



Development of Modern Technologies in English Language Teaching and Learning in the 21st Century: A Historical Overview

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Abstract: In the 21st century, educational technology has witnessed significant advancements in English language teaching and learning, accompanied by a variety of learning tools. This paper provides a qualitative historical overview of the evolution and integration of novel technological tools into the field of English language teaching and learning from 2000 to the present. Based on the literature review and the researcher's viewpoint, the study categorizes the period of historical development into four main phases. Starting from Computer-Assisted Language Learning tools (CALL), the Web 2.0 and social media era, Mobile-Assisted Language Learning (MALL), to the current landscape of immersive technologies and AI-generated content, and beyond the present. The study examines the pedagogical characteristics of each stage, mentions the famous tools of that period, and traces how technology integration in ELT has evolved and reshaped pedagogical practices over time as well as the challenges associated with every stage. It concludes with an outline of expected future trends in English language teaching and learning.

Keywords: Educational Technology, ELT, ELL, CALL, MALL, AR&VR, AI-generated.

1. INTRODUCTION

The relationship between technology and English language teaching and learning (ELT/L) has been characterised by continuous innovation, changing pedagogical practices, and persistent challenges. Since the beginning of the twenty-first century, digital technologies have become increasingly integrated into language education, influencing not only the content and resources used in instruction but also how, when, and where teaching and learning take place. This development has expanded the possibilities for accessing language resources, facilitating interaction, supporting independent learning, and diversifying instructional approaches (Chapelle, 2020; Kukulska-Hulme et al., 2017). The emergence of successive technological innovations, from computer-assisted language learning and mobile applications to cloud-based platforms and artificial intelligence (AI), has further reshaped the landscape of technology-mediated language education. Yet each technological wave has also generated unforeseen challenges. Understanding the trajectory of technology-enhanced ELT is therefore not merely an exercise in historical documentation but a critical necessity for informed decision-making in curriculum design, teacher preparation, technology investment, and educational policy.

2. BACKGROUND OF THE STUDY

The 21st century has witnessed unmatched technological advancements, significantly influencing various educational fields, including English Language Teaching. The integration of modern technologies has notably transformed instructional practices by enabling greater interactivity, learner autonomy, and access to authentic language resources (Chapelle, 2001; Stockwell, 2013). Starting from the advent of digital tools in the early 2000s as computer-assisted language learning to the current landscape dominated by immersive technologies like virtual reality (VR) and artificial intelligence (AI). These tools have enhanced language acquisition and provided students with interactive and immersive experiences.

This article aims to provide a summary historical overview of the development of modern technologies in teaching and learning processes, focusing on key milestones and categorizing these advancements into certain time periods, how these innovations have impacted English language teaching and learning, how reshaped pedagogical practices over time (both classroom instruction and informal language learning environments), and highlighting the challenges and future directions their ongoing advancement brings.

3. Problem Statement:

Although digital technology has become increasingly integrated into English language teaching and learning (ELT/L), the existing literature appears to lack a comprehensive synthesis that systematically examines the evolution of digital technologies, associated pedagogical approaches, and the challenges encountered across the two decades of the twenty-first century. Much of the existing research focuses on particular technologies, specific pedagogical applications, or limited periods of development, rather than providing a longitudinal perspective on the broader evolution of technology-mediated English language education. Addressing

this gap would provide a more comprehensive understanding of how digital technology has shaped ELT/L, the pedagogical opportunities and limitations associated with its integration, and the challenges.

4. Questions of the Study:

1. How have modern technologies in English language teaching and learning developed during the 21st century?
2. What are the key tools of each historical phase of technological integration in the educational processes?
3. What challenges accompanied each stage of digital tools in the educational processes?

5. Objectives of the Study:

1. To examine the historical development of modern technologies in ELT during the first quarter of the 21st century.
2. To propose a chronological framework that categorizes the stages of digital tools integration in ELT.
3. To identify the major challenges that accompanied the integration of technological tools into the educational process.

