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Harnessing AI in CALL: Theories, Pedagogies, and Applications for Adult Language Learning

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Abstract

The growing integration of Artificial Intelligence in Computer-Assisted Language Learning is reshaping the landscape of second language acquisition, particularly, for adult learners seeking flexible, personalized, and effective language instruction. This paper explores the pedagogical impact of AI-enhanced CALL systems through the lens of three foundational theoretical frameworks: Sociocultural Theory, Cognitive Load Theory, and Interactionist perspectives. These perspectives offer complementary insights into how AI technologies, such as intelligent tutoring systems, natural language processing, and adaptive learning platforms, work. Which support learner autonomy, engagement, and communicative competence through personalized feedback, adaptive learning paths, and interactive practice. Drawing on recent empirical studies, the paper highlights both the transformative potential and practical challenges of implementing AI in adult language education. Including concerns over data privacy, teacher readiness gaps, and the risks of algorithmic bias that necessitate mitigation to ensure equitable and effective adoption. Building on these insights, the paper proposes a framework for ethically and pedagogically grounded AI integration to guide researchers, educators, and developers in designing responsible and impactful CALL practices. Ultimately, this study contributes to the evolving discourse on technology-enhanced language learning by providing theoretical depth and practical guidance for leveraging AI in adult second-language contexts.

Keywords: artificial intelligence, computer-assisted language learning, cognitive load theory, second language acquisition, sociocultural theory

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Introduction

In today's interconnected and multilingual world, the demand for effective methods of Second Language Acquisition (SLA) continues to rise, particularly among adults engaged in higher education, professional growth, and lifelong learning. Unlike younger learners, adults often bring diverse linguistic backgrounds, shifting motivations, and limited time for consistent study. These realities make language learning more complex, while also increasing the value of Computer-Assisted Language Learning (CALL). AI-driven CALL systems, in particular, respond to these challenges by offering personalized pacing, targeted support, and on-demand practice—options that traditional, uniform approaches struggle to provide (Al-Said, 2022).

Recent advances in Artificial Intelligence have further reshaped CALL environments, introducing levels of personalization and responsiveness that were previously unattainable. Natural Language Processing (NLP), machine learning, and Intelligent Tutoring Systems (ITS) can adapt materials to individual needs, track progress dynamically, and deliver feedback that mimics human responsiveness. These tools are now being used in both formal classrooms and informal learning spaces, and their potential has attracted growing attention within Arab higher education contexts, where issues of teacher readiness and learner autonomy remain particularly salient (Al-Khalifa & Alharbi, 2023). Despite these advances, it is necessary to evaluate AI-enhanced CALL not only for its pedagogical promise but also through critical theoretical and ethical lenses.

This study draws on Sociocultural Theory (Vygotsky, 1978), Cognitive Load Theory (Sweller, 1988), and Interactionist perspectives (Long, 1981; Gass & Mackey, 2007) to examine how AI technologies shape language learning. These frameworks complement one another: Sociocultural Theory explains how AI functions as a mediational tool within the learner's zone of proximal development; Cognitive Load Theory clarifies how adaptive systems help balance mental effort; and Interactionist perspectives illuminate the role of AI-driven feedback and conversational agents in promoting input, negotiation, and output. Together, these perspectives provide a foundation for understanding the interactional, cognitive, and social dimensions of AI-mediated language learning.

This paper emphasizes adult learners, a group still underrepresented in CALL research. By synthesizing theoretical insights and empirical findings, it seeks to:

- Evaluate the alignment of AI-driven CALL with core SLA principles,
- Identify the benefits and limitations of its use in adult learning, and
- Propose recommendations for ethical and practical integration.

Accordingly, the study addresses three research questions:

1. How do AI-enhanced CALL systems respond to the particular needs of adult learners in areas such as personalization, scaffolding, and assessment?
2. In what ways do Sociocultural Theory, Cognitive Load Theory, and Interactionist perspectives explain the processes underlying AI-mediated learning?

