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# A Review of the Affordances and Challenges of Artificial Intelligence Technologies in Second Language Learning

**Zahra Fakher Ajabshir**

Assistant Professor of Applied Linguistics, University of Bonab, East Azarbaijan, Iran. Email: fakherzahra@yahoo.com

## Abstract

Second language (L2) learning has witnessed a significant surge in the utilization of artificial intelligence (AI), offering a wide range of advantages that can significantly enhance language acquisition. AI technology encompasses various applications such as chatbots, virtual tutors, speech recognition systems, language learning apps, and adaptive learning platforms. These advantages of AI in L2 learning provide learners with personalized and interactive experiences, real-time feedback, authentic language input, and the opportunity to practice language skills in a secure and supportive environment. By harnessing the potential of AI, language learners can benefit from tailored instruction, effective assessment, and engaging learning activities, ultimately expediting their proficiency in L2. This study aims to provide a review of AI in the English as a foreign language (EFL) context by summarizing the affordances and challenges associated with six prevailing types of AI technologies, including natural language processing (NLP), automatic writing evaluation (AWE), computerized dynamic assessment, automatic speech recognition (ASR), chatbots, gamification, and virtual reality. Some potential avenues for future research were also recommended to provide fresh perspectives for forthcoming studies.

*****Corresponding Author:** Zahra Fakher Ajabshir

**Email:** fakherzahra@yahoo.com

## Introduction

The emergence of computer-assisted language learning (CALL) has rapidly transformed the landscape of second language (L2) learning. Using machine learning algorithms, techniques for processing natural languages, and big data analysis, artificial intelligence (AI) technologies have gained the capacity to revolutionize how we acquire and master a new language. These advancements have paved the way for interactive chatbots, virtual language tutors, and intelligent language assessment tools that can comprehend and respond to the unique needs of learners. AI-powered platforms can offer personalized learning experiences tailored to an individual's proficiency level, learning style, and goals. This personalized approach enhances motivation and optimizes learning outcomes by delivering targeted content and adaptive feedback. By incorporating AI, language learners can benefit from an immersive and interactive learning environment replicating real-life situations and encouraging practice and fluency. AI can facilitate the integration of speech recognition, automated translation, and natural language generation, thereby increasing the accessibility and efficiency of language learning across different contexts and proficiency levels.

As AI continues to be applied in the field of CALL, there is an increasing development of technological language learning tools. However, there are concerns regarding the insufficiency of information and teacher preparation. To effectively utilize these tools, teachers, students, and stakeholders must thoroughly understand the recently developed AI-based language learning tools. Considering the proliferation of AI use and research in the English as a foreign language (EFL) context and the need for gaining an in-depth understanding of a range of AI technologies available in L2 learning, this study provides an overview of six prevalent types of AI technologies, namely natural language processing (NLP), automatic writing evaluation (AWE), computerized dynamic assessment, automatic speech recognition (ASR), chatbots, gamification, and virtual reality. Each AI-enabled technology is discussed along with a range of affordances it might contribute to learning different facets of L2. The existing state of the empirical research on how either technology affected L2 is discussed. Finally, potential areas for future research are recommended.

## Natural language processing (NLP)

NLP allows computers to comprehend natural language in the same manner as humans. AI is utilized in NLP to analyze real-world input and interpret it in a way that a computer can comprehend (Millstein, 2020). AI-driven NLP leverages machine learning algorithms, statistical models, and deep learning techniques to analyze and comprehend natural language data (Zhang & Teng, 2021). The continuous advancements in AI-driven NLP technologies have resulted in notable enhancements in language comprehension, contextual interpretation, and natural language generation. These technologies improve human-computer interaction and facilitate more productive and streamlined communication. So far, NLP has found applications in various domains, including machine translation, processing and summarization of natural language texts,

user interfaces, multilingual and cross-language information retrieval, speech recognition, morphological/syntactic analysis, expert systems, etc.