6. Significance of the Study:

This review examines the evolution of technology in English language teaching and learning (ELT/L) over a 25-year period, tracing developments from early computer-based language learning (CALL) through Web 2.0 technologies and mobile-assisted language learning (MALL) to contemporary applications of artificial intelligence (AI) and immersive technologies. By organising these developments into a four-stage framework, the review provides a structured account of technological change and establishes a conceptual basis for future comparative research. This framework can help researchers situate their findings within the broader historical development of technology-mediated language education. In addition, the synthesis of research on technological tools, pedagogical applications, learning outcomes, and implementation challenges offers insights that may inform teaching practices, curriculum design, and educational decision-making. The review also identifies emerging trends and potential directions for future research, connecting the historical development of educational technology with the pedagogical, institutional, and technological considerations likely to shape the future of ELT/L.

7. Methodology

The study used a qualitative historical overview methodology based on an extensive systematic literature review. It encompassed relevant studies published in international journals, peer-reviewed journals, academic monographs, and authoritative research reports spanning educational technology and English language teaching (ELT). It covered publications addressing Educational Technology, ELT/L with digital tools.

The analysis employed a chronological-thematic approach. The study traced dominant technological tools and platforms across historical periods to study their pedagogical affordances and practical limitations.

8. Historical Development of Technologies in ELT/L: A Four-Stage Framework (2000–present)

The study divided the historical development into four phases as below:

8.1 Stage1: Early 21st Century - The Rise of CALL and Multimedia in ELT/L (2000-2007)

8.1.1 Introduction

The period from 2000 to 2007 represents the maturation of Computer-Assisted Language Learning as a recognized field and the gradual transition from the "early CALL" of the 1980s and 1990s to what Warschauer (2000) termed "integrative CALL." The transformation has marked a pivotal in English Language Teaching (ELT). with the growing adoption of Computer-Assisted Language Learning (CALL) and multimedia applications is more engaging and interactive forms. Multimedia resources such as CDs, DVDs, language software, and the rising internet in various types facilitated dynamic learning experiences, gradually supplanting traditional text-based materials. The technological landscape of Phase 1 included several categories of tools, each with specific applications to ELT.

A- CD-ROMs and Language Software:

In the 2000s, CD-ROMs and dedicated language software became prevalent tools for language learning. Programs like Tell Me More and Rosetta Stone were accessible in two primary formats: online (Web-pass) and as standalone CD/DVD software. These tools allowed learners to study at their own pace, offering a diversity of interactive features such as audio clips, video content, and engaging exercises to improve listening, speaking, reading, and writing skills.

B- Data Projectors:

Gaining widespread popularity from the late 1990s into the early 2000s, data projectors revolutionized classroom teaching. These effective tools enabled teachers to project computer screens, videos, and multimedia content onto large screens, turning traditional classes into visually engaging experiences. by making it easier to present information to an entire class.

C- Dictionaries and Grammar Tools:

The evolution of digital language tools like Oxford and Cambridge Dictionaries, Merriam-Webster, Word Reference, and Grammarly revolutionized the way learners engage with the English language. These aids went beyond simple word lookups, offering comprehensive definitions, pronunciation guides, and contextual examples, real-time feedback on sentence structure, punctuation, and writing style, empowering users to enhance vocabulary development and write and communicate with confidence and precision.

D - Learning Management Systems (LMS) and Online Communities:

Platforms like Blackboard, Moodle, and Livemocha blended online courses and language exchange and allowed teachers to organize course materials, facilitate conversations, and track student progress through assessments and interactive exercises, quizzes with automated scoring, and gradebooks (Coates et al., 2005)

E-Blogs, Wikis, and Chat Rooms:

With the rise of the internet and digital communication tools, Educators and learners embraced blogs, wikis, and chat rooms as new methods to enhance language learning. Blogs have provided a platform for teachers and learners to share their thoughts, develop writing skills on their learning journey, and engage with a wider audience through comments and discussions. Wikis encouraged teamwork by allowing students and educators to co-create and edit content collectively. Meanwhile, free chat rooms became - which they are informal environments- valuable spaces for learners to express their opinions, engage in dialogues, exchange ideas, practice English, and build confidence in expressing themselves.