3. What benefits, limitations, and ethical issues arise when AI is incorporated into adult SLA?

The sections that follow present a theoretical review, examine empirical evidence, discuss challenges, and outline future directions for AI in CALL, contributing to broader debates at the intersection of artificial intelligence, adult education, and second language pedagogy.

Literature Review: Theoretical Frameworks in CALL

The effectiveness of Computer-Assisted Language Learning (CALL) is increasingly understood through well-established theories of language acquisition and instructional design. Among these, Sociocultural Theory, Cognitive Load Theory, and Interactionist Perspectives provide robust foundations for designing and evaluating AI-enhanced CALL systems, particularly for those who require adaptable, efficient, and socially meaningful learning environments (Golonka et al., 2014; Reinders & White, 2016).

Sociocultural Theory and CALL

Rooted in the work of Vygotsky (1978), Sociocultural Theory emphasizes the centrality of social interaction, mediation, and cultural context in learning. A cornerstone of this theory is the Zone of Proximal Development (ZPD)—the gap between what a learner can do independently and what they can achieve with appropriate guidance. In CALL contexts, this guidance often takes the form of technological scaffolding, such as adaptive feedback, guided practice, and interaction with AI-based virtual agents or peer collaboration platforms (Blake, 2016; Kukulska-Hulme & Viberg, 2018).

Research supports the relevance of Sociocultural Theory in CALL. For example, Lai and Li (2011) found that adult ESL learners using social platforms such as blogs and wikis developed language skills more effectively when peer interaction and collaborative tasks were embedded. Warschauer and Kern (2020) further argue that digital environments replicate key social elements of the ZPD, as learners engage with both human and machine-based facilitators who help shape their understanding.

Recent findings confirm that AI integration can significantly increase learner motivation and satisfaction through personalized interaction and feedback (Chen et al., 2025). AI uniquely operationalizes SCT principles by providing dynamic, just-in-time scaffolding based on learner input, directly mediating within the ZPD. Intelligent tutoring systems, conversational agents, and context-aware feedback tools extend learners' capabilities while tailoring support to their immediate needs. For adult learners, who often balance learning with professional and personal commitments, such self-paced ZPD support ensures that scaffolding is available whenever and wherever they engage with the system, making socially mediated learning accessible beyond the classroom.

Cognitive Load Theory and Multimedia Learning in CALL

Cognitive Load Theory (CLT), proposed by Sweller (1988), posits that learning is most effective when instructional materials are designed to minimize unnecessary mental effort and optimize working memory usage. For CALL environments—especially those enhanced by AI and multimedia tools—this theory underscores the importance of instructional design that integrates modality, coherence, and segmenting principles (Mayer, 2009).

AI-driven CALL platforms often incorporate text, audio, animation, and interactive assessments. While such tools have the potential to deepen comprehension, poorly designed interfaces can overwhelm learners, especially adults returning to formal education after a long break. Studies by Plass and Jones (2021) and Makransky and Mayer (2022) show that learners benefit from platforms that balance information across modalities, such as pairing spoken explanations with synchronized visuals rather than overloading one sensory channel.

More recent research demonstrates that AI systems capable of adaptive sequencing and personalized content reduction can effectively manage intrinsic and extraneous cognitive load, enhancing focus and retention in online learning contexts (Al-Saadi et al., 2024; Zhang & Li, 2025). AI can tailor complexity, eliminate redundancy, and adapt content pacing to learner readiness. These features are particularly beneficial for adult learners—often facing cognitive overload when re-engaging academically—because they manage cognitive load to foster sustainable learning without overwhelming the learner.

Interactionist Perspectives on Language Acquisition in CALL

Interactionist theories—advanced by Long (1981) and Gass and Mackey (2007)—emphasize that interactional feedback, negotiation of meaning, and output opportunities are essential for second language development. Learners must engage in meaningful conversation, process comprehensible input, and be allowed to modify their output based on corrective feedback.