A wealth of L2 empirical studies has documented how NLP contributes to learning different L2 aspects, including collocations (Chang et al., 2008), listening (Vu et al., 2022), grammar, and sentence production (Kim, 2019). Numerous studies have reported the positive impacts of using intelligent tutoring systems and how they cope with input and generate output (Demir, 2019; Mitrovic et al., 2013; Murray & Pérez, 2015). Murray and Pérez (2015) implemented an adaptive feedback mechanism within the assessment system. Their study demonstrated that this system outperformed the traditional learning system in terms of efficiency. Mitrovic et al. (2013) utilized intelligent tutoring tools to rectify misconceptions in another study. It was suggested that intelligent tutoring systems primarily focus on addressing errors and misconceptions could be further enhanced by incorporating a positive feedback feature. The empirical assessment revealed that students who engaged with the augmented edition of the tutor, which provided negative and positive feedback, acquired knowledge at a rate twice as fast as those students who interacted with the standard version that only provided error feedback. More recently, Demir (2019) argued that AI-based tutors can seize exceptional teaching opportunities by harnessing negative feedback that emerges from errors. These opportunities allow for a deeper understanding of an individual's capabilities, improving problem-solving skills and knowledge specialization and facilitating learning at advanced levels. Text-to-speech and speech-to-text systems have also facilitated language learning, enabling learners to improve their speaking and listening skills (Janokar et al., 2023). A further affordance of NLP technology is machine translation, which provides learners with real-time translations, simplifying complex sentences and explaining idiomatic expressions (Lee, 2020). NLP models can also provide contextually relevant suggestions for completing sentences or selecting appropriate lexicon, thus helping learners improve their lexicon, writing, and communication skills (Zhang & Teng, 2021).

## Automatic writing evaluation (AWE)

AWE is using technology to evaluate and offer feedback on written compositions. By employing AI and NLP techniques, AWE can analyze various aspects of a text, including grammar, vocabulary, organization, and coherence. There are several advantages to utilizing AWE. First, it provides instant feedback on writing, enabling learners to promptly recognize and rectify errors, thereby enhancing their writing skills in real time. Secondly, the AWE system assesses writing consistently and objectively, minimizing the subjective bias that may arise when human graders are involved (Ngo et al., 2022). Thirdly, it expedites the evaluation process, enabling teachers to provide feedback to a more significant number of students within a shorter period (Waer, 2023). Finally, AWE can be utilized for self-assessment, allowing learners to practice and evaluate their writing independently (Giessler, 2023).

The literature includes ample studies on the beneficial impacts of AWE on different aspects of writing. Waer (2023) examined the impact of utilizing AWE in diminishing writing apprehension and improving grammatical proficiency. The participants were divided into two groups: the experimental group utilized an AWE tool to assess their writing, while the control group evaluated their essays by an instructor. The findings revealed that AWE assisted apprehensive writers in reducing their apprehension and enhancing the grammatical knowledge

of non-apprehensive writers. Additionally, negative associations were observed between writing apprehension and grammatical knowledge. A study by Fakher Ajabshir and Ebadi (2023) also explored the effects of teacher-focused feedback and AWE on the writing performance of EFL learners in terms of global aspects and various linguistic measures such as syntactic complexity, accuracy, lexical diversity, and fluency (CALF). The participants were randomly assigned to either the teacher feedback or AWE groups. During the intervention, the teacher provided instruction on narrative and argumentative writing genres, and the participants engaged in writing texts and received feedback either from the teacher or AWE. The results revealed improvements in overall writing performance, particularly in formal aspects, as well as enhancements in CALF measures. Although there was no significant difference in overall writing performance between the two groups, AWE yielded higher lexical diversity and syntactic complexity scores, while the teacher feedback group outperformed in fluency.

Several recent research studies have also explored the effectiveness of AWE tools in supporting the psychological aspects of L2 learning, thus enhancing the writing abilities of L2 learners. In a study by Yao et al. (2021), the students were randomly divided into experimental and control groups. Both groups were provided with English writing instructions based on the syllabus. However, only the students in the experimental group participated in three peer assessment activities, which were facilitated by an AWE program. The outcomes revealed that the students in the experimental group exhibited a greater inclination towards using L2 and sustained a high level of motivation throughout the study. These findings imply that the integration of AWE can serve as a valuable addition to peer assessment activities in L2 writing classrooms, fostering a more positive mindset among students. Sherafati and Mahmoudi Largani (2023) also reported the positive impacts of AWE on fostering self-regulation and self-efficacy beliefs of students. Finally, Giessler (2023) found high levels of cognitive engagement with AWE feedback even when learners chose not to accept the suggested corrections.