8.1.2 Educational Applications

During the early 21st century, CALL was primarily applied in English language teaching as a means of supporting structured practice in vocabulary, grammar, listening, and pronunciation. Drill-and-practice programmes were widely used for vocabulary acquisition, particularly for memorising word lists, collocations, and lexical sets through repeated exposure and controlled exercises (Chapelle, 2001; Levy, 1997). Similarly, grammar practice was commonly delivered through interactive exercises that provided immediate feedback on learners' responses, enabling them to identify and correct errors at the point of practice (Chapelle, 2001; Warschauer & Healey, 1998). Listening comprehension was also supported through multimedia materials incorporating audio and video, which offered learners opportunities to develop receptive skills through repeated exposure to aural input (Kern & Warschauer, 2000). Pronunciation training, although comparatively limited by contemporary standards, was introduced through early speech-recognition software that allowed learners to practise and receive basic feedback on their pronunciation (Chapelle, 2001). In many institutional contexts, CALL functioned as supplementary practice outside classroom instruction, with teachers assigning computer-based tasks as homework or as reinforcement of previously taught content (Levy, 1997; Stockwell, 2007).

8.1.3 Contributions to Teaching and Learning

The pedagogical contributions of early CALL were therefore considerable, particularly in relation to individualisation, feedback, multimodality, motivation, and accessibility. One of the most significant advantages was individualisation: CALL enabled learners to practise at their own pace, thereby accommodating differences in learning speed, proficiency level, and individual needs (Chapelle, 2001; Levy, 1997). Automated feedback systems also provided learners with immediate information about their performance, which supported self-correction and encouraged greater awareness of their own learning processes (Chapelle, 2001; Warschauer & Healey, 1998). In addition, multimedia technologies offered multimodal input through combinations of audio, visual, and textual resources, making it possible to address a wider range of learner preferences and learning styles than traditional print-based materials (Kern & Warschauer, 2000). The novelty and interactive character of CALL also contributed to increased learner motivation and engagement, particularly when compared with conventional textbook-based activities (Levy, 1997; Stockwell, 2007). Finally, digital materials could be accessed repeatedly, allowing learners to review content, revisit difficult items, and reinforce previously learned language (Chapelle, 2001). Taken together, these applications and contributions positioned early CALL as a valuable complement to classroom instruction, even though its pedagogical potential was constrained by the technological and infrastructural conditions of the period.

8.1.4 Challenges in this stage (2000–2007)

Despite remarkable advancements during this period, early technologies offered new possibilities for self-directed learning through diverse computer applications. They encouraged active participation both inside and outside the classroom and provided access to various learning resources. However, several challenges persisted as below, hindering the effective adoption of technology in language education:

1. Digital Divide:

Unequal access to technological resources created disparities among users, particularly in under-resourced regions, limiting their opportunities to benefit from modern educational tools.

2. Digital Literacy:

Both teachers and students faced the challenge of acquiring the digital necessary skills to navigate and utilize emerging technological tools in language teaching and learning.

3- Teacher Training:

The need for ongoing professional development became evident as teachers struggled to adapt to new technologies. Many have required continuing training and support to seamlessly blend digital tools into their teaching methods and develop attractive instructional approaches.

4- Relatively Essential Software:

many of the language learning software available during this period was relatively simplistic, usually focusing on grammar drills and rote vocabulary exercises rather than providing immersive and interactive learning experiences.

8.2 Stage2: Late 2000s to Early 2010s: Web 2.0 and Social Media Era (2008-2012)

8.2.1 Introduction

The period from 2008 to 2012 marked a significant phase in technology-enhanced English language teaching and learning (ELT/L), characterised by the growing adoption of Web 2.0 technologies. Coined by O'Reilly (2005), the term refers to web-based applications that facilitate user-generated content, collaboration, and social interaction, moving beyond the largely static websites of the early Internet. Tools such as blogs, wikis, online forums, and social networking platforms enabled learners to create and share content, interact with authentic audiences, and collaborate beyond classroom boundaries (Warschauer & Grimes, 2007). These affordances supported communicative and sociocultural approaches to language education by promoting meaningful interaction and more active learner participation (Godwin-Jones, 2009).

Despite these opportunities, the adoption of Web 2.0 technologies varied across educational contexts. Challenges such as information overload, privacy concerns, digital distraction, unequal access, and differences in institutional infrastructure and digital competence limited their effective integration (Selwyn, 2011). Thus, although this period marked a shift towards more participatory and collaborative language learning, the pedagogical value of Web 2.0 depended on how these tools were incorporated into teaching practices and the conditions in which they were used.