CALL environments, especially those powered by AI, align well with these principles. AI chatbots, virtual speaking partners, and automated evaluators simulate real-time dialogue, analyze learner input, and generate individualized feedback that promotes language restructuring (Godwin-Jones, 2023; Li, 2022). Such interaction-rich environments foster linguistic noticing and metalinguistic reflection, which are essential mechanisms in SLA (Schmidt, 1990).

Recent studies highlight how AI conversational agents provide scalable, interactive opportunities for language practice, feedback, and negotiation of meaning that were previously resource-prohibitive (Nguyen, 2023; Wang & Chen, 2024). For adult learners who may experience anxiety or self-consciousness in live classrooms, AI-driven interaction creates a safe practice space where they can rehearse workplace, academic, or social communication scenarios with confidence.

Synthesis and Implications

Together, these three theoretical perspectives offer a comprehensive foundation for understanding how AI-driven CALL systems support second language acquisition. Sociocultural

Theory informs the importance of interactive, scaffolded learning; Cognitive Load Theory ensures multimedia instruction remains cognitively efficient; and Interactionist approaches validate the need for practice-rich, feedback-driven environments.

Notably, the combination of these frameworks provides a more holistic evaluative lens than any single one alone. SCT explains the mediational and social aspects of AI scaffolding, CLT addresses the cognitive efficiency of adaptive instruction, and Interactionist theory captures the communicative value of AI-driven feedback and negotiation. For adult learners, whose needs span self-paced support, cognitive efficiency, and safe communicative practice, this integrated framework ensures that AI-enhanced CALL is analyzed in a way that reflects the full spectrum of their learning realities.

AI Technologies in Language Learning

The integration of Artificial Intelligence (AI) in Computer-Assisted Language Learning (CALL) has introduced innovative, adaptive, and learner-centred solutions to address the diverse needs of adult language learners. Among the most impactful AI technologies in CALL are Natural Language Processing (NLP), Machine Learning (ML), and Intelligent Tutoring Systems (ITS). These technologies enhance learner autonomy, provide timely feedback, and personalize instructional delivery—features especially valuable for adults balancing education with professional and personal responsibilities.

Natural Language Processing (NLP)

NLP enables machines to interpret, analyze, and generate human language. In language education, it powers tools for grammar checking, text summarization, error detection, and writing enhancement. Applications such as Grammarly, Write & Improve, and Turnitin Revision Assistant provide immediate, form-focused feedback that helps learners independently identify and correct syntactic and lexical errors (Chen et al., 2024; Katinskaia, 2025).

Recent innovations include chatbots and conversational agents that simulate realistic dialogue through NLP algorithms. These tools deliver non-judgmental, interactive speaking practice, which is crucial for adults who may experience anxiety in classroom interactions. Studies demonstrate that chatbot-based practice improves fluency, pragmatic competence, and motivation (Karataş et al., 2024; Godwin-Jones, 2023). However, NLP technologies still struggle with pragmatic subtleties and context-dependent errors, such as tone, irony, or cultural nuances, which means that adult learners may require supplementary guidance when dealing with more complex communicative contexts.

Machine Learning and Adaptive Learning Systems

Machine Learning (ML), a core branch of AI, empowers CALL systems to analyze learner data and adapt instruction in real-time. ML algorithms can detect patterns in grammatical error types, vocabulary acquisition speed, and task completion behaviors, and then adjust instructional

trajectories accordingly (Chen et al., 2025). This creates personalized pathways that allow learners to progress at their own pace and revisit challenging material when needed.

Beyond personalization, ML-driven platforms utilize predictive analytics to identify early signs of disengagement or underperformance, enabling timely intervention and differentiated instruction. Research confirms that such systems enhance satisfaction and proficiency outcomes, especially in heterogeneous classrooms (Mohsen et al., 2023; AlAqlobi et al., 2024). However, ML is highly dependent on the quality and quantity of learner data, and flawed or biased datasets can result in ineffective or even misleading adaptation. For adults with highly diverse linguistic and professional backgrounds, ensuring representative data is particularly important.