In general, previous studies (e.g., Fakher Ajabshir & Ebadi,2023; Li, 2021; Ranalli, 2018; Shang, 2019; Sherafati & Mahmoudi Largani, 2023; Ti & Nikolov, 2022; Waer, 2023) focusing on AWE consistently demonstrate that its usage is linked to better learning outcomes and heightened learner motivation, autonomy, and self-regulatory behaviors. These findings suggest that AWE has the potential to facilitate effective and personalized feedback, promote learner engagement, and support the overall language development of L2 learners. Nevertheless, it is worth noting that AWE has its limitations and should not be relied upon as a complete replacement for human evaluation. It may encounter challenges when assessing specific aspects of writing, such as content and creativity. Therefore, a comprehensive approach that combines automated evaluation and human feedback is suggested for effective writing instruction.

## Computerized dynamic assessment

AI has made significant progress in the field of computerized assessment, presenting new opportunities to enhance the assessment process. The utilization of AI in computerized assessment has the capability to revolutionize the L2 assessment domain, presenting improved efficiency, dependability, and tailored assessment experiences. AI algorithms can be trained to evaluate and score subjective answers, such as essays or open-ended questions. By analyzing patterns in extensive sets of human-scored responses, AI models can learn to provide accurate and consistent

scores, reducing the reliance on human assessors (Poehner & Wang, 2021). This not only saves time but also increases efficiency and enhances objectivity. AI may also serve as an intelligent tutoring system (Hooshyar et al., 2016), providing personalized feedback and guidance to learners based on their assessment performance. These systems analyze areas where learners struggle and provide targeted explanations, resources, and practice materials to address their specific weaknesses. This adaptive feedback significantly improves learning outcomes (Wu et al., 2017). Further, AI models can analyze vast amounts of assessment data to identify patterns and trends, enabling educators to gain insights into student performance, learning gaps, and instructional effectiveness. This information can be utilized to develop targeted interventions and enhance teaching strategies to support students better.

AI-based assessment also helps maintain the integrity and security of computerized assessments. Computerized assessment enables rigorous access control measures, guaranteeing that solely authorized individuals can access and manage assessments. AI-based proctoring systems employ computer vision techniques to oversee individuals taking online exams. By utilizing facial recognition, eye-tracking, and behavior analysis, these systems are capable of identifying any dubious actions such as cheating or impersonation (Jongerius et al., 20121). Consequently, implementing such systems guarantees the preservation and safeguarding of the authenticity and security of computerized assessments. AI algorithms can also be employed to identify instances of plagiarism in assessments. As Garg and Goel (2022) argued, AI systems compare a submitted work against an extensive database of sources and flag any potential cases of copied content. This helps ensure academic integrity and upholds the credibility of assessments.

A plethora of studies have found supportive evidence for the impact of computerized assessment on yielding better L2 learning outcomes (e.g., Ebadi & Saeedian, 2016; Ebadi et al., 2018; Estaji & Saeedian, 2020; Jeon, 2023; Yang & Qian, 2020). Estaji and Saeedian (2020) examined the effects of mediation delivery in three distinct formats, computer-based, human-based, and a combination of both human and computer-based, on EFL learners' reading comprehension. The findings indicated that both forms of mediation had a comparable impact on the learners' reading comprehension. The study proposed that computers can significantly assist as long as human mediators supplement them. In a study by Kamrood et al. (2021), the learners were provided with ZPD-based mediation through hints and prompts using software. This software generated three types of scores: an actual score reflecting their independent performance, a mediated score reflecting their performance with mediation, and a learning potential score (LPS) indicating the improvement between the actual and mediated scores. The findings demonstrated a significant difference between the learners' actual and mediated scores, highlighting the limitations of non-dynamic testing in capturing learners' responsiveness to mediation. Additionally, the LPS could distinguish between learners who were classified at the same level through non-dynamic testing. Based on these results, the authors concluded that analyzing each learner's scoring profile and LPS can effectively identify their strengths and weaknesses in various language constructs covered in the test. Similar findings in terms of the contribution of computerized assessment to L2 learning were reported by several studies addressing different L2 aspects, including reading (Yang & Qian, 2020), writing (Vakili & Ebadi, 2022), listening (Kao & Kuo, 2023), vocabulary (Ebadi et al., 2018; Jeon, 2023), and pragmatics (Rassaei, 2023).