8.2.2 Dominant Technologies and Tools

A- Interactive whiteboards (Smart Boards)

They began gaining traction in educational environments during the early and mid2000s as they provided an engaging method to deliver lessons. It's noted that the widespread adoption and integration of smart boards in classrooms has been a gradual process, with varying levels of implementation across different educational institutions and areas.

B- Widespread Use of Blogs and Websites:

Class blogs provided a shared space for announcements, discussion, and collaborative projects (Sun, 2010). Blogs and websites became widely used during this phase, allowing institutions and learners to express themselves creatively and explore diverse writing styles. This marked a significant shift from the earlier phase, where such platforms were not commonly used in English language teaching (ELT) environments.

C- Social Media Networks:

Facebook, WhatsApp, Twitter, and YouTube became popular and powerful tools for language practice and cultural exchange, enabling learners to connect with native speakers and access diverse cultural content.

D- Massive open online courses (MOOCs)

They came into existence in the late 2010s. Websites like Khan Academy (founded in 2008) and Coursera (founded in 2012) gained popularity, providing free and paid courses on a wide range of subjects, making education more accessible to learners worldwide.

Many of these tools from the first and second stages are still actively used by teachers in classrooms and by in-person learners. Some have also evolved to align with the latest technological advancements.

8.2.3 Pedagogical Applications in ELTL

The pedagogical applications of Web 2.0 technologies in ELT were diverse and far-reaching. Wikis and Google Docs transformed writing instruction by enabling students to engage in collaborative writing processes—planning, drafting, revising, and editing—that mirrored authentic workplace practices (Kessler, 2009). In parallel, telecollaboration initiatives such as the European Union's eTwinning program connected language learners across national boundaries, a practice theorized as enabling the development of intercultural communicative competence, defined as the ability to communicate effectively and appropriately with people from different cultural backgrounds (Byram, 1997; O'Dowd, 2013). Research found that telecollaboration supported linguistic development, intercultural awareness, and learner motivation, though it also documented challenges including mismatched expectations, unequal participation, and task design limitations. A further significant insight concerned the extent of extramural English—learners' self-initiated engagement with English outside formal instructional contexts (Sundqvist, 2009). Young learners, in particular, were spending hours daily on gaming, social media, and video streaming in English, and this informal learning was often more engaging and more frequent than formal instruction, raising questions about how classrooms could bridge to these extramural experiences (Sundqvist & Wikström, 2015). Perhaps the most theoretically significant contribution of Web 2.0, however, was the provision of authentic audiences beyond the teacher. When students published blog posts, wiki pages, or podcasts that could be read by anyone globally, writing shifted from an exercise to be evaluated to a communicative act to be understood, a shift theorized to increase student motivation, attention to audience awareness, and uptake of feedback (Reinhardt, 2019).

8.2.4 Contributions to Teaching and Learning

Research on Phase 2 technologies produced several substantive contributions to understanding technology-enhanced language learning. First, Web 2.0 tools were consistently found to support learner autonomy, as learners who could access authentic materials, communicate with native speakers, and receive feedback from global audiences independently of teachers exercised greater control over their learning processes (Benson, 2011). Second, collaborative writing using wikis and Google Docs improved writing quality, increased attention to both content and language form, and supported the development of editing and revision skills (Kessler, 2009; Storch, 2013). Third, telecollaboration research demonstrated the possibility of developing intercultural communicative competence through structured online exchanges (O'Dowd, 2013). Fourth, the integration of learners' extramural digital practices with classroom instruction emerged as a productive direction, with studies documenting how gaming, fan fiction writing, social media engagement, and video streaming in English contributed to vocabulary development, reading comprehension, and fluency (Sundqvist & Wikström, 2015). However, the gap between extramural language use and classroom language instruction remained substantial in most contexts.

8.2.5 Major Challenges and Limitations

Despite these contributions, Phase 2 technologies presented several significant challenges. At the micro-level, while peer feedback was promoted as a benefit of Web 2.0 collaboration, research documented substantial quality concerns: peers provided incorrect corrections, focused disproportionately on surface errors while ignoring deeper organizational issues, and were reluctant to offer critical feedback for social harmony reasons, a problem particularly acute in contexts where all learners were non-native speakers (Kessler, 2009). In addition, the same features that made Web 2.0 engaging—notifications, multimedia, and social interaction—also facilitated distraction and off-task behavior, with students documented to engage in multitasking that reduced attention to learning tasks (Kirschner & De Bruyckere, 2017). At the meso-level, when language learners published content online, participated in social media, or interacted with unknown others, privacy and safety concerns arose. Finally, traditional assessment methods proved poorly suited to evaluating collaborative, process-oriented, multimodal Web 2.0 work.

