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A systematic review of current trends in artificial intelligence in foreign language learning

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Abstract

Purpose – This study aims to examine the trends and advancements in AI-supported language learning over the past decade. By analyzing 15 empirical research articles, the study seeks to fill the gap in understanding the effectiveness and challenges of AI-assisted language learning for both first- and second-language learners.

Design/methodology/approach – The research utilizes activity theory, which includes seven components: tool, subject, object, rules, community, division of labor and outcome. This theoretical framework helps to reveal the dynamic interactions and contradictions among these elements. The selection and screening process for relevant articles followed the PRISMA method, ensuring a systematic and comprehensive review.

Findings – The study found that AI-supported technology shows promise in enhancing language learning, particularly in areas such as writing quality, scoring accuracy and learner engagement. However, challenges remain in terms of dialogic competence and the necessity of teacher intervention in pedagogical design. While AI-supported systems can effectively aid in language acquisition, improvements are needed to foster language use for communication and collaborative design.

Research limitations/implications – The review highlights the need for more empirical studies on the pedagogical impacts of AI-supported language learning and the engagement levels of both learners and teachers. It also underscores the importance of investigating the application of AI-assisted language learning in actual classroom environments.

Practical implications – The implications of this study offer significant insights for both educational practice and future research in AI-supported language learning. As AI technologies continue to evolve, their potential to enhance learning outcomes and support teachers' efforts becomes increasingly apparent. However, effective implementation requires not only the availability of technological tools but also proper pedagogical integration and teacher intervention. Furthermore, AI presents unique opportunities to personalize learning and foster collaboration among learners, aligning with the growing trend of hybrid learning environments.

Originality/value – This paper addresses the need for a comprehensive review of AI's role in language education, providing insights into emerging trends and identifying areas for future research. It emphasizes the importance of integrating AI tools with educational theories and the necessity of teacher configuration in enhancing AI-supported language learning.

Keywords Activity theory, Artificial intelligence, EFL, Language learning, Language teaching

Paper type Literature review

Introduction

The evolution of artificial intelligence (AI) has greatly influenced the utilization of information and communication technology in language learning, particularly in computer-assisted language learning. Although previous studies have demonstrated that AI can improve language education when used correctly, there is a limited understanding of its advantages and

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challenges for both first and second-language learners. Researchers have explored various AI-supported language learning tools and predicted their potential impact on future language teaching. However, there is a need for a comprehensive review of empirical research trends in this field. To address this gap, this empirical review study aims to analyze the emerging trends and patterns in recently published studies on AI-supported language learning from 2011 to 2022. To that end, Activity theory, a theoretical framework that helps to understand and analyze the key factors involved in teaching and learning at both individual and collective levels, was used to analyze the data. This theory is particularly relevant for computer-assisted language learning, including its sub-branch, mobile-assisted language learning, which shares similarities with AI-supported language learning. By applying activity theory, this study aims to identify research trends in AI-supported language learning and provide insights for future research in this area.

Literature review

AI in education

John McCarthy's work provides a unique blend of technical expertise, creative thinking, and philosophical reflection, helping to shape AI into what it is today. He defined AI as "the science and engineering of making intelligent machines," emphasizing that AI systems should go beyond copying human intelligence to address real-world problems effectively and flexibly (McCarthy, 1997). This vision reflects McCarthy's belief that machines should not only perform tasks but also solve unexpected challenges in dynamic environments, much like humans do. He envisioned intelligent systems not merely as tools for automation but as collaborators in creative processes—generating ideas, solving puzzles, and making decisions in ways that humans might not consider. This idea highlights McCarthy's conviction that AI should enhance, not replace, human abilities by expanding the boundaries of what's possible.

In his collaboration with Tom Costello, McCarthy explored the importance of counterfactual reasoning—AI's ability to think through hypothetical "what-if" scenarios (McCarthy and Costello, 1999). He believed that machines should not just learn from direct experience but also consider alternative outcomes to improve their decision-making. This capacity for imagining different possibilities helps modern AI systems, like those used in predictive analytics or game strategies, anticipate challenges and develop more effective solutions.

