 3). Although some situational factors are objective, focusing on concrete elements such as persons (who), activities (what), locations

(where), and times (when), a situation also encompasses learners’ perceptions and TELLE-related elements in shaping learners’ WTC. Building on this, the following sections elaborate on how the TELLEs positively impact learners’ WTC through various situational factors.

Figure 3

Situational Factors Identified in the Review



Learner-content Interaction

This refers to the interactive and engaging experiences facilitated by TELLEs between learners and the instructional materials. It encompasses the use of TELLEs to enable learners to select pertinent topics and engage in meaningful and authentic communication, thereby enhancing interactive and enriched learning experiences. The analysis identified unique findings that highlighted the efficacy of facilitating connections with like-minded individuals and promoting engagement with content that resonated on a personal level. Specifically, key features of social media platforms such as YouTube, WeChat, and blogs were instrumental in enhancing WTC. These platforms allowed learners to connect with others who shared similar interests in specific content, creating a common ground that enhanced their engagement with the material. The shared interest in content led to meaningful interactions rooted in the learners’ engagement with the instructional material. For instance, Lee and Lu (2021) provided novel insights into how EFL learners leveraged digital environments to engage with like-minded peers on topics pertinent to their personal and future aspirations, such as sports and music. This engagement helped learners minimize the discrepancy between their current and ideal L2 selves, substantially boosting their WTC. Similarly, Alm (2016) demonstrated that blogging offered a communal space for learners to connect with others who shared similar interests, fostering meaningful interactions that enhanced WTC. In sharp contrast to traditional EFL settings, which often relied on static, repetitive content and failed to foster WTC due to their uninspiring nature (Jauregi et al., 2012; Lee, 2019; Lee & Chiu, 2023), the innovative use of TELLEs in language learning presented a transformative approach.

Likewise, the analysis showed that digital games, VR, and simulated environments enhanced WTC by linking traditional learning with real-world language use. These TELLEs allowed learners to engage actively with content through realistic opportunities, preparing them for diverse real-world interactions and

boosting linguistic and cultural readiness. Hsieh et al. (2023) developed a task-based robot and tangible objects system to "replicate the process of communication in the real world" (p. 11), enhancing WTC. Reinders and Wattana (2014) found that the interactive nature of gaming environments significantly increased WTC by promoting active language use during gameplay. Wu and Hung (2022) noted that VR's immersive experiences raised learner confidence and encouraged spontaneous language usage. Lee and Lee (2020) and Freiermuth and Huang (2012) emphasized that such contextualization was crucial for effective communication in professional and multicultural settings, enriching the linguistic context and underscoring the importance of genuine language use for learners' future careers.

Learner-interlocutor Interaction

This interaction, facilitated by TELLEs, involves dynamic engagement between language learners and their interlocutors at both individual and collective levels. At the individual level, features such as global connection and social spaces enhanced learner engagement and fostered a positive L2 WTC environment by promoting global friendships and social media collaboration, which increased familiarity, confidence, and enjoyment in language use (Altunel, 2021; Soyooof, 2022). Dynamic engagement in TELLEs nurtured a positive atmosphere, supported by interlocutors who respected learners' interests and fostered empathy through strategic verbal and non-verbal expressions like compliments and motivational feedback (Ardiansyah et al., 2020; Jauregi et al., 2012; Lee & Liu, 2022).

At the collective level, technologies such as IRS, MMOVGs, and social networking sites for language exchange enhanced peer support, group cohesion, and a shared sense of community, contributing to visible progress and a heightened sense of achievement among learners (Bijani & Abbasi, 2022; Chang & Lin, 2019; Horowitz, 2019; Tai & Chen, 2020; Seydreazen & Ziafar, 2014). Instantaneous and non-judgmental peer feedback in these contexts fostered increased familiarity and self-confidence (Grimshaw & Cardoso, 2018; Jauregi et al., 2012; Reinders & Wattana, 2014). Soyooof (2022) further emphasized the concept of an "affinity space" in online games and social media, where shared activities and interests boosted WTC in the target language.

