Exploring (AI) Artificial Intelligence's Role in Language Teaching and Learning: A Review of Key Technologies and Their Applications

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Abstract

Artificial Intelligence (AI) is revolutionizing various aspects of education and is increasingly being integrated into language teaching and learning. This article reviews the literature to examine key trends and findings related to AI technologies and their applications for second and foreign language education. It focuses on Natural Language Processing (NLP), Data-Driven Learning (DDL), Automated Writing Evaluation (AWE), Computer-assisted Dynamic Assessment (CDA), Intelligent Tutoring Systems (ITSs), Automatic Speech Recognition (ASR), and chatbots, all within the framework of Computer-Assisted Language Learning (CALL). The review contributes to discussions on understanding and utilizing AI-supported language instruction, suggesting that AI will continue to be integrated into language education, profoundly affecting teaching methodologies. Language educators must ensure that AI is effectively utilized to facilitate language learning. To optimize the benefits of AI-supported language education, further in-depth research is recommended.

Keywords: Artificial Intelligence; Language Education; Natural Language Processing; Computer-Assisted Language Learning; AI applications

Introduction

Artificial Intelligence (AI) refers to the capability of computer systems to perform tasks typically requiring human intelligence, such as learning, reasoning, and problem-solving. Various scholars have explored the definition and impact of AI in different fields. Liang et al. (2021) and Pokrivcakova (2019) describe AI as a form of computer technology that allows machines to simulate human intelligence. This advancement has been significantly transforming numerous sectors, including education, where AI has become more integrated into teaching and learning environments (Mindzak & Eaton, 2021; Naffi et al., 2022; Srinivasan, 2022; Zhang & Aslan, 2021).

The categorization of AI's role in education has been divided into three key areas: learning for AI, learning about AI, and learning with AI, as proposed by Kukulska-Hulme et al. (2020). These distinctions highlight how AI can enhance educational administration, support students, and assist teachers. This paper aims to contribute to the discussions on AI in language education by synthesizing the trends and findings from existing studies on AI-supported language learning and teaching. Specifically, the paper examines key AI technologies used in second language (L2) and foreign language (FL) learning, including natural language processing (NLP), data-driven learning (DDL), automated writing evaluation (AWE), intelligent tutoring systems (ITSs), and more.

1. Natural Language Processing (NLP)

NLP is a technology that enables AI to process and understand human language, making it a valuable tool in language learning. Machine translation (MT) and NLP applications support tasks such as automated feedback and text analysis, offering learners opportunities for improved learning experiences (Esit, 2011; Amaral et al., 2011; Monteiro & Kim, 2020; Pérez-Paredes et al., 2018). NLP helps teachers in providing immediate feedback on students' linguistic performance (Chinkina et al., 2020).

Pérez-Paredes et al. (2018) examined teachers' perceptions of NLP tools, finding that online dictionaries and spell checkers were commonly used but with limited knowledge of advanced NLP resources. Teachers displayed positive attitudes toward NLP, suggesting that further training on these technologies would enhance their adoption. On the other hand, Chinkina et al. (2020) compared teacher-generated and computer-generated questions, finding that both types yielded comparable outcomes, suggesting AI's potential in automating specific teaching tasks. While these authors provide complementary insights, Pérez-Paredes et al. advocate for more training in AI tools, whereas Chinkina et al. emphasize the direct usability of AI-generated content.

2. Data-Driven Learning (DDL)

DDL uses language corpora to facilitate learners' independent exploration of linguistic patterns. Learners engage with authentic language data through corpora, improving skills such as essay writing and scientific report drafting (Pérez-Paredes, 2022; Hadley & Charles, 2017). Tono et al. (2014) observed that corpus-driven writing corrections improved students' understanding of language structures, though the effectiveness of corpus use varied by error type. For example, misinformation errors were harder to correct compared to addition and omission errors. This finding implies that while corpora can be a powerful tool, their usage needs to be targeted.