The understanding of AI varies among researchers and educators. Some definitions highlight AI as the capabilities of digital computers to perform cognitive tasks akin to human minds, such as learning and problem-solving, while others emphasize its ability to interact intelligently with humans (Baker and Smith, 2019). In the realm of AI-supported education, AI presents opportunities for more personalized, adaptable, inclusive, and engaging learning experiences. For example, AI can aid teachers by handling tasks like grading numerous student assignments and offering immediate feedback to learners.

The integration of AI in AI-driven education promises a learning environment that is more tailored, flexible, inclusive, and captivating. Through AI technology, tasks like grading a large volume of student work that would be impractical for a single teacher to manage can be efficiently completed. Moreover, AI can furnish learners with essential support, including instant feedback from automated systems (Pokrivčáková, 2019).

Research publications on AI-driven education have surged, prompting calls for more studies on practical applications of AI in classroom settings (Zhai *et al*., 2020). Researchers advocate for a shift in focus from the technological aspects of AI-powered education to encompass pedagogical, cultural, social, economic, and ethical considerations.

Several in-depth reviews have investigated AI-driven education, as evidenced by research from Chen *et al*. (2020) and Zawacki-Richter *et al*. (2019). These studies emphasize the significance of deploying AI in actual educational environments and aligning AI tools with educational theories. In a comprehensive bibliometric study, Chen *et al*. (2022) pinpointed language education, especially natural language processing, as a burgeoning field within

AI-driven education. This underscores the need for a dedicated systematic review on AI's role in language education.

AI in language learning and teaching

AI-backed technology in language education is part of computer-assisted language learning (CALL), targeting areas like natural language processing, automated grading and feedback, adaptive learning platforms, and smart tutoring systems. The shift from CALL to intelligent computer-assisted language learning (ICALL) has revolutionized how students interact with computers, integrating big data analytics and machine learning techniques (Kannan and Munday, 2018; Pokrivčáková, 2019). Intelligent language tutors provide benefits like saving time and money, minimizing stress and anxiety, offering prompt feedback, and predicting learners' future performance. They collect data from learners to form individualized profiles and models, tailoring content to each learner's needs and progress. Moreover, educators and researchers can use this data to forecast learner performance or pinpoint possible learning challenges (Godwin-Jones, 2019).

According to Yang and Kyun (2022), three primary challenges exist in AI-assisted language learning. First, there is a lack of empirical studies on the pedagogical impacts and engagement levels of learners and teachers with AI-supported methods (Pokrivčáková, 2019). Second, technological barriers, notably the AI's dialogic competence, pose challenges (Weigand, 2019). Lastly, addressing perceptions and concerns about AI's role in language learning and its necessity remains essential (Godwin-Jones, 2019). Several review studies have been conducted on the use of AI in language education, with some focusing on certain language skills, such as reading comprehension (Xu *et al*., 2019), and others examining specific technologies like chatbots (Smutny and Schreiberova, 2020). However, there is a limited number of comprehensive research reviews on the topic. It is important to note that only peer-reviewed journal papers were included in this review, as peer review is considered a quality standard for published research (Bond *et al*., 2020). This review provides insights into the limitations of each reviewed paper and highlighted areas for future research.

AI in EFL learning and teaching

The study by Abdalgane and Othman (2023) investigates the impact of AI technologies in Saudi English as a Foreign Language (EFL) classrooms. It explores how tools such as Google Translate, automatic evaluation systems (AESs), and AI-powered writing assistants (e.g. Wordtune) improve students' writing skills, facilitate language learning, and enhance pedagogy. Data collection was based on questionnaires administered to 20 tertiary-level instructors, with responses analyzed using SPSS. The findings suggest that AI can enrich English language teaching (ELT) by helping students develop better writing fluency and enabling instructors to offer real-time feedback. Despite these benefits, the study highlights challenges in integrating AI, including instructors' limited technological skills and difficulties with internet connectivity. The research emphasizes that teacher training and infrastructure improvements are essential for successful AI adoption. The authors conclude that AI can play a critical role in fostering collaboration, individual learning, and motivation, thus advancing the quality of education in EFL classrooms (Abdalgane and Othman, 2023).