8.3 Stage 3: Mobile Learning and Apps (2013-2019)**8.3.1 Introduction**

The period from 2013 to 2019 marked a significant phase in technology-enhanced English language teaching and learning (ELT/L), characterised by the widespread adoption of smartphones, tablets, and educational applications. Mobile-Assisted Language Learning (MALL) expanded opportunities for flexible, personalised, and context-sensitive language learning beyond the classroom's physical and temporal boundaries. Mobile applications, social media, and communication platforms supported vocabulary development, language skills practice, collaboration, and authentic communication across formal and informal settings. Duolingo (launched 2011) alone reached 300 million users by 2019. While MALL enhanced accessibility and informal learning, concerns persisted regarding pedagogical coherence, screen-time management, and the digital divide (Stockwell & Hubbard, 2013). This phase underscored the importance of aligning mobile technologies with instructional objectives.

8.3.2 Dominant Technologies and Tools

A-Tablets:

Tablets started acquiring traction as educational tools in 2010 with the release of Apple's iPad. Its user-friendly interface, portability, and access to educational apps made it an attractive option for classrooms. By the mid-2010s, tablets had become mainstream in institutions, transforming learning through interactive classes, digital content, and personalized educational experiences, particularly with the rise of Android tablets.

B- Language Learning Apps (M- Learning) :

Smartphones and tablets became ubiquitous, leading to the rise of mobile apps for language learning. Duolingo dominated the market, offering gamified instruction across dozens of languages. Research on Duolingo documented its effectiveness for vocabulary and grammar at beginner levels, with some evidence for reading and listening development, but limited efficacy for productive skills (speaking and writing) (Loewen et al., 2019). Other notable apps included Memrise, Babbel, and Hello Talk. These apps offered deep experiences, making language learning engaging and accessible.

C- Messaging Apps:

WhatsApp, WeChat, LINE, and Telegram became platforms for language learning research and practice. Teachers created class WhatsApp groups for announcements, homework submission, and informal interaction. Researchers documented how authentic communication in messaging apps supported the development of interactional competence.

D-Mobile-Friendly Content:

Websites and LMS platforms adapted to mobile devices, allowing learners to access materials anytime, anywhere.

E- Digital Dictionaries and Translation Tools:

Google Translate underwent a fundamental transformation during Phase 3, moving from word-for-word translation to neural machine translation that produced remarkably fluent output. The implications for language teaching were profound: if machines could translate instantly with high quality, what was the purpose of language learning? Responses ranged from prohibition of translation tools to their integration as learning resources (Levy & Steel, 2015).

F- Podcasts and Audiobooks:

Audio resources like ESL Podcast and Audible provided listening practice on the go.

G-Speech Recognition and Pronunciation Apps:

Advances in speech recognition technology, powered by deep learning, dramatically improved accuracy. Apps such as Replika, ELSA Speak (launched 2016), and Pronunciation Power offered targeted pronunciation and conversation practice with automated feedback on specific phonemes, stress patterns, and intonation contours. Research found that app-based pronunciation practice could produce measurable gains, though the ecological validity of receiving feedback from machines rather than human interlocutors remained debated.

H. Virtual Reality (VR) and Augmented Reality (AR):

In the late 2010s, immersive technologies like VR and AR began to transform ELT by creating realistic language practice environments, and they still need more development to align with the objectives of the educational process.

8.3.3 Pedagogical Applications

The expansion of MALL encouraged a shift towards more flexible, context-sensitive, and learner-directed approaches to language education. Its pedagogical applications were closely associated with ubiquitous learning, situated learning, self-regulated learning (SRL), and learner autonomy. Ubiquitous learning emphasised the possibility of accessing learning resources across different times and locations, while situated learning focused on engaging with language in meaningful contexts. For example, learners could use translation applications while travelling, practise English during everyday activities, or complete language tasks connected to their immediate surroundings.