Learner-teacher Interaction

This interaction occurs when teachers deliver information, provide feedback, and guide learners in the teaching process through TELLEs. It empowers teachers to actively communicate with learners, creating a blended learning environment that incorporates key design features of instructional tools. Firstly, the analysis revealed that strategic integration of TELLEs helped teachers to tailor pedagogical support, enhancing learners' WTC. Lee and Liu (2022) and Zohrabi and Farshbafan (2022) demonstrated that using multifunctional tools for live feedback, pair-work, game-embedded activities, contextual cues, polls, and questionnaires allowed teachers to engage learners actively, enhance cognitive processing, and meet diverse learning preferences. Taherian et al. (2023) reported that using multimodal resources effectively reduced learners' foreign language boredom. This integration facilitated a more effective and personalized instructional approach, increasing L2 WTC. Additionally, features of asynchronous tasks like timing flexibility, replay and review options, and adaptive learning paths enabled self-paced, autonomous learning (Buckingham & Alpaslan, 2017; Peng, 2019; Zarrinabadi & Alipour, 2020). This design allowed learners to review and analyze their performance, fostering self-reflection and improvement over time, positively influencing learners' WTC.

Another significant finding in this regard was the strategic use of adaptive and personalized features of TELLEs by teachers to create conditions that fostered L2 WTC. Lee et al. (2022) revealed how teachers leveraged features like free choice of learning content, content subscription, interaction, and global community connection in the IDLE platform to align the learning experience with learners' personal interests. This creation of optimal psychological conditions was found to be closely tied to enhancing WTC. The review also revealed that tools like personal blogs, Livemocha.com, Google Apps, and Flipgrid, when thoughtfully integrated into the curriculum, contributed to creating conditions conducive to WTC. These tools provided controlled yet flexible environments catering to diverse learner personalities and preferences

(Alm, 2016; Jaramillo, 2022), thereby fostering a sense of autonomy and personalization that encouraged WTC. Furthermore, Peng (2019) found that the intentional use of multimodal presentation tools like PowerPoint slides played a role in creating conditions favourable for L2 WTC. These tools helped sustain attention, stimulate imagination, and transcend physical boundaries, fostering an engaging and immersive environment that promoted WTC.

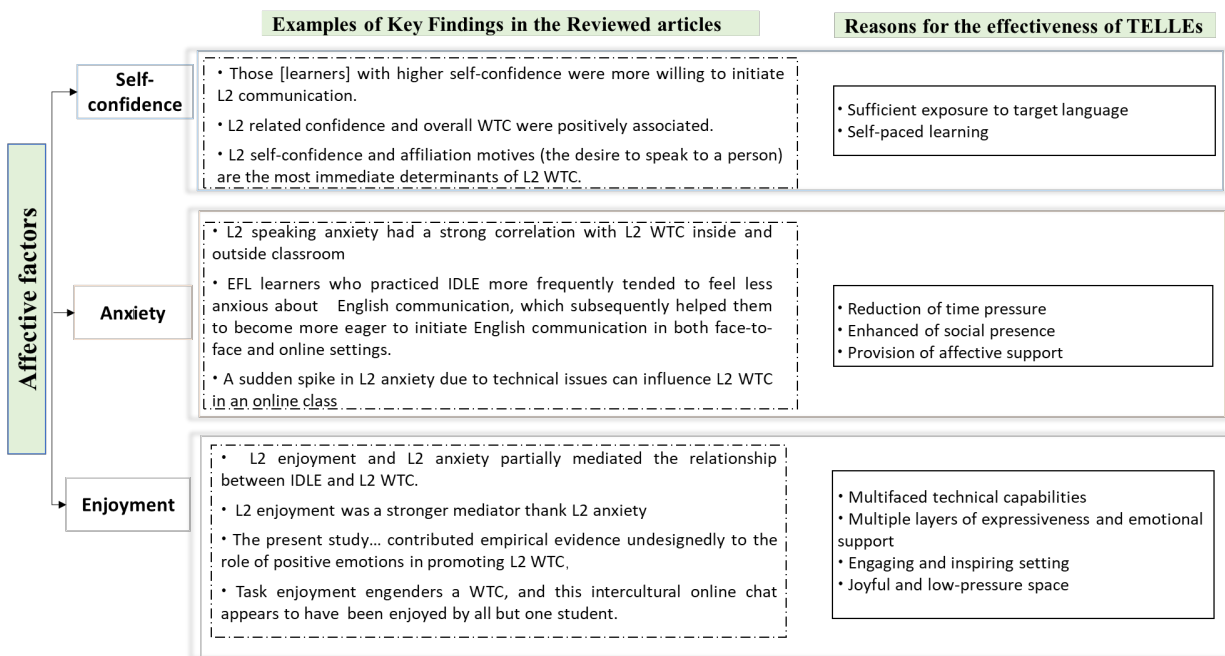
Lastly, the creation of conditions that facilitated positive emotions and minimized negative emotions was a crucial factor related to learner-teacher interaction. In synchronous virtual classes, features enabling kinaesthetic modalities (e.g., smiles, head nods) and digital expressions (e.g., virtual flowers, hand raising) allowed teachers to convey immediacy and emotional support (Peng, 2019; Shen et al., 2022; Zohrabi & Farshbafan, 2022). This fostered a positive, enjoyable learning environment conducive to learners' WTC. Additionally, self-paced and adaptive learning features were highlighted to help create conditions that reduced learner anxiety associated with time constraints (Buckingham & Alpaslan, 2017; Lepore, 2014). By minimizing this negative emotion and promoting a more relaxed state, learners felt more confident in their language communication approach.