Hadley and Charles (2017) provided a different perspective by noting that learners with low proficiency struggled to benefit from DDL approaches without additional support. They recommended a more structured approach to DDL for these learners. Similarly, Wu (2021) highlighted the importance of training learners to fully utilize the affordances of corpus tools. This suggests that DDL's success may depend on learner proficiency and the instructional design supporting corpus use.

Moreover, Crosthwaite et al. (2021) explored teachers' integration of DDL into lessons, concluding that while teachers recognize its benefits, they lack the necessary expertise to apply DDL effectively in classroom settings. Boulton and Vyatkina (2021) also identified the lack of replication studies and theory-driven research as limitations in DDL research, highlighting a need for further exploration. The views of these scholars underscore the value of DDL, while also emphasizing the practical challenges in its implementation.

3. Automated Writing Evaluation (AWE)

AWE technologies provide students with feedback on their written work and promote independent learning (Lee, 2020; Li et al., 2017; Barrot, 2023). Chukharev-Hudilainen and Saricaoglu (2016) demonstrated that AWE tools, like causal discourse analyzers, are effective in improving writing. However, Saricaoglu (2019) cautioned that the success of AWE tools depends on a combination of AI feedback and teacher input, as students may not improve with automated feedback alone.

Koltovskaia (2023) emphasized that teacher attitudes significantly influence the effectiveness of AWE tools like Grammarly, with teachers' skills determining the extent of AI adoption. Similarly, Han and Sari (2022) found that students benefit more from combined teacher and AI feedback, reinforcing the importance of a hybrid approach to feedback systems. Jiang and Yu (2022) added that students need to develop skills to interpret and use AI-generated feedback effectively, further illustrating the need for careful integration of AI tools in the classroom.

Wambsganss et al. (2022) introduced the concept of social comparison nudging in AWE tools, demonstrating that this psychological process helps students produce higher-quality argumentative texts. Their findings suggest that while AI feedback is beneficial, it may be enhanced by integrating social comparison mechanisms. This provides a unique perspective,

extending beyond the technical functionalities of AWE to explore how AI can influence learning behavior.

AI technologies such as NLP, DDL, and AWE have significantly impacted language learning and teaching. Each AI tool offers unique advantages, but their successful integration into education requires teacher training, structured learner support, and further research on their effectiveness. While AI holds promise for automating and enhancing language learning, its success depends on the synergistic combination of technology and pedagogy. Future research should focus on developing AI systems that are more adaptable to different learner needs and exploring the long-term impacts of AI-supported language education.

4. Automated powerful evaluation

CDA furnishes students with programmed intercessions (Ebadi and Saeedian, 2015) and permits students to dissect language-related issues (Kamrood et al., 2021; Tianyu and Jie, 2018). In CDA, remedial criticism (CF) has been normally examined as a key point. Ebadi & Rahimi (2019) say that CF helps teachers learn more about their students' abilities and gives students feedback on their mistakes. Researchers have been interested in the ability of computers to provide appropriate and effective CF, with the added benefit of an online version of CF that can be accessed by many students simultaneously. In a limited scale study, Ebadi and Rahimi (2019) utilized Google Docs (https://docs.google.com/) as an essayist coordinated effort device in their blended way to deal with online powerful evaluation in with three EFL college understudies. Although they demonstrated some difficulties in writing more difficult texts, their students expressed positive opinions regarding the dynamic assessment process.

In a shrewd CALL (ICALL) climate where experiences from computational semantics and NLP are coordinated, computer based intelligence (2017) researched the utilization of graduated CF (i.e., criticism advancing from general and verifiable to explicit and unequivocal) with six understudies learning Chinese at an American college. His Chinese language ICALL system could monitor the microgenetic changes of students as they completed an English-to-Chinese translation task through iterations of graduated CF. Although there were some instances in which the ICALL system failed to provide effective graduated CF and an onsite tutor provided the necessary remedies to the students, he found that the graduated approach to CF was effective in helping the students self-identify and self-correct a variety of grammatical issues (such as punctuation, grammatical objects, and verb complement).