Mobile devices also facilitated spontaneous and just-in-time learning by allowing learners to access linguistic resources when particular needs arose. Gamification represented another important development in this period. By incorporating game-design elements such as points, badges, leaderboards, streaks, and incremental rewards, educational applications sought to sustain participation and motivation. Studies generally reported positive effects on engagement and short-term motivation (Reinhardt & Sykes, 2014). Microlearning and Spaced Repetition used Mobile apps to exploited the affordances of brief, frequent interactions through microlearning (short learning units designed for completion in 5–10 minutes) and spaced repetition (algorithms that schedule review of previously learned items at optimal intervals). Duolingo, Memrise, and Anki (a flashcard app) incorporated spaced repetition algorithms to maximize retention efficiency (González-Fernández & Schmitt, 2020).

8.3.4 Contributions to Teaching and Learning

MALL expanded opportunities for English language learning by providing flexible access to educational resources and enabling learners to engage with English beyond formal instructional settings. Mobile applications supported structured practice and learner autonomy through features such as progress tracking, goal setting, personalised learning pathways, and just-in-time support (Lai, 2017). In addition, access to authentic materials, including news articles, videos, podcasts, social media, and online games, allowed learners to engage with language content aligned with their interests. Research on extramural English found associations between engagement with English outside formal instruction and vocabulary size, listening comprehension, and oral fluency (Sundqvist & Wikström, 2015).

Meta-analyses reported positive effects of mobile learning on vocabulary acquisition ($g = 0.72$), grammar ($g = 0.55$), listening ($g = 0.63$), and reading comprehension ($g = 0.58$), with smaller effects for speaking ($g = 0.35$) and writing ($g = 0.41$) (Burston, 2013; Lin & Lin, 2016; Sung et al., 2016). These findings also indicated that outcomes were stronger when mobile activities incorporated design principles such as spaced repetition, context awareness, and seamless learning, rather than simply transferring desktop-based activities to mobile devices. Thus, the contribution of MALL depended not only on access to technology but also on how mobile resources and affordances were integrated into learning activities.

8.3.5 Challenges and Limitations

Despite its potential, Mobile-Assisted Language Learning (MALL) faced technological, economic, and pedagogical challenges. Differences in operating systems, screen sizes, processing capabilities, and software compatibility affected application usability,

particularly on older or lower-cost devices. Small screens could also limit extended reading, detailed writing, and visually complex activities, while unreliable connectivity, limited battery life, data charges, and application costs further constrained access (Kukulka-Hulme, 2012). In addition, the combination of educational resources with messaging, entertainment, and social media created opportunities for digital distraction; Ravizza et al. (2017) found strong negative correlations between off-task device use and academic performance.

Concerns also arose regarding the depth and sustainability of app-based learning. Although microlearning facilitated frequent practice, dividing language learning into short exercises could encourage superficial engagement at the expense of more comprehensive development (Traxler, 2018). Commercialisation introduced further concerns about privacy, data collection, and affordability, as free applications could rely on advertising or user data, while paid subscriptions and limited institutional licensing restricted access. Moreover, the commercial priorities of educational applications did not necessarily align with sound language-learning principles (Selwyn, 2016).

The effective integration of MALL into formal education also depended on teacher preparation and institutional support. Despite the growing ownership of mobile devices among learners, teachers did not always receive adequate training in mobile pedagogy or sufficient guidance on integrating applications into existing curricula. These limitations highlight that the availability of mobile technology alone was insufficient to ensure effective language learning; its educational value also depended on appropriate pedagogical integration and the conditions supporting its use.

8.4 Stage 4: Early 2020s: Artificial Intelligence and Beyond (2020-present)

8.4.1 Introduction

The period from 2020 to the present marks a significant stage in technology-enhanced English language teaching and learning (ELT/L), characterised by the growing integration of artificial intelligence (AI), learning analytics, and immersive technologies. Two developments have particularly shaped this phase: the COVID-19 pandemic, which accelerated the adoption of online and hybrid instruction, and the emergence of accessible generative AI following the public release of ChatGPT in late 2022 (Moorhouse, 2020; Pokhrel & Chhetri, 2021; Godwin-Jones, 2022; Warschauer et al., 2023). Meanwhile, advances in virtual reality (VR) and augmented reality (AR) hardware, including Meta Quest 2 and 3 and Apple Vision Pro, have made immersive learning experiences more accessible, although their adoption remains limited.