Intelligent Tutoring Systems (ITS)

Intelligent Tutoring Systems (ITS) provide individualized instruction and feedback that mirrors one-on-one tutoring. Grounded in cognitive and pedagogical models, ITS tracks learner performance and applies scaffolding strategies, adjusting task complexity as proficiency increases (Makransky & Mayer, 2022; Plass & Jones, 2021). Examples include platforms offering dynamic listening comprehension tasks, grammar explanations, and interactive reading support.

For adult learners with varied educational and linguistic backgrounds, ITS provides tailored pathways that address both form and meaning while encouraging reflective learning and metacognitive awareness (Godwin-Jones, 2023; Tafazoli, 2023). Recent ITS developments integrate multimodal input (visual, auditory, and textual cues) and immersive technologies such as Augmented Reality (AR) and speech recognition, enabling authentic communicative practice (Caetano et al., 2024). Still, creating truly "intelligent" pedagogical models that capture the complexity of human tutoring remains a challenge, as ITS often relies on scripted scaffolding rather than nuanced instructional judgment.

Synthesis

AI technologies in CALL collectively reshape language learning—particularly for adult learners. NLP enhances written and spoken communication but still struggles with deeper pragmatics. ML facilitates personalized, data-driven pathways, yet it depends heavily on robust datasets. ITS provides real-time scaffolding, while facing limitations in replicating human-level pedagogical intelligence. Importantly, these technologies often work in tandem: NLP powers the interface for written and spoken interaction, ML drives the adaptation engine using data parsed by NLP, and ITS integrates both to deliver holistic tutoring experiences. When thoughtfully combined, they promote autonomy, engagement, and long-term language development. At the same time, effective implementation requires careful pedagogical design, digital literacy support, and ongoing research into their long-term impact.

Empirical Studies on AI-Enhanced CALL

The effectiveness of AI-enhanced Computer-Assisted Language Learning (CALL) has been increasingly validated through a range of recent empirical studies. These studies provide valuable insights into the pedagogical benefits and implementation outcomes of AI technologies across diverse language learning settings, particularly among learners in higher education and continuing education contexts.

Efficacy of AI in Language Learning

Numerous studies have shown that AI-supported CALL environments enhance language proficiency in grammar, writing, pronunciation, and vocabulary acquisition. For example, a randomized controlled trial by Chen et al. (2024) investigated a multi-strategy AI-powered EFL writing system that utilizes deep learning to provide personalized feedback on grammar and content. Learners in the experimental group demonstrated statistically significant improvements in writing fluency, coherence, and grammatical accuracy compared to a control group receiving traditional feedback.

Similarly, a meta-analysis by Chen et al. (2025), synthesizing findings from 32 studies on AI-enabled assessment tools, concluded that intelligent evaluation platforms yielded consistent, statistically significant gains in both formative and summative performance indicators in L2 learning. The authors emphasized that the immediacy, consistency, and adaptiveness of AI feedback were central to these outcomes, though effect sizes varied depending on task type and learner proficiency.

Learner Outcomes and Engagement

AI-enhanced CALL systems also influence learner engagement, autonomy, and motivation—key drivers of adult SLA. A mixed-methods study by Karataş et al. (2024) examined ChatGPT-based instruction for adult EFL learners and reported moderate effect sizes on motivation and interactional competence. Participants noted a reduction in anxiety and an increased willingness to experiment with language, attributing these improvements primarily to the tool's safe and responsive feedback environment.

Godwin-Jones (2023) echoed these findings, observing that AI-mediated conversational agents and adaptive writing support promoted metacognitive awareness and learner autonomy. These affordances are especially important for adults, who value tools that accommodate diverse prior knowledge and support reflective, self-paced practice. In addition, learner log data from AI platforms often show increased time-on-task and higher completion rates compared with traditional digital tools, indicating observable improvements in sustained engagement (Mohsen et al., 2023).