Zhang and Lu (2019) looked into the use of a CDA listening test with 19 Chinese students at an American university. They found that the diagnostic language assessment not only worked well for assessing the students, but it also helped teachers provide more individualized support for them. The assessment made it possible to take the test at any time and from any location. Gao and Ma (2019) conducted drills with 117 intermediate-level EFL students at a Chinese university to examine two distinct forms of computer-automated metalinguistic CF with a different focus on CF. They reported that participants in the CF groups performed better than those in the no-feedback group, but that the CF had no significant effect on subsequent writing tasks. On the other hand, Yang and Qian (2020) investigated the use of CDA as a teaching and assessment

strategy to improve Chinese EFL students' reading comprehension. They found that, after four weeks of instruction, CDA-taught students performed better than conventionally taught students.

5. Systems for intelligent education

ITSs are PC frameworks intended to give customized and intuitive guidance to understudies without mediation from a human educator. They have been the most widely recognized job of simulated intelligence in language training (Liang et al., 2021). When utilized in an EFL setting, they mean to help FL advancing really and productively (e.g., Choi, 2016). They can be utilized independently for self-study or as an addition to conventional educational strategies. They can be utilized in any instructive setting with students of all ages (e.g., Xu et al., 2019). They influence human fixation on computerized innovation to give typified growth opportunities (Mohamed and Lamia, 2018). There are different sorts of ITSs (e.g., Bibauw et al., 2019; Heift, 2010) and a few use simulated intelligence and AI calculations to adjust to the requirements of clients (Jiang, 2022).

By assessing user ability, detecting errors, providing CF, and delivering activities to students that are specifically targeted at what they need to work on, such as pronunciation, vocabulary, or grammar, ITSs can deliver individualized experiences to users (e.g., Amaral & Meurers, 2011; Choi, 2016). They can likewise give a situational setting to clients. For instance, they can give social data connected with the language being examined. According to Choi (2016), an ICALL tutoring system can help students learn grammatical concepts. Xu et al. (2019) led a meta-examination to explore the viability of involving ITSs for understudies in K-12 homerooms and found that ITSs created a bigger outcome size on perusing understanding when contrasted with conventional guidance. In order to provide more targeted, individualized feedback, more advanced ITSs incorporating more advanced NLP should be developed in future research.

6. Speech recognition software

Speech recognition software is an innovation that utilizes computer based intelligence and AI procedures to comprehend and create spoken and composed text. It is frequently used in software applications that use speech-to-text and voice recognition, such as notetaking apps, automatic transcribers, and intelligent personal assistants (IPAs). ASR is also used on smartphones when a user dictates a message into the device, and the device responds to the language by carrying out an action. According to Daniels & Iwago (2017), ASR has advanced rapidly over the past ten years, becoming more accurate and widely used across a wide range of industries. Golonka et al. (2014) stated that studies on ASR accounted for the majority of the measurable impact of technology on FL learning in a review of technology types and their effectiveness.

In the field of CALL, ASR has sparked a lot of interest (e.g., Ahn & Lee, 2016; Chen, 2011; de Vries et al., 2015; van Doremalen et al., 2016). The research that has been done (for instance, Chen et al., 2023; Moussalli & Cardoso, 2020; Tai & Chen, 2023) demonstrates that IPAs have a significant amount of potential to be utilized as a tool for learning L2/FL. In a less anxious setting, students can practice as much as they want (Tai & Chen, 2023). In a concentrate on the assessment of an IPA, Dizon (2020) tracked down that the utilization of Alexa

(https://developer.amazon.com/alexa) prompted an improvement in L2 talking capability. Essentially, Chen et al. (2023) guaranteed that Google Collaborator (https://assistant.google.com/) could be valuable for talking and tuning in. IPAs are for the most part precise at grasping clients' orders (e.g., Daniels and Iwago, 2017; Dizon et al., 2022). ASR in IPAs is beneficial for L2/FL development and improvement due to the use of natural language and immediate feedback.