8.4.2 Dominant Technologies and Tools

A- Virtual Classrooms:

Platforms like Zoom and Microsoft Teams became essential during the COVID-19 pandemic, enabling remote teaching.

B- Generative AI and Large Language Models (LLMs):

ChatGPT, Claude, Gemini, etc., represent the most significant technological development for ELT since the graphical web browser. Kohnke et al. (2023) identified several ELT applications: AI as conversational partner (simulated interaction with native or fluent speaker), AI as writing assistant (feedback on grammar, vocabulary, style, organization), AI as content generator (reading passages, exercises, test items), and AI as tutor (adaptive instruction based on learner performance). Other AI models assist with lesson planning, content creation, and personalized tutoring.

C- Learning Analytics and Adaptive Learning Systems:

Learning analytics involves the measurement, collection, analysis, and reporting of data about learners and their contexts for understanding and optimizing learning (Siemens & Baker, 2012).

D- Virtual Reality (VR) and Augmented Reality (AR):

VR creates fully immersive digital environments accessed through head-mounted displays (HMDs), while AR overlays digital information onto the physical environment through smartphone screens or AR glasses. ELT applications of VR include virtual field trips, task-based simulations, and social VR spaces (collaborative activities with avatars of learners from different countries) (Parmaxi, 2023). AR applications include vocabulary acquisition by pointing a phone at real-world objects to see their English labels (Google Lens, Microsoft Translator), interactive print materials (AR-enhanced textbooks), and location-based activities (language tasks triggered by GPS coordinates). Meta-analyses by Parmaxi (2023) and Pellas et al. (2021) found positive effects of VR/AR on motivation, engagement, vocabulary acquisition, and situational language use, with the strongest effects for task-based and communicative activities.

E- Automated Writing Evaluation (AWE):

AWE tools have advanced significantly from early grammar checkers to comprehensive writing assistance such as Grammarly Premium, ProWritingAid, and Turnitin Revision Assistant. Research by Ranalli (2018) and Zhang (2020) found that AWE feedback can be as effective as human feedback for certain error types.

8.4.3 Contributions to English Language Teaching and Learning

AI and immersive technologies offer several potential contributions to English language teaching and learning (ELT/L). Generative AI and automated feedback tools support language production, error correction, and revision, while conversational agents provide accessible speaking practice beyond conventional drill-and-practice activities (Fryer et al., 2020). Feedback can facilitate repeated practice, although its effectiveness depends on the learning task: immediate feedback may support error correction, whereas delayed feedback can encourage deeper processing (Shute, 2008).

Virtual reality (VR) and augmented reality (AR) enable learners to practise language in simulated, contextualised environments. Research has associated VR-based learning with reduced foreign language anxiety and greater situational willingness to communicate (Yang et al., 2020). Similarly, learning analytics and adaptive systems can inform teaching by identifying performance patterns and learning difficulties, directing learners towards areas requiring improvement, and reducing time spent on mastered content (Siemens & Baker, 2012; Hwang et al., 2020). However, their effectiveness depends partly on the relevance of system recommendations and the extent to which they accommodate learner choice. The expansion of digital instruction during the COVID-19 pandemic also generated evidence about technology-mediated ELT across educational contexts with differing levels of resources (Moorhouse & Tiet, 2021).

8.4.4 Challenges and Limitations

Despite their potential benefits, Stage 4 technologies present significant pedagogical, ethical, and structural challenges. Generative AI raises concerns about academic integrity and assessment validity because it can produce sophisticated texts that learners may submit as their own. This challenges traditional assessment practices while creating opportunities to reconsider the aims of writing instruction (Warschauer et al., 2023). Moreover, when learners rely excessively on AI to produce written work, improvements in text quality may not reflect equivalent development of their language skills (Stommel, 2014). Such dependence may also undermine independent writing and critical thinking.

Ethical concerns extend to algorithmic bias and data privacy, particularly regarding consent, ownership, data security, and potential surveillance (Selwyn, 2019; Hoel & Mason, 2018). AI integration also raises questions about teachers' professional roles and the balance between automated assistance and human instruction.

Furthermore, the rapid development of AI has outpaced the establishment of evidence-based pedagogical frameworks for its integration into ELT. Teachers and institutions must determine how AI-mediated conversation should complement human interaction, what level of AI assistance supports rather than replaces writing development, and how inaccurate feedback should be addressed. Without clear pedagogical guidance, implementation risks becoming inconsistent or misaligned with learning objectives.