Affective factors

The analysis identified that TELLEs also influenced learners' WTC through affective variables, particularly high self-confidence, low anxiety, and enjoyment (see Figure 4).

Figure 4

Affective Factors Identified in the Review



Self-confidence

Self-confidence, defined as perceptions of communicative competence coupled with low-level anxiety (MacIntyre et al., 1998), emerged as a crucial factor in enhancing WTC. The analysis illuminated that self-confidence not only directly enhanced WTC through increased language exposure and autonomous learning modalities but also fostered a pivotal reciprocal dynamic between learners' skill development and psychological empowerment. As learners enhanced their self-efficacy, a notable increase in self-confidence and motivation was observed, which, in turn significantly elevated their WTC (Lee et al., 2022; Ramak et

al., 2022; Soyooof, 2022). Specifically, Alimorad and Akbarzadeh (2022) demonstrated that Iranian English learners in extramural digital settings, such as Discord and WhatsApp, experienced a rise in self-confidence through extensive engagement with L1 English speakers and global peers, thereby reducing anxiety and promoting WTC in these informal and community-focused platforms.

Moreover, studies by Chang and Lin (2019) and Liu (2016) provided important insights regarding the influence of self-confidence on WTC through self-paced learning scenarios. TELLEs such as IRS and video-based blogging empowered learners to customize their educational encounters and assert control over their learning trajectories. Transitioning from formal educational settings to more relaxed, video-enhanced interactions facilitated learners to scrutinize and refine their language skills, fostering autonomy and strengthening self-confidence (Jauregi et al., 2012). These conditions were instrumental in fostering a robust sense of self-assurance, which, in turn, significantly amplified their WTC (Jaramillo, 2022; Lee & Liu, 2022). These insights highlighted the transformative potential of learner-controlled TELLEs in enhancing language learning efficacy and WTC.

L2 anxiety

L2 anxiety has long been found to adversely impact WTC in existing literature (MacIntyre & Gregersen, 2021). However, this review found that TELLEs offered promising avenues for mitigating anxiety through three key mechanisms: the reduction of time pressure, the enhancement of social presence, and the provision of affective support. Firstly, TELLEs were reported to alleviate the time pressure often associated with face-to-face interactions. For example, asynchronous communicative activities allow learners more time to think and respond, reducing extraneous cognitive load and facilitating deeper engagement with language tasks (Buckingham & Alpaslan, 2017; Jaramillo, 2022; Jaramillo & Nadolny, 2023).

Secondly, empirical evidence indicated that affective support was a crucial factor in mitigating L2 anxiety and enhancing WTC. Several studies (e.g., Ayedoun et al., 2019; Jaramillo & Nadolny, 2023; Tai & Chen, 2020) demonstrated that empathetic support, including reassurance and encouragement, significantly lowered anxiety levels and boosted learners' confidence in TELLEs that utilized chatbots. Additionally, some studies revealed that maintaining a moderate level of social presence, particularly in text and audio chats, effectively alleviated anxiety in online settings by reducing apprehension and fostering a less intimidating environment (Ramak et al., 2022; Van Le et al., 2018). Importantly, while a lower level of social presence reduced language anxiety and promoted WTC, an excessively high level had the opposite effect. Conversely, the absence of a well-developed social presence in more formal online learning settings was also detrimental (Liu, 2016). Therefore, the impact of social presence on WTC was context-dependent and required a balanced approach.