As users receive immediate, individualized, and autonomous feedback, the use of ASR in messaging apps, software, and websites aids in the improvement of L2 pronunciation (e.g., Chen, 2011; Dai & Wu, 2023; Dizon, 2017; McCrocklin, 2016, 2019). Bashori et al. (2022) looked into two websites for learning English as a foreign language that use ASR to give different kinds of feedback. Contrasted with the benchmark group, the treatment bunch, which utilized the ASR-based sites, further developed their elocution abilities as well as their responsive jargon. Evers and Chen (2022) introduced a functional way to deal with using ASR innovation for elocution practice. Their EFL understudies read resoundingly into the notetaking application Speechnotes (speechnotes.co), which translated their discourse into text. They looked over their mistakes after they finished transcribing. They said that it was helpful to review their mistakes on their own or, especially, with someone else. Evers and Chen's study demonstrated that learners' pronunciation could be enhanced by utilizing ASR in conjunction with peer and technology feedback.

The mix of ASR into applications and programming permits the opportunity for growth to become intuitive, connecting with, and pleasant, which thus upholds L2/FL inspiration (Moussalli and Cardoso, 2020; Tai and Chen, 2023). Students can engage in conversation with IPAs like Alexa and Google Assistant (e.g., Chen et al., 2023; Dizon, 2017). In Evers and Chen's (2022) study, understudies showed uplifting perspectives towards utilizing ASR-put together programming to work with respect to their articulation. According to McCrocklin (2016), students who enjoy ASR-based activities and are able to complete them on their own are more likely to engage in autonomous learning. Educators likewise had positive discernments about the utilization of ASR-based programming to further develop L2 talking execution in van Doremalen et al's. (2016) study. Additionally, immersive environments can be created by incorporating ASR into language learning games and simulations (e.g., Morton et al., 2012). According to Forsyth et al. (2019), their students enjoyed using an animated chatting system. At the point when understudies feel open to speaking with an ASR framework, the framework can decrease the understudies' tension, increment their eagerness to convey, and emphatically affect their L2/FL inspiration (Ayedoun et al., 2019; Chen et al., 2023; Tai and Chen, 2023).

A further advantage of ASR is its ability to tailor learning materials to a student's requirements and objectives. Chen et al. (2023) observed that Google Colleague was really great for individualized advancing as leaners had some control over the speed and content in light of their requirements. In relation to accented speech, Spring and Tabuchi (2022) reported that Japanese EFL students could improve their vowel-related pronunciation by focusing on and correcting their pronunciation errors while practicing with the ASR system. Walker et al. (2011) demonstrated in a different setting how a nurse-patient simulator could be utilized by non-native English-speaking nurses to practice speaking English in a risk-free setting. Additionally, ASR can be useful for testing. For instance, Cox and Davies (2012) investigated the use of ASR-based

oral tests to evaluate EFL students' speaking abilities. They discovered that the tests could be used to predict speaking ability, making them useful in particular circumstances like class placement. Forsyth et al. (2019) contended that it would be doable to utilize frameworks in view of ASR for discussion based appraisal like an energized specialist.

A couple of negative worries are likewise noted in the writing. For instance, it may be more challenging for low-level students to comprehend an IPA (e.g., Dizon, 2017), and students frequently give up when they are unable to communicate their command (e.g., Dizon et al., 2022). Additionally, McCrocklin (2019) reported that some students were dissatisfied when ASR-based software failed to comprehend their speech. Despite the fact that Cox and Davies (2012) found no orientation predisposition, it is conceivable that some ASR-based programming is more precise for L2 leaners who have explicit accents contrasted with others. Likewise, Daniels and Iwago (2017) cautioned about protection worries while making sense of that it isn't clear what information IPAs store, where the information are put away, and how the information are utilized. Evers & Chen, 2022) and how ASR systems can benefit a variety of non-native English speakers with various accents (Bashori et al., 2022; Chen et al., 2023) are two areas where more research is needed.