8. Future Directions

The future of technology-enhanced English language teaching and learning (ELT/L) will likely be shaped by the continued integration of generative AI, immersive technologies, and learning analytics. AI-driven adaptive systems are expected to offer increasingly personalised learning pathways and real-time feedback. However, further research is needed to establish how these tools can support deep language learning without undermining learner autonomy or replacing meaningful human interaction.

Advances in virtual reality (VR), augmented reality (AR), and mixed reality are also likely to expand opportunities for authentic and engaging language practice. Research should examine the specific conditions under which immersive environments provide greater learning benefits than less costly alternatives, while addressing accessibility barriers for learners with disabilities. Similarly, increasingly sophisticated learning analytics may enable more targeted instructional interventions, but further investigation is needed into how teachers interpret and use analytics to respond meaningfully to learners' needs.

Another important direction involves integrating insights from neuroscience and cognitive science into educational technology design to better support language acquisition and processing. Equally important is the development of inclusive and culturally responsive technologies. As many existing tools reflect the linguistic norms, cultural assumptions, and pedagogical values of the Global North, research should give greater attention to the experiences of learners and teachers in under-represented contexts. Across these developments, ethical considerations, human-centred design, and teacher empowerment must remain central to ensure that emerging technologies enhance rather than displace human learning and interaction.

9. Conclusion

This article has critically examined the development of technology-enhanced English language teaching and learning (ELT/L) from 2000 to the present through a four-phase chronological framework. Phase 1 (2000–2007) saw the consolidation of computer-assisted language learning (CALL) and multimedia technologies; Phase 2 (2008–2012) introduced the collaborative possibilities of Web 2.0 and social media; Phase 3 (2013–2019) was characterised by the expansion of mobile-assisted language learning (MALL) and language learning applications; and Phase 4 (2020–present) has brought together artificial intelligence (AI), learning analytics, and immersive technologies. Although each phase has expanded opportunities for language learning, persistent challenges remain in access, teacher preparedness, pedagogical integration, assessment, and ethical implementation.

Three key issues emerge from this historical analysis. First, the gap between technological capabilities and pedagogical implementation demonstrates that innovation alone does not guarantee improved learning outcomes; effective integration requires sound instructional design, curriculum alignment, and sustained teacher development. Second, technology can both broaden access and reinforce existing inequalities, particularly where infrastructure, resources, and culturally responsive design are lacking. Third, the changing distribution of control among teachers, learners, and increasingly autonomous systems raises questions about learner agency, pedagogical responsibility, and assessment. These concerns highlight the need for assessment approaches that accommodate collaborative, process-oriented, multimodal, and AI-mediated learning.

The framework illustrates how these challenges evolve across levels. At the micro level, digital literacy increasingly encompasses the critical evaluation and use of AI-generated content. At the meso level, institutions need coherent frameworks to guide technology integration, while at the macro level, concerns about equitable access intersect with algorithmic governance, data privacy, and environmental sustainability. Addressing these challenges requires coordinated support for learners and teachers, institutional reform, and policies that promote ethical and sustainable technological development.

The growing influence of generative AI and immersive technologies also raises fundamental questions about language proficiency, assessment, and the role of teachers. AI systems can generate sophisticated language, provide feedback, and simulate conversation, challenging established assumptions about language learning and development. Advances in automated translation further prompt questions about the purposes of additional language learning. These developments require critical investigation into how technology can support meaningful language development and learner autonomy while complementing human interaction and pedagogical expertise.

Overall, the historical trajectory of technology-enhanced ELT/L suggests the need for both caution and optimism. Successive innovations have expanded opportunities for communication, collaboration, and personalised learning, yet their educational potential has often been constrained by inequality, insufficient teacher preparation, and weaknesses in pedagogical implementation. The central lesson is that technology does not teach in itself; its educational value depends on how effectively teachers, designers, and institutions integrate it into purposeful learning experiences.

As technology-enhanced ELT/L moves into its next phase, progress will depend not simply on technological capabilities but on evidence-informed practice, equitable access, teacher empowerment, and human-centred design. Understanding the patterns and limitations of the past twenty-five years is therefore essential to ensuring that future innovations respond to the diverse needs of language learners and teachers across educational contexts.

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