Alhalangy and Abdalgane (2023) analyze how artificial intelligence enhances EFL education in Saudi universities. The study examines AI-based applications, such as intelligent teaching systems (ITS), virtual environments, and self-regulated learning, to assess their influence on teaching effectiveness and student engagement. The research methodology involved distributing questionnaires to 45 university teachers, with results indicating that AI tools significantly improve learners' linguistic abilities and classroom dynamics. Teachers and students, however, face challenges like limited familiarity with AI tools and motivational decline due to excessive reliance on technology. The authors recommend greater emphasis on teacher training and further integration of AI to foster student engagement and provide tailored

learning experiences. Overall, the study concludes that AI can streamline educational processes, enhance student-teacher interaction, and improve performance, provided that its integration is carefully managed and supported by adequate training (Alhalangy and Abdalgane, 2023).

Theoretical framework: activity theory

Activity theory was first developed by Vygotsky in 1978, based on his triad model of subject, object, and tools for psychological development. Engeström later expanded on this model in 1987 by adding contextual elements such as rules, community, and division of labor to the original triad (Figure 1). These six elements together form the unit of analysis within activity theory, which considers both individual and collective levels in a socio-historical context. (Koszalka and Wu, 2004)

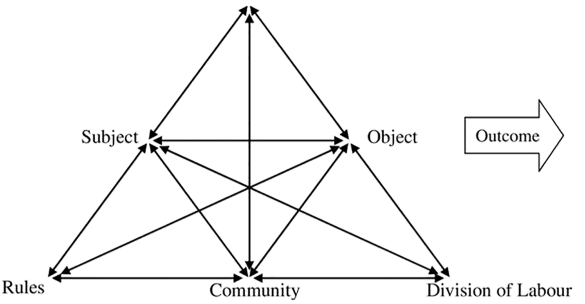
Activity Theory, as delineated by Jonassen and Rohrer-Murphy (1999) and Rambe (2012), offers a framework for examining technology-enhanced learning environments. Within this framework, the "subject" refers to an individual or group actively involved in the activity, while the "object" signifies the goal motivating their engagement. "Tools" encompass both physical and psychological artifacts facilitating the interaction between the subject and object, "rules" govern behavior and cooperation, "division of labor" allocates responsibilities, and the "community" serves as a medium for interaction.

The application of activity theory in educational technology research has seen a rise, notably in domains such as game-based learning and integration of social media (Carvalho *et al*., 2015; Rambe, 2012). Scholars advocate for its suitability in studying the interplay between technology and individuals (Karanasios *et al*., 2018). Liang *et al*. (2021) utilized activity theory to explore the dynamics between AI technology, subjects, and objects in human-technology interaction. This approach illustrates the shift from individual to collective activities for analyzing object-oriented, tool-mediated activity systems. It also delineates the boundary between tools and subjects and shows how consciousness manifests through socially mediated activities.

In a similar vein, Yang and Kyun (2022) employed activity theory to scrutinize the dynamic interactions and contradictions among the seven elements in AI-supported language learning. Their findings suggest that while AI-supported technology serves as a tool for language acquisition, it requires enhancements, particularly in fostering language use for communication and collaborative design. They underscore the significance of teacher intervention and configuration in optimizing AI-supported language learning effectiveness.

(1) Which language skills receive emphasis in AI-supported language education?

(2) How is AI technology employed in language learning trends?



Source(s): Engeström (1987)

Figure 1. Activity theory framework

(3) What research trends are utilized in AI-supported language learning?

Methodology

Selection procedure

The systematic content analysis in the empirical review was conducted by searching for relevant articles on the Web of Science. It is recognized as one of the principal and supplementary systematic search systems based on its evaluation in terms of coverage, recall, precision, efficiency, and reproducibility (Gusenbauer and Haddaway, 2020). Therefore, it was chosen as the search system for this systematic literature review. The selection procedure involves conducting an initial search using specific search terms related to the topics of artificial intelligence and language learning. For the topic of artificial intelligence, the search terms include "Artificial intelligence," "AI," "Intelligent support," and "Machine learning." These terms encompass various aspects of artificial intelligence, including its applications and related technologies.