L2 Enjoyment

Empirical findings revealed a strong correlation between L2 enjoyment and learners' WTC (Lee et al., 2022). This enjoyment, fostered by dynamic, engaging, and motivational settings, significantly enhanced WTC through the multifaceted capabilities of TELLEs. Freiermuth and Huang (2012) and Lee and Liu (2022) demonstrated that Synchronous Computer-mediated Communication (SCMC) platforms enriched learners' communicative experiences by incorporating features like emoticons, text highlighting, and drawing tools, which added expressiveness and support essential for enjoyable language interactions. Additionally, Taherian et al. (2023), in their longitudinal IDLE study, found that implicit training over time led to enjoyment, inducing a flow state and boosting WTC. Beyond SCMC, immersive TELLEs such as VR and digital games captivated learners by offering motivationally charged atmospheres (Bijani & Abbasi, 2022; Reinders & Wattana, 2014; Wu & Hung, 2022). TELLEs promoting out-of-classroom practices also created joyful, low-pressure spaces where learners could rehearse, self-assess, and master communicative goals, thus enhancing engagement and reducing language anxiety (Ebadi & Ebadijalal, 2022; Jaramillo, 2022; Lloyd, 2012).

Linguistic and cognitive factors

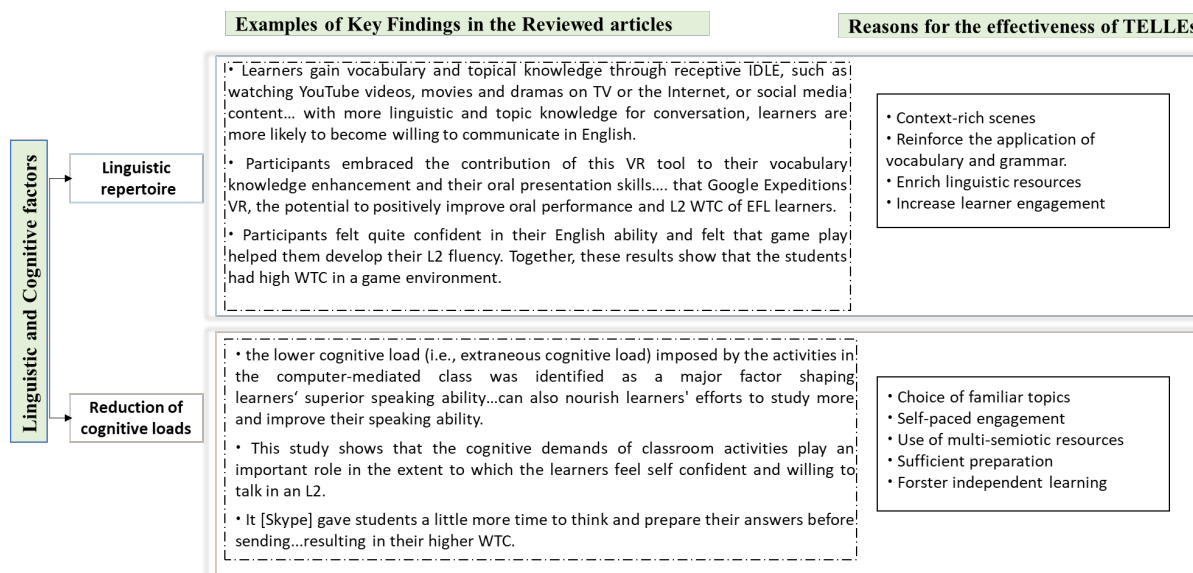
WTC has been identified as closely interconnected with linguistic and cognitive aspects (Huang, 2023; Nematizadeh, 2021). Empirical evidence indicated that the mediation occurred through the enrichment of learners’ linguistic repertoire and the reduction of cognitive load.

Linguistic repertoire refers to the diverse set of language elements (e.g., vocabulary, sentence structures, pragmatic strategies) that learners encounter and apply within TELLEs. Wu and Hung (2022) reported that learners’ WTC was positively impacted because of the immersive experiences offered by the VR platforms. In such TELLEs, they were exposed to target words and sentence patterns within context-rich scenes. This contextualization reinforced their understanding and application of vocabulary and grammar. These enhancements in linguistic proficiency not only aligned with increased motivation to communicate but also stimulated learners’ engagement in language interactions within the VR environment (Ebadi & Ebadijalal, 2022).