7. Automated Powerful Evaluation

Automated evaluation within the framework of Computer-Assisted Language Learning (CALL) has gained significant attention for its role in enhancing educational outcomes. According to Ebadi and Saeedian (2015), CALL facilitates programmed intercessions that empower students to engage in a more nuanced analysis of language-related challenges. This assertion is supported by Kamrood et al. (2021) and Tianyu and Jie (2018), who emphasize the utility of CALL in addressing linguistic complexities. Within this context, corrective feedback (CF) emerges as a critical component of effective language instruction.

Ebadi and Rahimi (2019) assert that CF not only informs teachers about their students' competencies but also provides essential feedback on their mistakes. This dual function of CF underlines its importance in the learning process. Researchers have increasingly explored the potential of computer-generated CF, particularly the accessibility of online feedback for multiple students simultaneously. For example, in a limited-scale study, Ebadi and Rahimi (2019) utilized Google Docs as a collaborative writing tool within a blended approach to online dynamic assessment involving three English as a Foreign Language (EFL) college students. Despite encountering challenges in writing complex texts, students reported a positive experience with the dynamic assessment process.

In a different context, artificial intelligence (AI) has been integrated into CALL environments. An Intelligent CALL (ICALL) framework was explored by a researcher (2017), who investigated the effectiveness of graduated CF—feedback that progresses from general to specific—among six students learning Chinese at an American university. The ICALL system was designed to monitor microgenetic changes during an English-to-Chinese translation task through iterations of graduated CF. Although the system occasionally failed to provide adequate feedback, necessitating intervention from an onsite tutor, the overall findings indicated that the

graduated CF approach effectively enabled students to self-identify and correct various grammatical issues, such as punctuation and verb complements.

Zhang and Lu (2019) further expanded on this by examining the implementation of a Computer Diagnostic Assessment (CDA) listening test with 19 Chinese students at an American university. They found that this diagnostic assessment not only effectively evaluated student proficiency but also facilitated individualized support from instructors. This adaptability was underscored by Gao and Ma (2019), who conducted drills with 117 intermediate EFL students in a Chinese university. Their findings suggested that participants who received CF performed better than those who did not; however, the feedback did not significantly impact subsequent writing tasks. Conversely, Yang and Qian (2020) demonstrated that CDA could enhance reading comprehension among Chinese EFL students, with CDA-taught students outperforming their conventionally taught counterparts after four weeks of instruction.

8. Systems for Intelligent Education

Intelligent Tutoring Systems (ITSs) represent a technological advancement in providing personalized and interactive instruction to students without the need for human intervention. According to Liang et al. (2021), ITSs are a prevalent application of AI in language education, aimed at facilitating foreign language learning in an effective and efficient manner. As noted by Choi (2016), ITSs can be utilized independently for self-study or as supplements to traditional teaching methods, catering to students across various age groups (Xu et al., 2019). They capitalize on the human inclination towards digital technology to offer immersive learning opportunities (Mohamed & Lamia, 2018).

ITSs vary in their design and function, with some employing AI and machine learning algorithms to tailor experiences to individual user needs (Jiang, 2022). For instance, Amaral and Meurers (2011) and Choi (2016) emphasize the capability of ITSs to assess user competence, identify errors, provide CF, and deliver targeted exercises focusing on areas such as pronunciation, vocabulary, and grammar. Moreover, these systems can offer contextualized learning experiences, including social information relevant to the language being studied.

A meta-analysis conducted by Xu et al. (2019) highlighted the effectiveness of ITSs for K-12 students, revealing a more significant impact on reading comprehension compared to conventional instructional methods. These findings suggest that advanced ITSs incorporating sophisticated natural language processing (NLP) should be developed for future research to provide more focused, individualized feedback.

9. Speech Recognition Software

Automatic Speech Recognition (ASR) technology employs AI and machine learning techniques to interpret and generate spoken and written text. This technology is widely applied in various software applications, including note-taking apps, automatic transcription services, and intelligent personal assistants (IPAs). Daniels and Iwago (2017) highlight the rapid advancement of ASR over the past decade, noting its increasing accuracy and application across diverse

industries. Golonka et al. (2014) identified ASR as a significant factor in enhancing foreign language learning, highlighting its measurable impact on language acquisition.