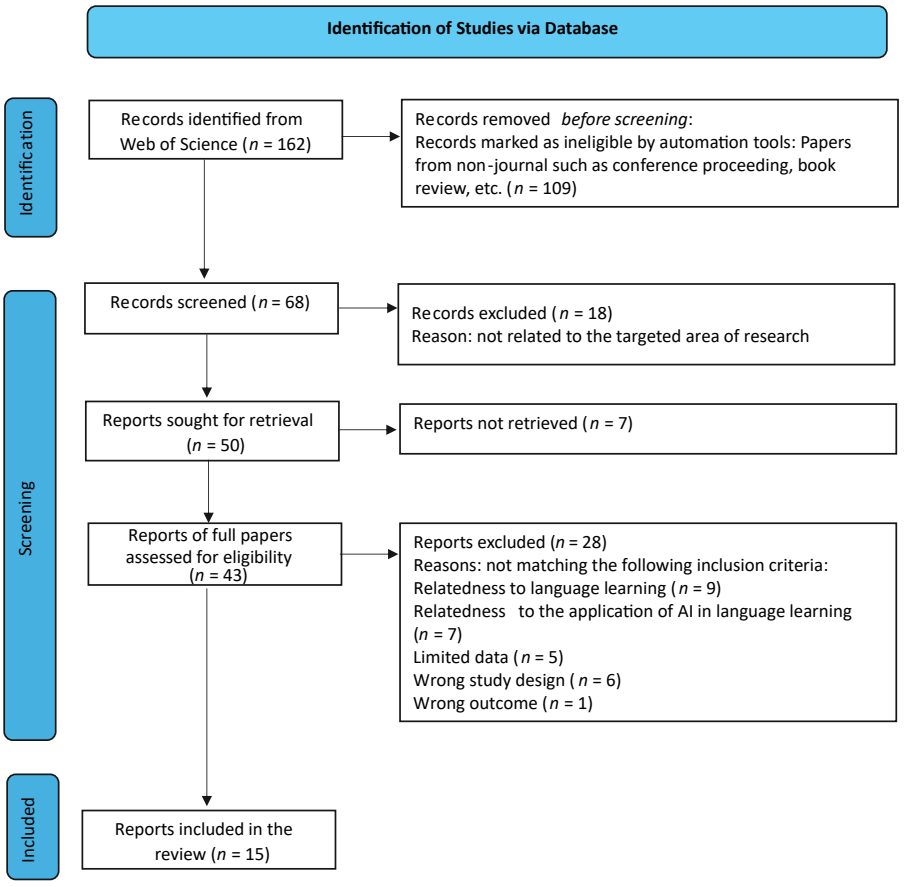
Similarly, for the topic of language learning, the search terms consist of "Language learning" and "Language education." These terms are designed to capture research and literature related to the process of acquiring language skills and education specifically focused on language acquisition. The initial search string serves as a starting point for identifying relevant literature and research articles on the specified topics. It allows researchers to cast a wide net and gather a comprehensive range of sources that address different aspects of artificial intelligence and language learning.

Once the initial search is conducted using the specified search terms, the selection procedure likely involves screening the search results to identify relevant articles that meet specific criteria, such as relevance to the research question, publication date, and credibility of the source. This screening process helps researchers narrow down the list of potential sources and select those that are most pertinent to their research objectives.

The selection and screening process for literature followed the PRISMA method and is illustrated in Figure 2.

