

**Research Paper**

## 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. [fakherzahra@yahoo.com](mailto:fakherzahra@yahoo.com)

### Abstract

The field of second language (L2) learning has witnessed a significant surge in the utilization of artificial intelligence (AI), which offers a wide range of advantages that can greatly enhance the language acquisition process. 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.

### Keywords:

Artificial intelligence (AI), Automatic speech recognition (ASR), Automatic writing evaluation (AWE), Chatbot, Computerized dynamic assessment, Gamification, Natural language processing (NLP), Virtual reality

**\*Corresponding Author:** Zahra Fakher Ajabshir  
Assistant Professor of Applied Linguistics, University of Bonab,  
East Azarbaijan, Iran.

**Email:** [fakherzahra@yahoo.com](mailto: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 the ways in which 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 possess the ability to comprehend and respond to the unique needs of learners. AI-powered platforms can offer personalized learning experiences that are tailored to an individual's proficiency level, learning style, and goals. This personalized approach not only enhances motivation but also optimizes learning outcomes by delivering targeted content and adaptive feedback. By incorporating AI, language learners can benefit from an immersive and interactive learning environment that replicates real-life situations and encourages 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 acquire a thorough understanding of 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 the generation of natural language. These technologies play a crucial role in improving human-computer interaction and facilitating 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). The positive impacts of using intelligent tutoring systems and how they cope with input and generate output were reported by numerous studies (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. In another study, Mitrovic et al. (2013) utilized intelligent tutoring tools to rectify misconceptions. It was suggested that intelligent tutoring systems, which 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, thereby improving problem-solving skills, knowledge specialization, and facilitating learning at advanced levels. Text-to-speech and speech-to-text systems have been also found to facilitate 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, simplification of complex sentences, and explanations of idiomatic expressions (Lee, 2020). NLP models are also able to 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 the utilization of technology to evaluate and offer feedback on written compositions. By employing AI and NLP techniques, AWE is able to 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, 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 larger number of students within a shorter span of time (Waer, 2023). Finally, AWE can be utilized for self-assessment purposes, 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 writings. 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 had their essays evaluated 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 scores in lexical diversity and syntactic complexity, 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 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 performance in assessments. 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 better support students.

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., 2012). Consequently, the implementation of 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 argued by Garg and Goel (2022), 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 the reading comprehension of EFL learners. The findings indicated that both forms of mediation had a comparable impact on the learners' reading comprehension. The study proposed that computers can play a significant assisting role as long as they are supplemented by human mediators. 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 was able to 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 along with their 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 in recent times, 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 can be utilized by machine learning models.

ASR technology offers several key advantages in language learning, particularly in terms of 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 suggestions for vocabulary and grammar enhancements, 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 aid in the improvement of 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 in comparison 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 been proven to positively influence motivation, engagement, and learning outcomes. Tai and Chen (2023) also reported that engaging with AI-based speech recognition tools resulted in learners' enhanced confidence and motivation to persist in their L2 acquisition journey.

While acknowledging the affordances of ASR, it is essential to note that ASR technology in the context of L2 acquisition has its limitations. 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 greatly contribute to the process of learning an L2. They offer learners a controlled and supportive environment where they can actively practice and enhance their language skills. Designed to engage in conversations, chatbots make excellent practice partners for language learners. By interacting with chatbots, learners can actively practice speaking, listening, and comprehending the target language. A further notable advantage of chatbots is their ability to provide learners with instant feedback (Huang et al., 2022). This immediate feedback is helpful in helping learners identify and rectify their mistakes promptly, facilitating continuous improvement in their language proficiency.

Chatbots can offer exercises, quizzes, and prompts that assist learners in solidifying their understanding of various linguistic aspects. They can adapt to learners' individual needs and deliver tailored language lessons based on their current 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 the fear of embarrassment or making mistakes (Yuan, 2023). This supportive environment helps learners build confidence and overcome any hesitations they may have 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 forms of 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 argued by Huang et al. (2022), 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. By engaging in conversation-based interactions with the chatbot, learners are able to practice and reinforce their comprehension of grammatical structures.

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 who interact 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, thereby 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 significantly enhance student engagement and collaboration. This is due to the fact that students can post questions and engage in discussions without the need for simultaneous presence, allowing for greater flexibility. Moreover, chat application program interface (API)s have the capability to facilitate collaboration among students 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 the acquisition of second languages. Learners have the convenience of accessing chatbots at any time 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 the learning. Notwithstanding the affordances associated by 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 encounter difficulties in 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). By introducing quests, challenges, and rewards, learners are incentivized to actively participate and progress in their language learning journey. This effectively addresses the common challenge of lack of motivation and ensures that learners remain engaged for extended periods of time. 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 with valuable opportunities to practice their language skills in an interactive, safe, and supportive setting, ultimately fostering confidence and fluency. Additionally, the utilization of 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.

The incorporation of 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 not only reinforces language knowledge and skills, but also stimulates critical thinking, creativity, and effective communication. Consequently, learners are more inclined to retain information and apply their language skills in real-life scenarios. The implementation of 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 actively participate and improve their language skills through interaction with others.