As the field of AI progresses, its potential influence on computerized assessment is extensive. Nevertheless, it is of utmost importance to tackle issues like data privacy, algorithmic biases, and striking a harmonious equilibrium between human judgment and automated systems (Wang, 2022). Employing a considerate and ethical approach is imperative to effectively harness the power of AI in computerized assessment and guarantee impartial and dependable evaluations.

## Automatic speech recognition (ASR)

ASR technology has witnessed significant progress recently, thanks to the advancements in machine learning and deep learning algorithms. These algorithms undergo training using extensive labeled speech data to identify patterns and make precise predictions. According to Yu and Deng (2016), during the ASR process, the audio signal initially undergoes preprocessing to eliminate any noise and enhance the speech signal. Subsequently, it is subjected to a feature extraction stage, where the signal is transformed into a format that machine learning models can utilize.

ASR technology offers several key advantages in language learning, particularly in providing real-time feedback on pronunciation and speech accuracy (Evers & Chen, 2022). By speaking into a microphone, learners can receive immediate feedback from the ASR system, which analyzes their speech patterns, identifies errors, and offers suggestions for improvement. This instant feedback is invaluable for learners as it allows them to practice and enhance their pronunciation, intonation, and overall speaking skills. Moreover, ASR technology can facilitate interactive conversations between learners and AI systems. These dialogues provide learners with a controlled and supportive environment to practice their listening and speaking skills (Yu & Deng, 2016). The AI system accurately transcribes learner responses, offers vocabulary and grammar enhancement suggestions, and provides targeted exercises tailored to individual learning needs. ASR technology can seamlessly integrate with language learning platforms and mobile applications (Dai & Wu, 2023), enabling learners to practice their speaking and listening skills anytime and anywhere. Learners can record their speech, compare it with the ASR-generated transcript, and evaluate their performance. This self-assessment capability empowers learners to take charge of their learning progress and monitor their advancements over time (Inceoglu et al., 2023).

Over the past years, there has been a notable surge in research dedicated to investigating the impact of AI-based speech recognition on the acquisition of L2. These studies have explored the diverse ways in which AI technologies, particularly speech recognition systems, can improve L2 learning. Some studies (e.g., Ahn & Lee, 2016; Litman et al., 2018) asserted that AI-based speech recognition can enhance the pronunciation and speaking skills of individuals learning an L2. By offering instant feedback and correction, AI systems enable learners to engage in a more interactive and personalized approach to practicing and honing their speaking abilities. The influence of AI-driven speech recognition on the acquisition of an L2 goes beyond just pronunciation. Numerous research studies have demonstrated that these advanced technologies can enhance listening and comprehension abilities (Foucart et al., 2016; Matthews & Cheng, 2015). AI systems can provide instantaneous transcription and precise analysis of spoken language, thereby assisting learners in comprehending the target language more efficiently. Matthews and Cheng (2015) indicated that students who incorporated AI-based speech

recognition tools witnessed notable enhancements in their listening comprehension skills compared to their counterparts who did not utilize such technologies.

Scholars have also delved into the possibilities of utilizing AI-driven speech recognition to offer customized and adaptable learning for individuals learning an L2, thereby enhancing their motivation to learn an L2. According to Evers and Chen (2022), these systems possess the capability to analyze learners' speech patterns, pinpoint areas of weakness, and create personalized exercises and feedback to cater to their specific requirements. This personalized approach has positively influenced motivation, engagement, and learning outcomes. Tai and Chen (2023) also reported that engaging with AI-based speech recognition tools enhanced learners' confidence and motivation to persist in their L2 acquisition journey.

While acknowledging ASR's affordances, it is essential to note that ASR technology has limitations in L2 acquisition. The accuracy of ASR systems is significantly influenced by variables such as the learner's native language background, accent, and speech quality (Keshet, 2018). Consequently, individuals with non-standard accents or speech patterns may face challenges in obtaining precise feedback. Additionally, ASR systems may encounter difficulties in accurately capturing the intricacies of pronunciation or context-specific speech (Yu & Deng, 2016).