Cognitive load refers to the mental effort and processing demands imposed on learners during learning activities and often involves the cognitive resources required for tasks (Sweller, 2010). Ramak et al. (2022) found that the introduction of asynchronous platforms, such as online forums and speaking and listening tasks, served as a strategic approach to reducing cognitive load and, consequently, fostering an environment conducive to enhanced WTC. Specifically, the flexibility inherent in asynchronous learning allowed learners to engage with tasks at a personalized pace, alleviating the cognitive pressure associated with real-time interactions. By minimizing cognitive load through asynchronous engagement, learners were granted the time and mental space to process information thoroughly, formulate articulate responses, and reflect on language content. As learners navigated language tasks with more deliberate and reflective approaches, they experienced a simultaneous boost in confidence and a reduction in anxiety, ultimately positively influencing their WTC (see Figure 5).

Figure 5

Linguistic and Cognitive Factors Identified in the Review



Concurrently, the incorporation of video examples, as highlighted by Zarrinabadi and Alipour (2020), emerged as a valuable strategy for reducing cognitive load and enhancing WTC. In their study, video examples designed to showcase language use in context served as potent TELLEs in diminishing the mental effort required for language activities. As learners visually and auditorily engaged with linguistic content,

they were exposed to complex language patterns and expressions, leading to a more intuitive understanding of the material, thereby positively impacting their WTC.

RQ2: How do the TELLEs negatively impact learners' WTC through various influencing factors?

While TELLEs have received praise for their positive impact on WTC, it is crucial to exercise discernment and critical evaluation in their application. Freiermuth and Huang (2012) argued that TELLEs' effectiveness was contingent on their integration into a well-thought-out pedagogical framework with a clear objective. This review identified several factors that adversely affected WTC: technical issues, the novelty effect of technology, personal factors, and concerns about anonymity and privacy.

Firstly, empirical evidence indicated that technical issues, ranging from minor annoyances to significant disruptions, could negatively impact the learning environment and learners' WTC. For instance, unfamiliarity with online platforms, technical glitches, communication delays, and malfunctioning microphones posed challenges to effective communication (Jauregi et al., 2012; Lee & Liu, 2022). Further complications, such as video lag and disturbing noises, significantly impeded the flow of communication (Ardiansyah et al., 2020). Poor Wi-Fi connections and software incompatibility not only caused decreased learning autonomy but also resulted in students spending considerable time fixing these issues (Wu & Hung, 2022).

Secondly, the novelty effect of certain TELLEs could both captivate and distract learners, potentially undermining their WTC in the long term. For instance, Jauregi et al. (2012) found that the initial excitement of interacting with L1 speakers via video conferencing waned over time, particularly for intermediate students who had prior experience with the TELLE. Similarly, Hu and Du (2022) reported that the attention-grabbing features of TikTok videos initially boosted learners' engagement in learning. However, criticism from seemingly trustworthy influencers within these videos eventually led to self-doubt and a sense of failure, diminishing the WTC in English with teachers and peers. In the study by Ebadi and Ebadijalal (2022), the immersive nature of VR became a distraction, causing learners to focus more on the platform than on language use, an issue further complicated by technical difficulties.

Moreover, TELLEs were identified to negatively impact WTC through personal factors such as digital literacy, individual preferences, and language proficiency. For instance, Horowitz (2019) reported that learners who were inexperienced or had no interest in online video games found such platforms unengaging. Shy learners felt uncomfortable in a digital context with a high social presence, further inhibiting their WTC (Jauregi et al., 2012). Personal preferences and varying levels of L2 proficiency also made online chat environments less comfortable for some learners, negatively affecting their WTC (Freiermuth & Huang, 2012; Horowitz, 2019). Jiang et al. (2023) explained that the limited effects of ASR on WTC may be due to Chinese students' cultural and educational contexts. Hu and Du (2022) noted that negative attitudes toward new TELLEs due to personal factors and preferences were a barrier for some learners to enjoy the digital environment, consequently leading to less WTC.

Lastly, concerns about privacy and anonymity were identified as negatively impacting WTC (Kruk, 2022; Seyydreazen & Ziafar, 2014; Van Le et al., 2018). Seyydreazen and Ziafar (2014) reported that while CMC offered a sense of security that promoted WTC, learners were also wary of privacy potential, such as scams or unauthorized access to personal information. Additionally, the anonymity provided by online platforms like SL sometimes led to rude or abusive interactions, which were demotivating and counterproductive to language learning (Kruk, 2022). Furthermore, the reduced social cues and controllability in online settings made participants more likely to disclose personal information, adding another layer of risk (Van Le et al., 2018).