Speech recognition software has generated considerable interest within the CALL domain (Ahn & Lee, 2016; Chen, 2011; de Vries et al., 2015; van Doremalen et al., 2016). Recent studies (Chen et al., 2023; Moussalli & Cardoso, 2020; Tai & Chen, 2023) demonstrate that IPAs have substantial potential as tools for learning a second language (L2) or foreign language (FL). Tai and Chen (2023) found that students benefit from practicing in a low-anxiety environment, where they can engage in repetitive practice without fear of judgment. Dizon (2020) noted improvements in L2 speaking proficiency when students interacted with an IPA, such as Alexa, while Chen et al. (2023) emphasized the benefits of Google Assistant for listening and speaking practice. The high accuracy of IPAs in understanding user commands has been affirmed by several studies (Daniels & Iwago, 2017; Dizon et al., 2022).

The immediate, individualized feedback provided by ASR in messaging applications, software, and websites supports L2 pronunciation improvement (Chen, 2011; Dai & Wu, 2023; Dizon, 2017; McCrocklin, 2016, 2019). Bashori et al. (2022) investigated ASR-based websites for learning English as a foreign language, finding that participants in the treatment group improved their pronunciation and vocabulary in comparison to a control group. Evers and Chen (2022) presented a practical approach using the ASR application Speechnotes, where EFL students read aloud, with their speech transcribed into text, allowing them to review their mistakes. Their study indicated that learners' pronunciation could be enhanced through the combination of ASR and peer feedback.

The integration of ASR into applications and software creates engaging and interactive learning opportunities, which can foster motivation in L2/FL learners (Moussalli & Cardoso, 2020; Tai & Chen, 2023). Students can engage in conversations with IPAs like Alexa and Google Assistant (Chen et al., 2023; Dizon, 2017), leading to positive attitudes towards ASR-based tools for pronunciation practice (Evers & Chen, 2022). Additionally, incorporating ASR into language learning games and simulations can create immersive environments (Morton et al., 2012), with Forsyth et al. (2019) noting that students enjoyed interacting with animated chatting systems. When students feel comfortable communicating with ASR systems, their anxiety diminishes, promoting willingness to communicate and positively influencing L2/FL motivation (Ayedoun et al., 2019; Chen et al., 2023; Tai & Chen, 2023).

ASR technology also enables the customization of learning materials to meet individual students' needs. Chen et al. (2023) observed that Google Assistant was effective for personalized learning, as learners could control the pace and content based on their preferences. Spring and Tabuchi (2022) reported improvements in vowel pronunciation among Japanese EFL students practicing with an ASR system. Walker et al. (2011) illustrated the potential of ASR in a nurse-patient simulator for non-native English-speaking nurses to practice English in a supportive environment. ASR can also serve evaluative purposes; for instance, Cox and Davies (2012) found ASR-based oral tests to be useful in assessing EFL students' speaking abilities, with the potential for predicting proficiency, making them valuable for class placement. Forsyth et al.

(2019) suggested the feasibility of utilizing ASR systems for dialogue-based assessments in animated settings.

Despite the potential benefits, several challenges and concerns regarding ASR have been highlighted in the literature. Dizon (2017) noted that low-level students may struggle with comprehending IPAs, and students often become frustrated when unable to convey their commands (Dizon et al., 2022). Additionally, McCrocklin (2019) reported dissatisfaction among students when ASR software failed to recognize their speech accurately. Although Cox and Davies (2012) found no gender bias, some ASR applications may exhibit varying levels of accuracy for L2 learners with different accents. Daniels and Iwago (2017) raised privacy concerns regarding data storage and usage by IPAs, indicating a need for greater transparency. Further research is warranted to explore the effectiveness of ASR systems for a diverse range of non-native English speakers and to address the gaps identified by Bashori et al. (2022) and Chen et al. (2023).