The PRISMA research method is a systematic review and meta-analysis approach used in healthcare and medical research, which consists of a series of steps to ensure transparency, reproducibility, and quality of the research process. The method, which stands for Preferred Reporting Items for Systematic Reviews and Meta-Analyses, includes the following steps: (1) defining the research question, (2) conducting a comprehensive literature search across various databases, (3) selecting relevant studies based on predefined inclusion and exclusion criteria, (4) extracting data from the selected studies using standardized forms or templates, (5) assessing the quality and risk of bias in each included study, (6) synthesizing the extracted data using statistical methods to provide an overall summary of the findings, (7) interpreting the synthesized results in light of the research question and objectives, and (8) reporting the findings in a comprehensive report following the PRISMA guidelines to ensure transparent reporting of all aspects of the systematic review methodology and findings. The PRISMA method provides a structured framework for conducting and reporting systematic reviews, ensuring transparency and reproducibility in the research process. The PRISMA method is designed to reduce bias by establishing a standardized procedure for conducting systematic reviews and meta-analyses. It assists researchers in ensuring the thoroughness, rigor, and reproducibility of their reviews while enhancing transparency in reporting methodologies and outcomes.

Following the selection and exclusion criteria, a detailed record was maintained to track the number of papers identified, excluded, and retained at each stage of the screening process. Researchers utilized key search terms to locate relevant articles in the Web of Science, with subsequent screening based on exclusion criteria 1 and 4. Out of the initial pool, 68 papers remained. Through three rounds of screening, involving both abstract and full-text assessments, the number was narrowed down. The first round eliminated articles unrelated



Source(s): Page *et al.* (2021)

Figure 2. PRISMA flow chart

to AI in language learning, resulting in 50 retained articles. Subsequent rounds further refined the selection, ultimately leading to 25 articles for the final review.

To ensure consistency in article identification and screening, the researcher took on the responsibility, with a colleague (Professor of Teaching English as a Foreign Language) verifying the final outcomes. Inter-rater reliability checks were conducted over three rounds, demonstrating a high agreement percentage of 94% in the third round for coding inclusion and exclusion criteria. A consensus was reached based on evidence aligned with the established criteria. The quality of inter-rater agreement, focusing on accuracy and precision, was evidenced by the agreement percentage. In cases of uncertainty during the exclusion process, a thorough examination of the full text of relevant articles was conducted to determine their inclusion or exclusion. This is shown in Table 1 below.

The table presents the inter-rater agreement percentages across three phases of the article selection process, demonstrating the reliability and consistency of the reviewers' decisions. During the screening phase, 68 papers were assessed based on abstracts and titles, with both reviewers agreeing on 59 papers and disagreeing on 9, resulting in a 92% agreement. In the retrieving phase, 50 papers were evaluated for further consideration, with 48 agreed upon and

Table 1. Inter-rater agreement percentage

	Screening	Retrieving	Full paper assessment
Total number of papers	68	50	69
Agreed-on papers	59	48	65
Non-agreed-on papers	9	2	4
Agreement percentage	92%	92%	94%

Source(s): Table created by the author

2 contested, maintaining an agreement percentage of 92%. The final phase involved a full-text assessment of 69 papers, where 65 were agreed upon and 4 were disputed, increasing the agreement to 94%. The progressive improvement in agreement reflects the reviewers' increased alignment through repeated evaluation. In case of disagreement, a thorough examination of the full texts was conducted to ensure accurate decisions regarding inclusion or exclusion. The purpose of this rigorous process is to highlight the reliability and precision of the study selection, ensuring the review's transparency and methodological soundness.

Data analysis

The empirical review went through three stages. First, articles were sorted by publication year and aspects of human-AI interaction, with a rise in research seen in 2019–2020. Next, the 15 studies were categorized using expanded activity theory components (Ali *et al*., 2015; Engeström, 1987): subject (participants), tool (AI's role), object (goal of AI use), outcome (AI application/results), rules (AI research design), community (involved parties like administrators and learners), and division of labor (task distribution among stakeholders) (Lin *et al*., 2019). Lastly, the results were merged, focusing on trends, limitations, context, and research design and human-AI interaction principles.

Results

The examined research focused on three main outcome categories concerning intelligent tutoring systems and AI-supported systems in language learning.

Effectiveness of intelligent tutoring systems

Several studies indicated that the use of intelligent tutoring systems led to enhancements in writing quality, increased accuracy in scoring systems, and decreased error rates. For instance, Weston-Sementelli *et al*. (2018) demonstrated improvements in writing quality, while Pandarova *et al*. (2019) highlighted enhanced scoring accuracy.