## Chatbots

Chatbots have the potential to contribute significantly to the process of learning an L2. They offer learners a controlled and supportive environment to practice and actively enhance their language skills. Chatbots are designed to engage in conversations and make excellent practice partners for language learners. By interacting with chatbots, learners can actively practice speaking, listening, and comprehending the target language. A notable advantage of chatbots is their ability to provide learners with instant feedback (Huang et al., 2022). This immediate feedback helps learners promptly identify and rectify their mistakes, facilitating continuous language proficiency improvement.

Chatbots can offer exercises, quizzes, and prompts that assist learners in solidifying their understanding of various linguistic aspects. They can adapt to learners' needs and deliver tailored language lessons based on their skill level and learning objectives. This personalized approach enhances the effectiveness and engagement of language learning (Klímová & Ibna Seraj, 2023). This technology creates a secure and non-judgmental space for learners to practice speaking without fearing embarrassment or making mistakes (Yuan, 2023). This supportive environment helps learners build confidence and overcome hesitation in utilizing the target language. Chatbots can offer learners valuable insights into the culture associated with the target language. They can provide information about customs, traditions, and local idioms, enriching learners' cultural competence alongside their language proficiency (Jeon, 2021).

According to empirical research, chatbots contribute to developing various L2 aspects. They provide various affordances for L2 writing, such as generating articles, crafting stories (Thorne, 2020), and producing other written content. Interestingly, some users have reported difficulty in distinguishing between text generated by chatbots and text written by humans (Elkins & Chun, 2020). In addition to writing, using chatbots has been reported to contribute to lexical acquisition (Huang et al., 2022; Jeon, 2023). As Huang et al. (2022) argued, the chatbot's

interactive nature facilitated learners' active participation in purposeful and repetitive exercises, resulting in enhanced retention and recall of vocabulary terms. Multiple studies (e.g., Huang et al., 2022; Kim, 2019) have also demonstrated that chatbots can be highly effective in aiding L2 learners in acquiring grammar and syntax rules in English. Through their ability to provide immediate feedback and corrections, these intelligent chatbots offer personalized guidance that assists learners in identifying and correcting grammatical errors. Learners can practice and reinforce their comprehension of grammatical structures by engaging in conversation-based interactions with the chatbot.

Studies (e.g., Jeon, 2023; Yang et al., 2022) have also demonstrated the effectiveness of chatbots in enhancing English conversational skills. Research indicates that individuals interacting with chatbots during conversational exercises exhibit improved speaking and listening abilities. By offering a non-judgmental and secure space, these chatbots enable learners to practice their conversational skills, boosting their confidence and fluency in spontaneous oral communication. The utilization of chatbots, as argued by Rokhayani et al. (2022), provides a platform for asynchronous communication, which has been observed to enhance student engagement and collaboration significantly. This is because students can post questions and engage in discussions without simultaneous presence, allowing for greater flexibility. Moreover, chat application program interfaces (APIs)s can facilitate student collaboration by creating student groups, enabling them to collaborate on various projects and assignments.

Recent research (e.g., Kohnke, 2023; Zhang et al., 2023) has also shed light on the efficacy of chatbots in promoting autonomous learning in acquiring second languages. Learners can access chatbots anytime and from any location, enabling them to learn at their own pace and engage in independent practice. Moreover, as chatbots offer personalized materials and adaptive exercises that cater to the specific needs of each learner, they can cultivate a sense of ownership and motivation in learning. Notwithstanding the affordances associated with AI-based chatbots, it is worth noting that they are also subject to certain limitations. Primarily, chatbots heavily rely on pre-programmed responses, which restricts their adaptability to cater to a wide range of learner needs and language variations (Yang et al., 2022). They may have difficulties comprehending and accurately interpreting complex language structures, idiomatic expressions, and cultural nuances (Kim, 2017). Furthermore, chatbots lack the capability to provide valuable feedback on pronunciation and intonation, which are vital aspects of language learning. Additionally, chatbots may struggle to grasp the contextual understanding required for effective language instruction, and they may face challenges in engaging learners in authentic and interactive conversations. These limitations emphasize the significance of incorporating diverse resources and opportunities for language practice and instruction.