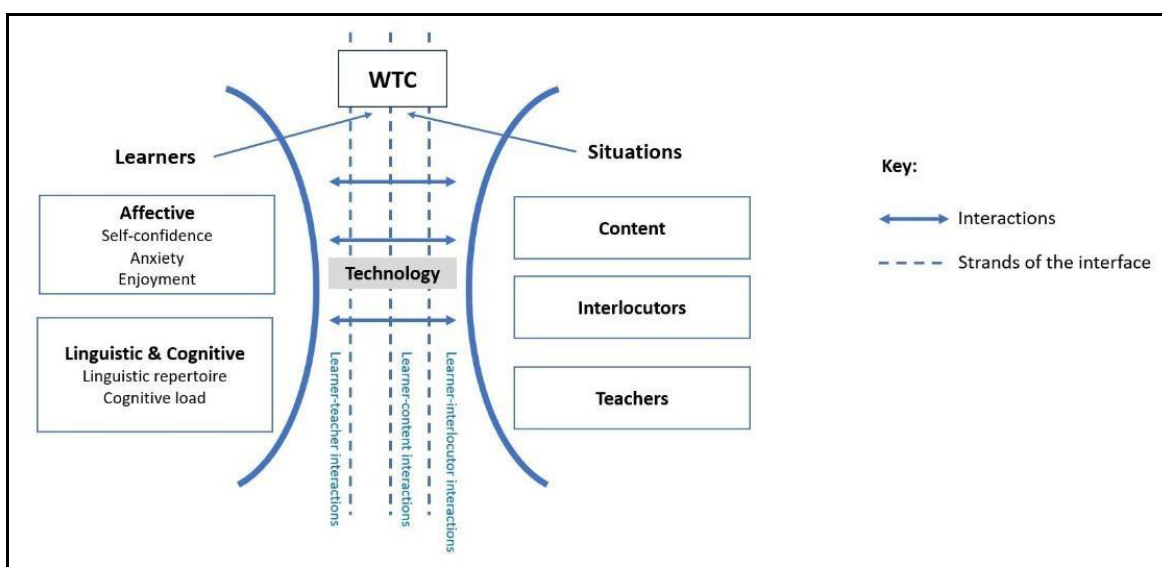
Discussion

This review synthesized 49 studies to deepen the understanding of the language learning research

community regarding the impact of TELLEs on learners' WTC, extending MacIntyre et al.'s (1998) model and Cao's (2011) ESL-focused study. MacIntyre et al.'s (1998) one-dimensional pyramid model, though recognizing multiple influences on WTC, does not adequately address the nuanced interplay of contextual, emotional, linguistic, and cognitive factors. This study extends the model according to the learner-context interface (White, 2003) to synthesize the influencing factors of WTC with a focus on their interactive effects (see Figure 6). According to this view, the interaction between WTC and TELLEs is characterized by learners continuously constructing a meaningful interface with their learning contexts. This process results from the intertwined influences of contextual, affective, linguistic, and cognitive variables, alongside various other factors.

Figure 6

Integrated Model of Factors Influencing WTC in TELLEs



Firstly, this study identified the mechanism by which TELLEs impacted WTC through three major situational factors as facilitators: interactions involving learners and content, learners and interlocutors, and learners and teachers. This is depicted in Figure 6, where content, interlocutors, and teachers form integral situational elements. Their impact on WTC is realized at the interface—various TELLEs, where interactions between individuals and contexts shape learners' WTC. This finding aligns with Zhang et al.'s (2018) review, highlighting how situational factors in various learning environments are influenced by individuals' interpretations and feelings within their surrounding contexts.

This review also reported how TELLEs positively influenced WTC through affective, cognitive, and linguistic factors. The role of self-confidence, anxiety, and enjoyment in shaping WTC through TELLEs' mediation aligns with Shamsi and Bozorgian's (2022) findings. TELLEs created conducive psychological conditions, enhancing enjoyment, excitement, and creativity in the learning process and using an L2. Furthermore, the connection between linguistic proficiency and cognitive load in shaping WTC aligns with Huang (2023) and Nematizadeh (2021). We explored cognitive load reduction through asynchronous platforms, video examples, and flexible learning, aligning with cognitive load theory (Sweller, 2010).