AI-supported automatic writing feedback systems

These systems were beneficial for students' writing skills. Tegos *et al.* (2014) illustrated that interventions by conversational agents improved students' dialogue proficiency, and Ayedoun *et al*. (2019) showed that such interventions boosted learners' communication willingness.

AI-supported computer models

These models could predict or reveal various learner-related factors. Hsu (2020) discovered that EFL learners' attention levels were highest during human interactions and meditation when engaging with chatbots. Chew and Chua (2020) proved that the use of humanoid robots increased learner engagement.

Moreover, research by Lu (2019) emphasized the effectiveness of automatic writing evaluation in aiding EFL students and motivating them to revise their work. While Bai and Hu (2017) noted the complementarity of AI-programmed automatic writing evaluation with peer and instructor feedback, Zhang and Hyland (2018) highlighted students' continued preference for teacher feedback on content and organization.

Despite its advantages, Lu (2019) suggested room for improvement in automatic writing evaluation, particularly in evaluating text structure and coherence. Zhang (2017) argued that the feedback's efficacy depended on students' behavioral, emotional, and cognitive engagement. Factors like social presence, peer influence, and immediate benefits also influenced emotional and cognitive engagement with feedback (Fu *et al*., 2020). The intention to use automatic writing evaluation was linked to learners' perceptions of its utility, attitude towards its use, and computer self-efficacy (Li *et al*., 2019). Jiang and Yu (2020) identified three sub-processes in learners' adoption of automatic writing evaluation feedback: information selection, emotion regulation, and goal setting for improvement. Additionally, Uzun (2020) found that artificial augmentation improved the accuracy of predicting EFL writing performance. Lastly, Yang *et al*. (2019) revealed the interconnectedness of phonological awareness, short-term memory, and long-term memory abilities through an AI-supported computer model. These findings have implications for L2 pedagogical design, especially in intervention strategies targeting cognitive abilities. Xiao and Hu (2019) utilized a support vector machine to differentiate high-achieving from low-achieving EFL students based on various factors.

While most of the examined studies showed positive results, a few reported less satisfactory outcomes. For example, Theodoridou (2011) noted that web-based pedagogical agent-supported vocabulary systems did not boost vocabulary recall and retention, despite learners' contentment with the learning setting. In the context of Turkish EFL, Ulum (2020) found that both teachers and students had reservations about an AI-based assessment system's reliability. This skepticism stemmed from the system's emphasis on memory assessment rather than gauging language proficiency and higher-level cognitive skills.

Discussion of findings

Which language skills receive emphasis in AI-supported language education?

The studies examined highlighted the efficacy of AI in supporting students' acquisition of language skills, as well as different language components such as vocabulary, pronunciation, and conversation (Ayedoun *et al*., 2019; Li *et al*., 2019; Uzun, 2020). They also delved into learner-related factors like attention, engagement, interest, attitude, and competence assessment (Liang *et al*., 2021). The use of AI in language learning led to improvements in writing proficiency, precision, active conversation, decreased speech-related stress, and increased levels of involvement. Notably, more research has been dedicated to language learning anxiety compared to the relatively limited exploration in the higher education sector as noted by Liang *et al*. (2021). The findings of the present study show that AI-supported systems are particularly effective in improving writing skills, including accuracy and fluency. Additionally, these systems enhance learners' willingness to communicate by reducing anxiety and improving engagement. However, AI tools still have limitations in promoting collaborative communication and deep language usage beyond basic interactions.

The incorporation of intelligent tutors, agents, and robots in language practice has proven effective in refining learners' pronunciation, error correction, communication willingness, engagement, and anxiety reduction (Bao, 2019; van den Berghe, 2022). While the effectiveness in vocabulary recall was not evident, integrating AI-supported language learning can streamline teachers' workload while effectively engaging students in language acquisition. Additionally, a shift has been observed in studies from merely testing effectiveness to investigating learners' interactions and engagement with AI-supported language learning. The intervention and setup of AI-supported language learning by teachers

in pedagogical design have been highlighted as pivotal for its efficacy (Tegos *et al*., 2014). Furthermore, this study concludes, AI tools are primarily used as intelligent tutors, automatic feedback systems, and conversational agents to personalize learning experiences and provide real-time assistance. The study highlights that these tools streamline teaching processes, such as grading and feedback, but require proper pedagogical integration by teachers to be fully effective. While AI shows promise in individualized learning, its role in facilitating peer collaboration remains underdeveloped.