## Gamification

The integration of gamification into L2 learning can significantly enhance the overall learning experience. By incorporating game elements and mechanics, language learning becomes more engaging, enjoyable, and effective. A key advantage of gamification is the strong sense of motivation and purpose it instills in learners (Philpott & Son, 2022). Learners are incentivized to actively participate and progress in their language learning journey by introducing quests, challenges, and rewards. This effectively addresses the common challenge of lack of motivation

and ensures learners remain engaged for extended periods. Moreover, gamification facilitates a more interactive and immersive learning environment (Raffone, 2022). Language learning games can simulate real-life situations, such as conversations with native speakers or navigating through virtual worlds. This provides learners valuable opportunities to practice their language skills in an interactive, safe, and supportive setting, ultimately fostering confidence and fluency. Additionally, gamification enables personalized and adaptive learning experiences (Pingmuang & Koraneekij, 2022). Language learning platforms can employ gamified systems to track learners' progress and adapt the learning content accordingly. This ensures that learners are presented with content and activities that suitably match their skill level, thereby offering them optimal learning experiences.

Incorporating gamification in education facilitates active learning and the cultivation of problem-solving and numerous skills required in real life (Phuong, 2020). Language learning games often necessitate learners to actively employ their language skills to accomplish tasks or resolve challenges. This reinforces language knowledge and skills and stimulates critical thinking, creativity, and effective communication. Consequently, learners are more inclined to retain information and apply their language skills in real-life scenarios. Implementing gamification in language learning can also nurture a sense of community and collaboration (Foroutan Far& Taghizadeh, 2022). By utilizing multiplayer games and online platforms, learners are provided with opportunities to engage in social interactions, allowing them to communicate, collaborate, and compete with their peers. This dynamic environment fosters a supportive learning community, encouraging learners to participate and improve their language skills through active interaction.

Empirical research has proved that gamification is a valuable tool for enhancing L2 learning in various ways. Some studies (e.g., Bueno-Alastuey & Nemeth, 2020; Castillo-Cuesta, 2020; Waluyo & Bucol, 2021) have indicated that gamification effectively improves vocabulary acquisition. By incorporating interactive and engaging game elements, learners are motivated to engage with the language and its lexicon actively. For example, researchers have discovered that gamified vocabulary learning apps, such as word-matching games or picture association exercises, significantly enhance the ability to memorize and recall new words (Thanasuan, 2015). Gamification has also enhanced grammar proficiency effectively (Castillo-Cuesta, 2020). Traditional language learning approaches often present grammar as a tedious and abstract concept. However, when grammar exercises are transformed into interactive games, learners become more motivated and demonstrate a better understanding of grammatical rules and structures. Zarzicka-Piskorz (2016) found that gamification proved to be highly effective in enhancing students' motivation and involvement in learning grammar. Similarly, Poole, Clarke-Midura, Sun, and Lam (2019) reported that games allowed students to explore various concepts without the fear of making mistakes. Azman and Yunus (2019) also found that incorporating Kahoot! as a form of gamification in grammar classes resulted in a more enjoyable and lasting experience of learning grammar. Finally, Ardi and Rianita (2022) argued that the students improved their grammatical skills and displayed engagement on behavioral, cognitive, and emotional levels throughout the implementation of Kahoot!

The gamification literature in L2 has also enhanced other skills, including listening, speaking, autonomy, and self-directed learning (e.g., Huang, 2018; Phuong, 2020; Zhang & Hasim, 2023). According to Huang (2018), by using interactive games, learners could actively

practice their listening skills by engaging with authentic audio content and responding to comprehension-based questions. These games often provide immediate feedback, enabling learners to identify areas for improvement and make the necessary adjustments. Zhang and Hasim (2023) also found supportive evidence for the positive impact of game-based activities in fostering L2 speaking. They argued that gamified speaking activities offer learners a secure and interactive environment to engage in role-plays, simulations, or virtual conversations within the game, thereby facilitating the development of fluency, accuracy, and confidence in utilizing the target language. Finally, gamification fostered a sense of autonomy and self-directed learning. According to Phuong (2020), many gamified language learning platforms offer learners a range of activities and paths to choose from, allowing them to navigate the learning process based on their interests and preferences. This element of autonomy promotes intrinsic motivation and a sense of ownership during the language-learning process.