Uniquely, the proposed model in Figure 6 shows how TELLEs negatively interacted with the learner-context interface, offering a comprehensive view of potential barriers in shaping WTC. This review identified four key aspects that negatively impact WTC: technical issues, the novelty effect, personal factors, and concerns about anonymity and privacy, consistent with findings in the literature (e.g., Huang, 2023). TELLEs' novelty effect can distract learners without a well-considered pedagogical framework. Although anonymity may reduce anxiety, valid concerns exist about learners becoming targets of criminal

activities, corroborating insights from Ghafar and Cahya (2023).

This study thereby stresses the need for extra support for learners with lower proficiency or limited backgrounds, aligning with Stepp-Greany (2002). Moreover, learners' technology acceptance and attitudes toward using TELLEs are crucial, as negative perceptions can affect their WTC, aligning with Hu and Du (2022) and Lee and Liu (2022). This supports Rafiee and Abbasian-Naghneh's (2021) emphasis on technology acceptance for successful implementation in language learning.

Conclusion and Implications

Through synthesizing existing literature on the impact of TELLEs on WTC between 2012 and 2023, this review identified salient enhancing factors of TELLEs on WTC, including situational, affective, linguistic, and cognitive aspects. TELLEs were found to influence interactions across various fronts: learner-content, learner-interlocutor, and learner-teacher dynamics. Affective variables such as increased self-confidence, reduced L2 anxiety, and enhanced enjoyment played pivotal roles in facilitating WTC. TELLEs also impacted the relationship between WTC and learners' linguistic and cognitive factors by enriching language skills, reducing cognitive load, and fostering higher-level cognitive abilities. Despite these benefits, challenges associated with TELLEs included technical issues, the novelty effect, and personal factors serving as barriers to WTC. Concerns about anonymity and privacy also impacted learners' willingness to engage. These findings underscore the importance of ensuring TELLEs serve as facilitators rather than barriers, with adjustable social presence and a focus on privacy.

This study has several implications for the integration of TELLEs in L2 education and future research in this field. Firstly, despite the important role of TELLEs in promoting WTC, it is crucial to mitigate any barriers they may present. For instance, the level of social presence in TELLEs should be adjustable to suit learner needs, reducing potential criticism or ridicule (Van Le et al., 2018). Specifically, teachers need to understand that learners may undergo a gradual process of both linguistic and intercultural development, as well as social presence tolerance in TELLEs (Freiermuth & Huang, 2012; Jauregi et al., 2012; Lloyd, 2012).

Pedagogically, to increase the positive impact of TELLEs on WTC, teachers need to employ a blend of motivational, multimodal, and affective strategies (Lee & Liu, 2022; Peng, 2019; Zohrabi & Farshbafan, 2022). Task design should address both learners' affective and linguistic needs, encouraging risk-taking, creativity, and real-world language use (Jaramillo, 2022). Clear pedagogical goals should be established to avoid aimless CMC tasks and ensure meaningful language learning experiences (Freiermuth & Huang, 2012), with the selection of TELLEs aligned to these needs (Altunel, 2021; Jaramillo, 2022). Understanding and accommodating learner factors is also essential for the successful integration of TELLEs. These factors encompass learners' personalities, preferences, learning styles, and educational and social contexts (Altunel, 2021; Hu & Du, 2022; Lee & Sylvén, 2021). For example, in test-oriented motivational environments, emotional needs should not be overlooked (Lee et al., 2021; Ramak et al., 2022). Moreover, emphasizing learners' technology acceptance and attitude toward integrating TELLEs into language learning curricula is crucial (Venkatesh et al., 2003).

Theoretically, the findings of this review hold the potential to enhance the conceptualization of WTC within existing literature frameworks, such as that proposed by MacIntyre et al. (1998). The influencing factors identified in this review and their reciprocal relationships with TELLEs contribute to a more nuanced understanding of the underlying mechanisms of WTC within a complex learning environment. Considering the prevalent use of TELLEs in language education, particularly in the post-pandemic era, it becomes evident that the facilitating factors influenced by TELLEs on WTC can be observed across various layers of MacIntyre's model (1998). This underscores the need to integrate TELLEs' influence on WTC into the framework to capture its evolving nature.