Recent studies have transitioned from evaluating the effectiveness of AI-supported automatic writing assessment to exploring learners' responses to feedback. While earlier research (Lu, 2019) primarily assessed the efficacy of AI-supported automatic writing evaluation, current studies (Li *et al*., 2019; Zhang and Hyland, 2018) have shifted focus toward understanding how learners interact with automatic writing evaluation feedback.

While studies suggest that automatic writing evaluation feedback primarily focuses on mechanical errors and learners tend to engage in superficial error correction, researchers recommend combining automatic feedback with teacher and/or peer feedback to improve student learning outcomes (Zhang, 2017). For future advancements, researchers propose that automatic writing evaluation should not only address mechanical errors but also evaluate aspects like text structure, content logic, ideas, and coherence (Lu, 2019).

How is AI technology employed in language learning trends?

The studies analyzed revealed the use of AI technology as a set of tools with human-like qualities to aid in language learning, as evidenced by the various names assigned to these tools, such as intelligent tutors, humanoid robots, or analytical tools for assessing learner-related factors. The evolution of the intelligent tutor illustrates the development from an intangible and integrated component of an online system to mobile applications that allow for text or audio interaction, and finally to more tangible and autonomous agents resembling humans, such as humanoid robots. Research on online-based intelligent tutors or agents in language learning has been extensive, with advancements in AI leading to the incorporation of personalized learning to provide tailored experiences for individual learners.

Interestingly, the number of educational apps has notably increased, including chatbot-based mobile apps for language learning, which enable learners to engage in language learning at any time and place using their mobile devices. These apps have been found to increase learners' interest and engagement through interactive conversations. Additionally, research has demonstrated that voice-enabled mobile applications can enhance learners' communication skills and literacy in reading and writing (Al-Kaisi *et al*., 2021). The integration of AI technology in language education aligns with broader trends in general education, including the use of learner profiling (i.e. collecting and analyzing data about learners to understand their needs), assessment and evaluation, pedagogical agents (i.e. AI-driven virtual characters or programs designed to assist learners), and intelligent tutoring systems (i.e. AI-powered platforms or software that offer personalized instruction, adapting to the learner's pace and style to provide tailored learning experiences) (Yang and Kyun, 2022; Zawacki-Richter *et al*., 2019).

Recent studies have also investigated the use of AI-based humanoid robots, also known as social robots, as instructional tools in language learning, specifically targeting children (Jamet *et al*., 2018; Kanero *et al*., 2018; van den Berghe *et al*., 2020). These studies have shown that humanoid robots can enhance children's thinking and perceptions by being perceived as social beings. For example, NAO is a humanoid robot that closely resembles children in appearance and can accurately mimic human movements. It can handle small objects, employ deictic gestures to facilitate learning and mimic gestures or signs. Furthermore, NAO can articulate language verbally with adjustable parameters for speech rate and tone, making it an effective tool for reading and pronunciation instruction (Jamet *et al*., 2018). The positive characteristics of humanoid robots contribute to fostering a positive attitude and motivation among children

towards language learning in educational settings. Consequently, there has been active research exploring the educational possibilities and applications of humanoid robots in classrooms.

The present study identifies a shift from evaluating the effectiveness of AI tools to understanding learner interaction with AI-generated feedback. There is also a growing focus on how teachers can configure AI within pedagogical design to enhance its impact. However, the findings emphasize the need for more classroom-based studies to explore the practical application of these tools in real-world educational settings.

What research trends are utilized in AI-supported language learning?