Despite their potential benefits regarding second language acquisition, adopting gamification may pose particular challenges. Firstly, creating effective gamified learning experiences requires expertise in both language pedagogy and game design (Chu et al., 2023), which can be a barrier for educators. Furthermore, the success of gamification heavily depends on the quality of the game design, as poorly designed games may end up distracting or boring learners instead of engaging them. Additionally, gamification may not be suitable for all learners, as individual preferences and learning styles vary (Buckley& Doyle, 2017). Some learners may not respond positively to gamified approaches, resulting in a lack of motivation or disengagement. Moreover, implementing gamification in ESL courses requires sufficient technological infrastructure (Pingmuang & Koraneekij, 2022), which may not be accessible or affordable for all institutions or learners. Lastly, the effectiveness of gamification in language learning may vary depending on the specific language skill being targeted, as certain skills may not naturally lend themselves to gamified approaches. Despite these challenges, a well-thought-out implementation of gamification can still lead to positive outcomes and enhance language learning experiences.

## Virtual reality

Virtual reality presents a distinctive and immersive opportunity that can significantly enhance the acquisition of an L2. By simulating real-life scenarios and interactions, virtual reality creates an environment rich in language, enabling learners to practice and enhance their language skills more engagingly and authentically (Lin & Wang, 2021). One of the primary advantages of virtual reality in L2 learning is its ability to offer learners meaningful and contextualized language input (Lan & Grant, 2021). Through virtual reality simulations, learners can be exposed to a variety of situations, such as ordering food at a restaurant, shopping, or engaging in conversation with a native speaker. They can interact with virtual characters, practice their speaking and listening skills, and receive immediate feedback on their language usage. These realistic and interactive experiences aid learners in developing their language fluency, vocabulary, and pronunciation more dynamically and effectively. Virtual reality also allows learners to delve into various cultural facets associated with the target language (Yeh et al., 2022). Learners can better comprehend cultural conventions, practices, and heritage by immersing themselves in virtual environments that mirror the cultural backdrop. This immersive cultural experience nurtures cultural sensitivity

and aids learners in cultivating not just language proficiency but also intercultural competence, a crucial aspect for successful communication in a foreign language.

Virtual reality can also empower learners to overcome the fear and anxiety often associated with speaking in an L2 (Satake et al., 2024). In a traditional classroom setting, learners may feel self-conscious or hesitant, which limits their willingness to practice speaking. However, virtual reality provides a secure and non-judgmental space where learners can freely practice without the fear of making mistakes or being judged. This boosts learners' confidence and encourages them to participate and actively communicate in the target language. By utilizing virtual reality, learners can transcend geographical constraints and effortlessly access language learning resources and authentic materials from around the world. Engaging in virtual language exchanges with native speakers or fellow learners worldwide enhances their language practice and facilitates cultural exchange.

A range of empirical studies on the contribution of virtual reality to L2 learning found positive evidence. Chen (2016) conducted a study to investigate the influence of a desktop-based virtual reality learning environment on the linguistic development of EFL learners. The findings indicated that this technology offers an optimal setting for immersive language learning and diverse situated learning opportunities. Consequently, learners' proficiency in phonology, morphology, grammar, and syntax was significantly improved. Similarly, some studies (e.g., Madini & Alshaikhi, 2017; Tai et al., 2022) also found that L2 vocabulary acquisition was enhanced through virtual reality, which provided a range of simulated real-life situations and contextual support. The study by Lan et al. (2016) focused on the effects of information-gap and reasoning-gap tasks performed in Second Life on the oral communicative accuracy of Chinese as a second language learners. The results demonstrated a notable enhancement in the learner's oral skills. The anxiety levels related to foreign language learning were examined by Melchor-Couto (2017) in a study involving participants who utilized the virtual-world platform Second Life for communication. The results indicated that the experimental group experienced a decrease in anxiety levels compared to a control group that engaged in similar interactions in a conventional classroom environment.

The adoption of virtual reality in education is hindered by some factors, including the high cost and limited accessibility of virtual reality devices and software (Lin & Wang, 2021). The expensive nature of virtual reality devices makes it challenging for learners and educational institutions to embrace this technology. Moreover, not all learners can access the necessary hardware, such as high-performance computers or virtual reality headsets. The lack of diverse and customizable content for ESL learning is another obstacle to utilizing virtual reality. Although virtual reality provides immersive environments, the available language learning content is limited and may not meet learners' specific needs and proficiency levels. A systematic review of the potential benefits offered by virtual reality by Bahari (2022) has highlighted a noticeable disparity in the research conducted on language skills acquisition. Most studies and resources found positive outcomes yielded by virtual reality in enhancing listening and speaking abilities, while reading and writing skills development received comparatively less attention.

