



Generative AI in Language Education: a critical framework for pedagogical integration

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Abstract

The rapid development and global accessibility of Generative Artificial Intelligence (GenAI) is profoundly transforming second (L2) and foreign language (FL) education. Scholars refer to this as a "calculator moment" for language teaching. This paper critically examines the dual impact of GenAI on L2 and FL teaching and learning, highlighting both educational opportunities and complex challenges. While GenAI offers adaptive content delivery, immediate feedback, and enhanced accessibility, it also presents risks, including misinformation, bias, and academic integrity concerns. Based on a recent scoping literature review, this paper argues for a balanced, human-centred framework prioritising a constructivist pedagogical approach, ethical use, and inclusivity. The paper calls for collaborative, policy-driven approaches ensuring GenAI enhances rather than diminishes language learning quality and equity.

Keywords: Generative AI, Language Education, Second (L2) and Foreign Language (FL) Teaching and Learning, AI Literacy, Educational Technology, Pedagogical Framework

1. INTRODUCTION

Feuerriegel et al [1] define generative AI (henceforth, GenAI) is defined [1] as computational techniques capable of producing "meaningful content - such as text, images, or audio - from training data".

This novel technology enables personalised, adaptive intelligent tutoring systems, offering dynamic content generation, real-time feedback, and individualised learning pathways. Dickey and Bejarano [2], in a conference paper, go as far as proposing the GAIDE (Generative AI for Instructional Development and Education) framework, highlighting how GenAI can support educators in crafting engaging course content and lesson plans that are grounded in pedagogical theories and prompting strategies while maintaining academic rigour and fostering student engagement.

GenAI is capable of producing novel content because it has been trained on large sets of data. For example, GenAI tools such as ChatGPT (short for Chat Generative Pre-trained Transformer), CoPilot, Google Gemini, Deepseek, Grok and Claude use Large Language Models (LLMs) to both understand and produce human-like text [3].

In education, the literature contends, the emergence of GenAI represents a watershed moment, particularly within language education. Authors, such as Macinska and Vinklers [4] note that this may be apt to the "calculator moment" in mathematics education. These authors argue that, just as calculators fundamentally altered mathematical pedagogy, GenAI tools are reshaping Second and Foreign Language pedagogies' theoretical foundations and practical applications.

This transformation is occurring at an unprecedented pace. Unlike previous educational technologies requiring gradual adoption over years, GenAI tools achieved widespread accessibility within months of public release of ChatGPT in late 2022 [5], [6], [7]. Since then, the academic field has experienced a substantial increase in research activity, presenting both significant opportunities and notable challenges for educators, learners, and institutions globally [8], [9]. The current volume of publications in the field is unparalleled.

GenAI represents a paradigm shift from traditional teaching to learner-centred pedagogies, challenging models often reliant on memorisation, repetitive practice, and standardised assessment. This necessitates, many researchers contend, fundamental reconsideration of learning objectives, pedagogical approaches, and assessment strategies in language education.

However, integration – not only in language teaching and learning, but education in general - remains highly controversial. Concerns about academic integrity, technological dependence, and diminished authentic language production have led to varied institutional responses, from prohibition to enthusiastic adoption. Some papers have even claimed that AI tools are harmful to students [10]. This



polarisation, the surveyed research agrees, underscores the need for nuanced, evidence-based approaches to understanding and implementing GenAI in educational contexts.

Thus, this paper argues that GenAI's impact on language teaching and learning must be understood through a comprehensive framework acknowledging both transformative potential and inherent limitations. Rather than viewing GenAI as a revolutionary solution or fundamental threat, a balanced, constructivist, and thereby human-centred approach prioritising pedagogical integrity, ethical use, and inclusive access is proposed.

While some educational technologists and AI proponents have suggested that generative artificial intelligence could diminish or even replace traditional teaching roles, emerging research demonstrates that teachers remain indispensable orchestrators in AI-integrated educational environments. Rather than displacing educators, generative AI amplifies the teacher's central role as pedagogical architect, ethical guide, and facilitator of meaningful human learning experiences that technology alone cannot provide [11].