The paper by Liang *et al*. reviewed research on the use of AI in language learning, which primarily employed experimental or quasi-experimental designs, with some case studies and interviews. The research aimed to demonstrate the effectiveness of AI in language learning through various experimental settings. The results from these studies suggest the importance of implementing AI-supported language learning technology in both traditional classroom settings and non-classroom learning environments. While most of the research has focused on individual learner interactions with AI, future studies should explore collaborative language learning designs supported by AI. Additionally, there is a need for more research on teachers' involvement in configuring AI-supported language learning in pedagogical design, as only two studies in this review considered teachers' intervention (Liang *et al*., 2021; Yang and Kyun, 2022).

The implications of this study offer significant insights for both educational practice and future research in AI-supported language learning. As AI technologies continue to evolve, their potential to enhance learning outcomes and support teachers' efforts becomes increasingly apparent. However, effective implementation requires not only the availability of technological tools but also proper pedagogical integration and teacher intervention. Furthermore, AI presents unique opportunities to personalize learning and foster collaboration among learners, aligning with the growing trend of hybrid learning environments. To maximize these benefits, institutions and educators need to address challenges related to cultural dynamics, social structures, and technological limitations. These practical implications can pave the way for improved educational strategies, while further research can deepen our understanding of AI's role in facilitating meaningful learning experiences. Practically, the findings suggest the importance of teacher training, hybrid learning strategies, and AI tools that support both individualized and collaborative learning. These approaches can improve student engagement and outcomes if implemented effectively. Future research should focus on real-world classroom applications, explore the role of cultural and social factors, address AI's current limitations, and assess long-term impacts on learner outcomes. Together, these implications provide a roadmap for refining AI-assisted language learning and ensuring its sustainable impact on educational practices.

Conclusion

This systematic review has explored the trends, tools, and challenges of AI-supported language learning by analyzing 15 empirical studies through the lens of activity theory. The literature review highlighted the shift from computer-assisted language learning to intelligent, AI-driven solutions such as automated feedback systems, humanoid robots, and personalized learning platforms. While these technologies enhance learner engagement, motivation, and writing proficiency, the findings underscore the limitations of current AI systems in promoting deeper communication and collaborative skills. The results also indicate that teacher involvement in configuring AI tools plays a crucial role in maximizing their pedagogical effectiveness.

AI-supported learning offers practical benefits such as reducing teaching workload through automated grading and feedback while personalizing student learning paths. However, there is still a need for improvement in the design and application of these tools, particularly in fostering collaboration among learners and enhancing their ability to use language creatively in real-life contexts. Additionally, the lack of large-scale classroom-based studies reflects a gap between technological capabilities and their real-world implementation, which future research should address.

The findings emphasize the importance of hybrid learning strategies that integrate AI tools with traditional teaching methods. AI technologies have the potential to support group work, peer-to-peer learning, and individualized instruction, but these benefits can only be realized through appropriate pedagogical integration. Future research should focus on practical implementations in classrooms, the influence of cultural and social factors on AI interactions, and ways to address existing technological limitations. Longitudinal studies examining the impact of AI on learner outcomes over time will also be essential to fully understand the potential of these systems. AI-supported language learning can lead to more effective, engaging, and sustainable educational practices by aligning AI tools with pedagogical frameworks and addressing practical challenges.

The shift towards hybrid learning models in AI-assisted language education suggests that future research should prioritize practical, real-world scenarios where learners engage with AI technology. Additionally, a promising avenue for investigation is the role of AI in facilitating collaborative learning experiences. This could involve exploring how AI can support group work, peer-to-peer learning, and other forms of collaborative learning design. This review suggests several other future research directions, including.

(1) How interactions with AI influence language and meaning negotiation: This research direction would examine how learners and AI interact with each other to construct meaning. This could involve studying how learners use AI to generate language, how AI responds to learner input, and how learners interpret AI's responses.

(2) The cultural role of teachers and students in the interaction with AI: This research direction would examine how the cultural backgrounds of teachers and students influence their interactions with AI. This could involve studying how teachers and students from different cultures perceive AI, how they use AI in their teaching and learning, and how they negotiate the meaning of AI-generated language.

(3) The impact of power structures on the interactions between learners and AI: This research direction would examine how power dynamics between learners and AI can influence the learning process. This could involve studying how learners with different levels of power interact with AI, how AI is used to reinforce or challenge existing power structures, and how learners can resist the power of AI.

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