## Concluding remarks

The utilization of AI tools holds immense promise in revolutionizing education. Their remarkable ability to perform tasks requiring both knowledge and creative intelligence, such as grading assignments and offering student counseling, has the potential to transform the way education is imparted completely. One effective strategy to adopt AI in the educational practice is to employ AI-powered virtual assistants to deliver students personalized and adaptive learning experiences (Tai, 2022). These virtual assistants can assess individual students' unique learning needs, preferences, and progress and tailor instructional content accordingly. This enables students to learn independently, receive immediate feedback, and actively engage in learning (Tai, 2024). Additionally, AI tools can assist teachers by automating administrative tasks such as grading assignments, generating personalized learning plans, and monitoring student engagement. This allows educators to focus more on instructional design and providing individualized support. Another approach to incorporating AI tools into pedagogical practices involves utilizing intelligent tutoring systems (Demir, 2020). These systems harness AI algorithms' power to offer students immediate, personalized, and expert-level guidance. By analyzing students' responses, these systems can detect misconceptions or gaps in their understanding and provide targeted interventions, explanations, and examples. Intelligent tutoring systems can adapt to each student's unique learning needs, offering additional support or challenges as required (Jeon, 2022). This fosters highly individualized and effective learning experiences, facilitating a more profound comprehension and mastery of concepts. Furthermore, AI tools can analyze vast datasets of educational content and student performance, enabling educators to make informed decisions based on data for curriculum development, instructional design, and assessment strategies (Teng et al., 2023).

While integrating AI tools within pedagogical practices holds significant potential in elevating the effectiveness of teaching and learning experiences, some challenges are associated with integrating AI in education. Initially, the excessive reliance on automated language learning tools, such as AI-driven chatbots and translation applications, may discourage students from actively engaging in critical thinking (Mohamed, 2023). These tools offer immediate answers and corrections, diminishing learners' need to analyze and solve language-related challenges independently. This dependence on AI tools may impede learners' critical thinking, autonomy, and capacity to independently analyze language, adapt their learning strategies, and cultivate a more profound understanding of linguistic structures (Darwin et al., 2024). Furthermore, concerns regarding data privacy also present a significant hurdle in language learning (Wang, 2022). Many language learning platforms and AI tools amass extensive user data, encompassing personal information, learning patterns, and performance metrics. While this data can be utilized to personalize the learning experience, it raises apprehensions regarding the privacy and security of students' information (Amin, 2023). A further challenge is that AI platforms typically present standardized materials and exercises that fail to encompass various cultural contexts and intricacies inherent in language usage (Jeon, 2021). This lack of cultural relevance may restrict learners' comprehension and proficiency when utilizing language in real-life scenarios (Kim, 2017).

To enhance the overall learning experience for students, teachers and educators must receive professional training to effectively utilize AI technologies in second-language learning

classes (Pokrivcakova, 2019). The potential of AI technologies to assist language learning is immense. However, successfully integrating these technologies requires well-trained teachers who comprehensively understand how to leverage AI tools to support pedagogical goals and adapt them to various learning contexts (Du & Gao, 2022). Teachers need to undergo training that equips them with the necessary skills to navigate and fully utilize AI technologies, ensuring they can create engaging and interactive language learning experiences for their students. Additionally, educators should be trained to comprehend the ethical implications and potential biases associated with AI systems, enabling them to make informed decisions regarding the implementation and use of these technologies in the classroom (Wang, 2022). Pradana (2023) argued that the education sector must strike a delicate balance between harnessing the power of AI to enhance the educational experience and preserving the essential human touch and interpersonal communication crucial for effective knowledge transfer.

It is recommended that future studies evaluate the effectiveness of AI in improving student learning results and take into account the ethical and legal consequences of implementing AI in education. Additionally, as Zimmerman (2018) argued, it is crucial to explore methods of integrating AI technologies into education that support teachers instead of replacing them to promote learning progress rather than hinder it. Future research on incorporating AI in education should also prioritize ensuring the reliability and accuracy of AI-generated responses and exploring approaches to ensure ethical and legal compliance in AI technologies.

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