Case Studies of Successful Implementation

Case-based research further validates the role of AI in enhancing language learning success. A longitudinal study by AlAqlobi et al. (2024) evaluated an AI-integrated platform combining pronunciation feedback, grammar correction, and vocabulary scaffolding among working professionals in a business English program. Over the course of 12 weeks, participants demonstrated measurable improvements in oral fluency and grammatical range, accompanied by consistently high satisfaction ratings.

Similarly, a case study by Katinskaia (2025) examined AI-supported CALL in an adult ESL program at a Korean university. The integration of chatbots and automated writing tutors resulted in improved self-correction strategies and increased linguistic complexity in writing. The study emphasized that clear instructional design and well-defined task goals are crucial for effective AI use.

Other studies highlight the role of AI in differentiated instruction and inclusivity. For example, adaptive systems that adjust to learners' pace, proficiency, and preferred input modes (e.g., text, audio, visuals) have been shown to narrow gaps in mixed-ability classrooms (Caetano et al., 2024; Tafazoli, 2023).

Synthesis

Collectively, these empirical studies confirm that AI-enhanced CALL systems contribute to improved linguistic outcomes, increased learner engagement, and greater instructional efficiency. However, several limitations are common: many studies focus on short-term interventions, target specific skills (e.g., writing or fluency) rather than holistic proficiency, or rely on self-reported engagement metrics in conjunction with performance data. While findings are promising, more longitudinal, large-scale research is needed to understand the sustained and comprehensive effects of AI integration in adult language learning.

Benefits of Integrating AI into CALL

The integration of Artificial Intelligence (AI) into Computer-Assisted Language Learning (CALL) environments has generated significant pedagogical benefits in diverse educational contexts. These benefits, however, are potential rather than guaranteed, and their realization depends heavily on the quality of implementation, alignment with pedagogical principles, and teacher facilitation. Among the most notable advantages are improvements in learner autonomy and motivation, the provision of immediate and personalized feedback, and the scalability of high-quality language instruction across varied learning settings.

Enhanced Learner Autonomy and Motivation

AI-based CALL platforms empower learners to take control of their own learning process. Through adaptive content delivery, self-paced modules, and goal-setting features, these tools support self-directed learning—an application that aligns closely with Sociocultural Theory, where

AI acts as a mediational tool within the Zone of Proximal Development, and with Machine Learning, which adapts to individual learner profiles. For adult learners managing multiple responsibilities, such self-paced scaffolding is especially beneficial (Godwin-Jones, 2023). The ability to track progress, revisit challenging tasks, and receive ongoing support fosters intrinsic motivation and sustained engagement; however, studies indicate that these gains are often moderate in effect size and depend on the thoughtful integration of AI into broader learning design (Karataş et al., 2024).

Immediate and Personalized Feedback

One of the core strengths of AI in CALL is its ability to provide real-time, individualized feedback. Tools equipped with Natural Language Processing (NLP) detect grammatical errors, suggest lexical alternatives, and assess pronunciation instantly, thereby operationalizing principles of Interactionist Theory, which emphasizes feedback and negotiation of meaning. This immediacy reduces learner frustration and accelerates revision cycles, supporting deeper learning outcomes (Chen et al., 2024, 2025). However, NLP systems still struggle with pragmatic subtleties and cultural appropriateness, occasionally mis flagging correct usage or reinforcing dominant language norms (e.g., privileging U.S. English over regional varieties). Such algorithmic bias highlights the need for teacher oversight and diversified training datasets.