Lastly, the scope of WTC research should expand beyond English to include underrepresented languages, which offer unique insights into WTC dimensions. For example, Chinese presents distinct linguistic and sociocultural challenges impacting WTC uniquely. Language learning involves not just production but also

the cognitive processing of language elements, each imposing a different cognitive load. Mastering Chinese tones, for instance, requires extra mental effort, affecting WTC (Huang, 2023). Given these complexities, expanding research to languages beyond English is crucial, revealing unique dimensions and enriching our global understanding of WTC. Future research should also diversify to include a broader range of directions, emphasizing customization of technological interventions across gender, age, and proficiency levels. The integration of TELLEs, like AI and natural language processing, could offer nuanced, context-rich learning opportunities, thus enhancing WTC across diverse contexts (Lee et al., 2024).

Limitations

The study acknowledges several limitations. Firstly, it is constrained by the selection of publications from limited collections, potentially impacting the comprehensiveness of our analysis. Additionally, the diverse range of findings within the collected data, coupled with space constraints, restricts reporting to key themes and exemplar studies, potentially overlooking nuanced perspectives. Finally, excluding sources like book chapters and conference presentations by influential researchers represents a missed opportunity for deeper insights, suggesting their inclusion in future work.

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Appendix. Technologies Investigated in Reviewed Studies

ED ¹ (Extramural digital settings)	ED+IDLE	1	Zadorozhnyy and Lee (2023); Taherian et al. (2023);
		2	Lee et al. (2023); Lee and Chiu (2023); Rezai (2023);
			Alimorad and Akbarzadeh (2022); Soyooof (2022); Lee et al. (2022); Lee et al. (2021); Lee and Lu (2021); Lee and Sylvén (2021); Lee and Lee (2020)
	Tik Tok	1	Hu and Du (2022)
	General ²	1	Seyydreazen and Ziafar (2014)
Synchronous online class and discussion	Synchronous Video Conferencing	5	Lee and Liu (2022); Altunel (2021); Hung and Huang (2021); Ardiansyah et al. (2020); Jauregi et al. (2012)
	Synchronous Text	2	Freiermuth and Huang (2012); Lloyd (2012)
	Chat		
	General ²	2	Zohrabi and Farshbafan (2022); Shahini (2015)
High immersive context:	Games	3	Grimshaw and Cardoso (2018); Horowitz (2019); Reinders and Wattana (2014)
	Virtual Reality	2	Ebadi and Ebadijalal (2022); Wu and Hung (2022)
	Second Life	2	Kruk (2022); Kruk (2021)
	Simulation	1	Bijani and Abbasi (2022)
Asynchronous online activities and discussion	Blogs	3	Jaramillo (2022); Alm (2016); Liu (2016)
	Asynchronous video discussions	2	Ramak et al. (2022); Jaramillo and Nadolny (2023)
	PowerPoint slides recordings	1	Buckingham and Alpaslan (2017)

	Asynchronous text and audio discussions	1	Van Le et al. (2018)
	Asynchronous voice discussions	1	Lepore (2014)
Embedded in classroom multimodal affordances	Videos	3	Shen et al. (2023); Shen et al. (2022); Zarrinabadi and Alipour (2020)
	Interactive response system	3	Jiang et al. (2023); Chang and Lin (2019); Hung (2017);
	PowerPoint slides	1	Peng (2019)
Human-to-Machine	Conversational agent	1	Ayedoun et al. (2019)
	Google Assistant	1	Tai and Chen (2020)
	R&T system ³	1	Hsieh et al. (2023)

1. *ED (Extramural digital settings)*, also known as Informal Digital Learning of English (IDLE) (Lee & Lee, 2020, p. 816): L2 learners in extramural digital contexts are autonomously involved in learning and practising L2 by using a range of digital resources (e.g. social media) and devices (e.g. smartphones) in an informal, unstructured manner.

2. *General* refers to the reviewed articles that do not specify the technology used or broadly refer to a certain category (e.g., Seyydreazen and Ziafar (2014) discussed learners' attitudes toward computer-mediated communication). Therefore, we classify them based on the discussed technological affordances (e.g., synchronous online classes) in the articles.

3. *R&T system*, Robot and Tangible objects, comprising a robot, a tablet, a cell phone, and sets of tangible objects, facilitating physical interaction for language learners.

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