Empirical research has provided evidence 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 is effective in improving vocabulary acquisition. By incorporating interactive and engaging game elements, learners are motivated to actively engage with the language and its lexicon. For example, researchers have discovered that gamified vocabulary learning apps, such as word-matching games or picture association exercises, significantly enhance learners' ability to memorize and recall new words (Thanasuan, 2015). Gamification has also proved to be effective in enhancing grammar proficiency (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 the gamification proved to be highly effective in enhancing students' motivation and involvement in the process of learning grammar. Along similar lines, Poole, Clarke-Midura, Sun, and Lam (2019)

reported that games provided students with the opportunity to explore various concepts without the fear of making mistakes. Azman and Yunus (2019) also found that the incorporation of 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 not only demonstrated improvement in their grammatical skills but also displayed engagement on behavioral, cognitive, and emotional levels throughout the implementation of Kahoot!

The gamification literature in L2 has also yielded positive outcomes in the enhancement of some 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 were able to 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 was found to foster 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 through the learning process based on their individual interests and preferences. This element of autonomy promotes intrinsic motivation and a sense of ownership during the language-learning process.

Despite the potential benefits they offer in terms of second language acquisition, adopting gamification may pose certain 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 in a more engaging and authentic manner (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 in a more dynamic and effective way. Virtual reality also offers learners the chance to delve into various cultural facets associated with the target language (Yeh et al., 2022). By immersing themselves in virtual environments that mirror the cultural backdrop, learners can acquire a more profound comprehension of cultural conventions, practices, and heritage. 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 actively participate and communicate in the target language. By utilizing virtual reality, learners can transcend geographical constraints and effortlessly access language learning resources and authentic materials from any part of 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, EFL learners' proficiency in phonology, morphology, grammar, and syntax was significantly improved. In a similar vein, some studies (e.g., Madini & Alshaiqi, 2017; Tai et al., 2022) also found that L2 vocabulary acquisition was enhanced through the utilization of virtual reality, which provided a range of simulated real-life situations and contextual support. The study conducted 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 oral skills of all the learners. 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 both learners and educational institutions to embrace this technology. Moreover, not all learners have access to 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 in utilizing virtual reality.

Although virtual reality provides immersive environments, the available language learning content is limited and may not meet the specific needs and proficiency levels of learners. 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. The majority of studies and resources found positive outcome yielded by virtual reality in the enhancement of listening and speaking abilities, while the development of reading and writing skills received comparatively less attention.

## Concluding remarks

The utilization of AI tools holds immense promise in revolutionizing the realm of 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 completely transform the way education is imparted. One effective strategy to adopt AI in the educational practice is to employ AI-powered virtual assistants to deliver personalized and adaptive learning experiences to students (Tai, 2022). These virtual assistants are capable of assessing the unique learning needs, preferences, and progress of individual students, and subsequently tailoring instructional content accordingly. This enables students to learn at their own pace, receive immediate feedback, and actively engage in the learning process (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 the utilization of intelligent tutoring systems (Demir, 2020). These systems harness the power of AI algorithms to offer immediate, personalized, and expert-level guidance to students. By analyzing students' responses, these systems can detect any misconceptions or gaps in their understanding and provide targeted interventions, explanations, and examples. Additionally, intelligent tutoring systems possess the capability to adapt to the unique learning needs of each student, offering additional support or challenges as required (Jeon, 2022). This fosters highly individualized and effective learning experiences, facilitating a deeper 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 the integration of AI tools within pedagogical practices holds significant potential in elevating the effectiveness of teaching and learning experiences, there are some challenges associated with the integration of 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, thereby diminishing the necessity for learners to analyze and solve language-related challenges on their own. This dependence on AI tools may impede learners' critical thinking and autonomy as well as their 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 quantities of 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 the wide array of cultural contexts and intricacies inherent in language usage (Jeon, 2021). This lack of cultural relevance may restrict learners' comprehension and proficiency when it comes to utilizing language in real-life scenarios (Kim, 2017).

In order to enhance the overall learning experience for students, it is imperative that teachers and educators 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, the successful integration of these technologies requires well-trained teachers who possess a comprehensive understanding of how to leverage AI tools to support pedagogical goals and adapt them to various learning contexts (Du & Gao, 2022). It is essential for teachers to undergo training that equips them with the necessary skills to navigate and fully utilize AI technologies, ensuring that 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). As argued by Pradana (2023), It is imperative for the education sector to strike a delicate balance between harnessing the power of AI to enhance the educational experience and preserving the essential human touch and interpersonal communication that are 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 argued by Zimmerman (2018), it is crucial to explore methods of integrating AI technologies into education that support teachers instead of replacing them, in order to promote progress in learning rather than hinder it. Ensuring the reliability and accuracy of AI-generated responses, as well as exploring approaches to ensure ethical and legal compliance in the use of AI technologies, should also be prioritized in future research on incorporating AI in education.

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