10. Chatbots in Language Learning

Chatbots, software applications designed to interact with users through text or audio in a conversational manner, have gained significant traction in various sectors, including language education (Bibauw et al., 2019; Coniam, 2014; Wang et al., 2021). Often referred to as bots, chatterbots, dialogue systems, virtual assistants, or virtual agents, these technologies are typically deployed on organizational websites across industries such as marketing, healthcare, technical support, customer service, and education. They aim to provide tailored services to website visitors (Fryer et al., 2020; Wang et al., 2021). In essence, a user initiates a query to the chatbot, which processes the input to discern the user's intent and subsequently delivers a programmed response. Frequently, chatbots facilitate various tasks, including gathering user information, confirming identities, and guiding users toward relevant resources (Kim et al., 2021; Smutny & Schreiberova, 2020).

The evolution of chatbots can be traced back to the 1960s with the introduction of ELIZA by Weizenbaum (1966), marking the inception of chatbot technology. Over the decades, this domain has witnessed substantial advancements, leading to the emergence of more sophisticated chatbots, such as ALICE and Cleverbot. Smutny and Schreiberova (2020) highlight the prolonged existence of web-based chatbots, which have become increasingly integrated into messaging platforms like Facebook Messenger. Furthermore, Ayedoun et al. (2019) emphasize that some chatbots, like Replika, are designed to present human-like characteristics, thus enhancing user engagement through text, audio, and visual elements. Huang et al. (2018) and Smutny and Schreiberova (2017) note that contemporary chatbots employ natural language processing (NLP), pattern recognition, and neural machine translation techniques to achieve their objectives.

The burgeoning interest in chatbots is largely attributed to their potential to facilitate second language (L2) and foreign language (FL) learning in innovative ways (Wang et al., 2021). For instance, Huang et al. (2017) developed a dialogue-based chatbot, GenieTutor, aimed at assisting users in learning English as a foreign language. This chatbot specifically targets essential

language learning topics, such as ordering food, while also allowing for free conversation on various subjects. The Mondly chatbot, as an additional language-learning tool, supports multiple languages and can focus on specific themes of interest without necessitating human intervention (Bibauw et al., 2019; Coniam, 2014; Fryer et al., 2020). This capacity for unlimited patience, instant responses in natural language, and the ability to alleviate learner anxiety fosters an environment conducive to self-correction and encourages communication (Fryer et al., 2020). Students can practice aspects of language they may hesitate to explore with a human instructor or during initial exposure to a new language.

Goda et al. (2014) found that utilizing a chatbot prior to a group discussion increased student output and supported the development of critical thinking skills. In a similar vein, Kim et al. (2021) reported positive outcomes when students interacted with an AI bot before completing speaking tasks. Notably, voice-based chatbots yielded better performance than their text-based counterparts and traditional in-person settings. Ayedoun et al. (2019) argue that the effectiveness of a chatbot in fostering willingness to communicate hinges on its ability to implement appropriate communication strategies. Coniam (2014) corroborates this by asserting that chatbots generally deliver grammatically accurate responses within different contexts. The capability of chatbots to log conversations with students can enable teachers to tailor lessons that address specific errors made by learners.

Conversely, some literature highlights potential drawbacks associated with chatbot use in language education. Fryer et al. (2017) discovered that while chatbots might initially spark interest due to their novelty, student engagement tends to decline rapidly when compared to interactions with human instructors. Smutny and Schreiberova (2020) point out that many chatbots lack essential communication components, resulting in overly mechanical interactions. Moreover, Coniam (2014) critiques several English-language chatbots for producing meaningless or grammatically incorrect responses. The scarcity of empirical studies examining the impact of chatbots on L2 and FL learning is a pressing concern, as emphasized by Kim et al. (2021). Bibauw et al. (2019) advocate for long-term studies with larger participant groups to comprehensively assess chatbot effectiveness. Smutny and Schreiberova (2020) further recommend that future research focus on providing guidelines for educators on integrating chatbots into their teaching practices, as well as conducting content analyses of student interactions with these technologies.