2. METHODOLOGY

This study employed a two-phase methodological approach, integrating a scoping review [12], [13] with a critical interpretive synthesis [14].

The scoping review was conducted to map the emerging body of scholarship on generative AI in second and foreign language education. From an initial pool of publications, 46 peer-reviewed papers were identified and analysed. Many of these studies are cited in the reference list. This approach was considered appropriate given the novelty and rapid growth of the field, as it allowed for the inclusion of diverse sources, including empirical studies and conceptual contributions. The review provided a comprehensive overview of current scholarship and enabled the identification of key themes, opportunities, challenges, and gaps relevant to pedagogical integration.

Building on this mapping, a critical interpretive synthesis was undertaken to move beyond description towards critique and theory-building. This process entailed examining underlying assumptions in the literature, reconciling contradictory perspectives such as the positioning of generative AI as both opportunity and risk, and developing a coherent, human-centred pedagogical framework.

Together, these complementary methods offered both a broad survey of the field and a critical, theory-informed synthesis designed to inform pedagogy, policy, and future research.

3. Literature Review

3.1 The Evolution of Technology in Language Education

Technology integration in language education has evolved from early computer-assisted language learning (CALL) systems to modern mobile applications and virtual reality environments [15]. Each advancement brought new possibilities while raising questions about pedagogical effectiveness, authentic language use and ethical use.

Today, GenAI in language education represents a comparable inflection point, potentially shifting emphasis from mechanical language production to critical thinking, cultural competence, and authentic communication skills [4], [16].

3.2 GenAI Capabilities in Language Education

Unlike traditional AI, which mostly classifies or predicts, generative AI is designed to produce outputs that resemble human work. In education, this means learners and educators can use GenAI not only as a tool for retrieving information (as in Google Search) but also as a creative partner for writing, designing, problem-solving, and experimenting with new ideas.

Current GenAI systems demonstrate remarkable proficiency in natural language generation, translation, error correction, and contextual adaptation [17], [18]. They produce coherent multilingual text, explain grammatical concepts, generate practice exercises, and offer personalised feedback [19]. Several of the reviewed studies suggest that generative AI tools are increasingly outperforming traditional machine translation (MT) systems.



3.3 Pedagogical Implications and Theoretical Frameworks

GenAI integration intersects with established theoretical frameworks in second and foreign language acquisition and pedagogy. Social constructivist theories (as proposed by John Dewey, Lev Vygotsky, Jean Piaget, Seymour Papert and Paulo Freire) emphasising collaborative learning and meaningful interaction find both support and challenge in GenAI applications. While these tools facilitate collaborative learning through shared resources and feedback, questions arise about whether human-AI interaction can substitute for authentic human communication in language development.

Task-based language teaching (TBLT) frameworks offer another examination lens [20], [21]. TBLT emphasises authentic, communicative tasks mirroring real-world language use [22], [23]. Recent research demonstrates that GenAI tools can support such approaches by providing authentic texts, facilitating communication practice, and offering immediate task performance feedback (including [24]).

These tools can enhance traditional learning outcomes. However, the challenge lies in ensuring AI-mediated tasks maintain authenticity and communicative purpose, as GenAI tools should complement rather than replace current pedagogical methods [25].

Learner autonomy takes on new dimensions in GenAI contexts. These tools can potentially enhance autonomy by providing 24/7 language support access, personalised learning pathways, and immediate feedback.