Scalability and Accessibility of Resources

AI technologies also enable CALL to be scaled across regions, populations, and learning formats. Cloud-based platforms can deliver instruction to thousands of learners simultaneously, while Intelligent Tutoring Systems (ITS) simulate individualized tutoring at scale by combining NLP-driven interfaces with ML-powered adaptation. This scalability reflects Cognitive Load Theory principles, as adaptive sequencing ensures learners are not overwhelmed when accessing content remotely. Moreover, AI allows personalization based on proficiency level, cultural background, or learning preferences, enhancing inclusivity (Mohsen et al., 2023; Caetano et al., 2024). Nevertheless, scalability brings challenges: poor infrastructure, insufficient teacher readiness, and unchecked algorithmic models can undermine accessibility. Mitigation requires investment in digital literacy for educators and learners, as well as transparent oversight of AI-driven systems.

Synthesis

Overall, the benefits of AI integration in CALL are compelling but closely tied to the frameworks and technologies discussed earlier. SCT explains how AI enhances autonomy, CLT ensures scalable systems manage cognitive load, and Interactionist Theory clarifies the role of real-time feedback. However, these benefits are interdependent: personalization relies on high-quality data (machine learning), feedback depends on NLP accuracy, and scalability requires robust integration of ITS. Challenges such as algorithmic bias, teacher readiness, and infrastructural

limitations are interconnected and require coordinated solutions to address them effectively. Mitigation involves teacher reskilling—not just general training, but specific competencies in data literacy, critical evaluation of AI outputs, and the ability to integrate AI feedback with human instruction. Addressing these challenges is essential to ensure that AI-enhanced CALL fulfils its promise for adult learners.

Challenges and Considerations in Integrating AI into CALL

While the integration of Artificial Intelligence (AI) in Computer-Assisted Language Learning (CALL) offers numerous benefits, it also presents several pedagogical, technical, and ethical challenges that must be addressed to ensure effective and equitable implementation—especially in adult education contexts. These challenges relate to data privacy, algorithmic bias, teacher readiness, accessibility issues, and the evolving balance of roles between teachers, learners, and AI systems.

Data Privacy and Ethical Concerns

AI-driven CALL systems rely heavily on collecting and analyzing large volumes of learner data, including language performance, behavioral patterns, and personal identifiers. This raises concerns about privacy, consent, and security, particularly in online environments. Studies have emphasized the need for transparency in how learner data is stored, processed, and used for algorithmic decision-making (AlAqlobi et al., 2024; Tafazoli, 2023). Without robust governance policies, adult learners—especially those less familiar with digital platforms—may be hesitant to fully engage with AI systems. Mitigation requires more transparent consent processes, encrypted storage, and institution-wide policies on the ethical use of data.

Algorithmic Bias and Content Fairness

AI tools trained in limited or non-diverse language corpora can reproduce biases in grammar correction, vocabulary suggestions, or accent evaluations, potentially disadvantaging learners from specific linguistic or cultural backgrounds. Karataş et al. (2024) caution that unchecked biases may reinforce stereotypes and harm learner confidence. For example, pronunciation engines may penalize regional accents, or essay scorers may undervalue non-Western rhetorical styles. Addressing these issues requires diverse training datasets, regular fairness audits, and the inclusion of culturally varied benchmarks.

Teacher Training and Digital Readiness

Despite the growing availability of AI technologies, many educators lack the technical skills and pedagogical readiness to integrate these tools effectively. As Godwin-Jones (2023) notes, resistance often stems from insufficient exposure during professional development. Teachers need not only general training but also specific competencies, such as data literacy, the ability to critically interpret AI-generated feedback, and strategies for blending automated feedback with

human judgment. Mitigation involves structured professional development, peer-learning communities, and the integration of AI modules into teacher education curricula.

Infrastructure and Accessibility Barriers

Access to reliable internet, modern devices, and platform-specific software remains a challenge, particularly in under-resourced regions. While AI offers scalability, it risks widening the digital divide without parallel investment in infrastructure. Caetano et al. (2024) emphasize the importance of accessibility features—such as multilingual interfaces, text-to-speech capabilities, and offline modes—for promoting inclusivity. Mitigation requires policy-level support, institutional investment in devices and bandwidth, and a design that prioritizes universal access.