In recent years, the emergence of ChatGPT (https://chat.openai.com/) has generated considerable interest across multiple domains. This advanced chatbot utilizes extensive databases to generate comprehensive responses to user inquiries. Although concerns about factual accuracy persist (Vincent, 2022), educators and researchers are actively discussing ChatGPT's implications for educational practices. Zhai (2022) conducted a pilot investigation on the use of ChatGPT for composing academic papers, finding the text produced to be coherent and informative. This suggests a potential shift towards enhancing creativity and critical thinking within educational contexts. If employed judiciously, ChatGPT presents an opportunity for language educators to enrich their teaching methodologies and create engaging learning experiences.

11. Future Directions

Research into artificial intelligence (AI) in language education continues to proliferate. Current studies primarily explore AI technologies or applications that utilize specific types of AI algorithms or systems (e.g., Pikhart, 2020). Recent findings indicate that language learners exhibit positive attitudes toward AI tools for language acquisition (Chen et al., 2023; Moussalli & Cardoso, 2020; Wang et al., 2022). In educational environments, AI facilitates immediate feedback and adaptability, empowering students to engage independently in their learning and extending opportunities beyond traditional classroom settings (Srinivasan, 2022). Notably, writing remains the most commonly studied skill in AI-related computer-assisted language learning (CALL) research (Liang et al., 2021).

Sharadgah and Sa'di (2022) conducted a comprehensive review of studies examining AI in language learning and teaching from 2015 to 2021, identifying gaps related to non-verbal communication, gestures, expressions, emotions, translation, the lack of complex instructional materials for AI-driven learning, and uncertainties surrounding the classification of AI capabilities. This underscores the urgent need for thorough research across diverse settings. Although progress has been made in investigating AI teaching assistants (Kim et al., 2020) and AI speech recognition technologies (Gao et al., 2021), there remains substantial ground to cover. Additionally, concerns persist regarding language instructors' preparedness to implement AI (Kessler, 2021). Ethical considerations must also be prioritized when conducting AI research involving student and teacher data. Future research and practice should focus on exploring the pedagogical and technical advancements of AI, as well as its efficient application in language education.

Conclusion

Research into artificial intelligence (AI) in language education is rapidly expanding, revealing a landscape rich with opportunities and challenges. Recent studies highlight a growing acceptance of AI tools among language learners, indicating positive attitudes towards these technologies in language acquisition (Chen et al., 2023; Moussalli & Cardoso, 2020; Wang et al., 2022). AI's capability to provide immediate feedback and adaptability facilitates independent student engagement, extending learning opportunities beyond traditional classroom settings (Srinivasan, 2022). Notably, writing is the most commonly investigated skill in the realm of AI-assisted computer-assisted language learning (CALL) (Liang et al., 2021).

The comprehensive review by Sharadgah and Sa'di (2022) underscores existing gaps in research, particularly concerning non-verbal communication, gestures, emotions, and the complexity of instructional materials in AI-driven learning environments. This highlights the urgent need for more extensive research across varied educational settings. While advancements have been made in areas such as AI teaching assistants (Kim et al., 2020) and speech recognition technologies (Gao et al., 2021), significant gaps remain, particularly regarding the preparedness of language instructors to effectively implement AI in their teaching practices (Kessler, 2021). Additionally, ethical considerations regarding the use of student and teacher data in AI research must be prioritized.

The literature reviewed in this article demonstrates that AI is increasingly transforming language education, shaping methodologies and practices within the field. The integration of advanced technologies such as natural language processing (NLP), automated writing evaluation (AWE), intelligent tutoring systems (ITSs), and chatbots is becoming more prevalent in language learning contexts. This article contributes to the ongoing discourse on the understanding and application of AI-supported language teaching and learning. The findings suggest that while AI presents various advantages, challenges remain that must be addressed for effective implementation.

As AI technologies continue to evolve and integrate into educational frameworks, it is crucial for language educators to harness these tools effectively to enhance learning outcomes. To maximize the benefits of AI in second and foreign language education, more comprehensive and longitudinal research is recommended, focusing on the pedagogical implications, practical applications, and ethical considerations of AI technologies in diverse language learning environments. Through such efforts, the transformative potential of AI can be fully realized in the realm of language education.

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