Evolving Roles and Collaboration

A frequently overlooked challenge lies in defining the optimal collaboration among teachers, learners, and AI systems. AI can mediate feedback and adapt pacing, but it cannot replace the cultural, ethical, and motivational roles that teachers play. Adult learners particularly benefit from teachers who act as facilitators, guiding them in interpreting AI feedback, setting realistic goals, and maintaining critical awareness of system limitations. Moving forward, compelling CALL will require a partnership model, where AI handles scalability and personalization, teachers provide human mediation and ethical oversight, and learners actively co-direct their learning paths.

Synthesis and Future Research Directions

Addressing these challenges is crucial to ensuring that AI in CALL functions not only as a technological innovation but also as a pedagogically sound and ethically responsible tool. Importantly, these issues are interconnected: teacher readiness affects how bias is managed, infrastructure shapes accessibility, and privacy policies influence learner trust. Future research should move beyond short-term outcomes to explore:

- How can teacher–AI–learner collaboration be structured to maximize learning without overburdening educators?
- What long-term effects do AI-driven CALL systems have on holistic proficiency, beyond targeted skills?
- How can algorithmic bias be detected, measured, and systematically mitigated in multilingual and multicultural contexts?
- What models of professional development best prepare teachers for AI-integrated classrooms in adult education?

By addressing these questions, researchers and practitioners can ensure AI-enhanced CALL evolves responsibly and inclusively.

Future Directions in AI-Enhanced CALL

As Artificial Intelligence (AI) continues to evolve, its potential to reshape language education through Computer-Assisted Language Learning (CALL) is both promising and

expansive. Future developments are expected to focus on greater personalization, immersive technologies, and ethical design frameworks that ensure equitable and learner-centered experiences.

Greater Personalization Through Multimodal AI

Future AI-driven CALL platforms will increasingly incorporate multimodal learning environments, combining speech, text, video, and gesture to create more context-rich, interactive learning experiences (Chen et al., 2025). AI algorithms will better interpret individual learner profiles, offering highly customized feedback and dynamic learning paths that adjust in real-time (Plass & Jones, 2021).

Integration of Immersive Technologies

Emerging technologies such as Augmented Reality (AR), Virtual Reality (VR), and haptic feedback systems are likely to redefine engagement in language learning. For instance, AR applications allow learners to practice vocabulary and communication skills in location-based or task-specific contexts, enhancing retention and cultural immersion (Caetano et al., 2024; Makransky & Mayer, 2022).

Ethical and Inclusive AI Design

As AI adoption accelerates, attention must turn to ensuring transparency, fairness, and inclusiveness in system design. Future CALL systems will need built-in mechanisms to audit for algorithmic bias, protect learner privacy, and promote universal accessibility—particularly for marginalized adult learners (Godwin-Jones, 2023; Tafazoli, 2023).

Conclusion

This study set out to examine how Artificial Intelligence can support Computer-Assisted Language Learning for adult learners. By drawing on Sociocultural Theory, Cognitive Load Theory, and Interactionist perspectives, it has been shown that tools such as Natural Language Processing, Machine Learning, and Intelligent Tutoring Systems can help manage cognitive load, provide scaffolding, and create more opportunities for meaningful practice.

The evidence points to measurable gains in accuracy, fluency, and learner engagement. At the same time, many studies remain short-term and skill-focused, which leaves important questions about long-term impact unanswered. Concerns over bias, data privacy, and uneven teacher readiness also remind us that the success of AI in CALL depends less on the technology itself than on how it is designed and implemented.

To move forward, this paper has proposed a framework that emphasizes inclusivity, pedagogical alignment, teacher competence, and learner agency. Within this model, AI adds scale and efficiency, teachers provide cultural and ethical judgment, and learners play an active role in shaping their progress.

In short, AI holds real promise for adult language education, but its value lies in its thoughtful and ethical use rather than novelty. When educators and learners work without technology, CALL can evolve into a more accessible, responsive, and human-centered practice.

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