4. Opportunities: The Transformative Potential of GenAI

The literature demonstrates substantial consensus regarding the transformative potential of GenAI technologies in language teaching and learning contexts. Research consistently highlights their capacity to deliver highly personalised learning experiences, marking a paradigmatic shift from traditional one-size-fits-all pedagogical approaches. Adaptive systems dynamically adjust to individual learner needs, preferences, and proficiency levels, while providing immediate, personalised feedback on language skills that can significantly enhance learning outcomes [26], [27]. Empirical evidence demonstrates that the personalisation features of AI tools play a crucial role in supporting learners' revision and editing processes, with quantitative studies reporting improvements in reading comprehension, motivation, anxiety reduction, and cognitive load management when compared to control groups. Real-time feedback on grammar, vocabulary, and sentence structure further helps learners expand their lexical repertoire and syntactic range by suggesting alternative word choices and rephrasings. At the same time, research cautions that over-reliance on such automated suggestions may undermine learners' critical thinking skills and independent judgement. Beyond personalisation, GenAI technologies also enhance accessibility and inclusion in language education. Learners with disabilities benefit from alternative interaction modes such as AI-generated infographics for visual learners and speech synthesis or voice interaction features for auditory learners. Furthermore, GenAI helps address geographic and economic barriers by making sophisticated language learning tools accessible to students in remote or underserved areas, thereby democratising access to quality instruction regardless of location or financial circumstances. Another key contribution lies in innovative assessment and feedback mechanisms. Traditional assessment methods often struggle to capture the complexity of language proficiency or reflect authentic communicative contexts. GenAI enables continuous formative assessment by monitoring progress in real time and providing ongoing feedback, while portfolio-based approaches can be enhanced through AI-supported reflection tools that help learners identify developmental patterns and set future goals.

Finally, GenAI contributes to resource efficiency by streamlining the creation of high-quality language learning materials. The automation of practice exercises, reading texts, and assessment items significantly reduces the time and cost traditionally associated with content development, enabling educators to concentrate on more creative and pedagogically sophisticated aspects of their work.



5. Challenges: Navigating the Complexities of AI Integration

5.1 Academic Integrity and Authenticity Concerns

GenAI integration raises fundamental questions about academic integrity and student work authenticity. Traditional plagiarism and cheating concepts become complicated when AI tools generate original text indistinguishable from student-produced work. This challenge is particularly acute in language education, where developing original expression and authentic communication skills is central to learning objectives.

The ease of accessing AI-generated content creates academic dishonesty temptations. Students may use GenAI to complete assignments without engaging in cognitive processes these activities are designed to promote. However, the challenge extends beyond simple cheating to nuanced questions about authentic language production nature in an AI-enabled world.

5.2 Bias, Misinformation, and Cultural Sensitivity

GenAI systems trained on vast datasets inevitably contain biases, stereotypes, and inaccuracies present in human-produced content. When used in language education, they may perpetuate harmful stereotypes, provide culturally insensitive content, or reinforce linguistic hierarchies marginalising certain languages and dialects.

Cultural bias manifests in ways particularly problematic for language education. AI tools may favour certain cultural perspectives, use examples irrelevant to diverse learner populations, or make inappropriate cultural norm assumptions. Linguistic bias presents another significant challenge, with AI systems trained primarily on dominant language variety data struggling with dialectal variations, informal registers, or culturally specific language use patterns.

5.3 Over-dependence and Skill Atrophy

As argued in the foregoing, GenAI tool convenience and effectiveness may create over-reliance and dependence risks potentially undermining essential language skill development. If students become accustomed to AI assistance for writing, translation, or error correction, they may fail to develop independent skills necessary for autonomous language use.

This concern particularly relates to fundamental language skills such as vocabulary acquisition, grammatical competence, and spelling. Excessive AI tool reliance may prevent developing automaticity and fluency characterising skilled language users. The development of metacognitive skills—the ability to monitor and regulate one's own learning—may also be compromised.

5.4 Privacy, Data Security, and Ethical Concerns

GenAI use in educational contexts raises significant privacy and data security concerns. These systems typically require student data access, including written work, personal information, and learning analytics, creating risks related to privacy breaches, unauthorised access, and personal information misuse.

Educational institutions must navigate complex data governance decisions, including questions about data ownership, consent, and students' rights to control personal information. The commercial nature of many GenAI systems raises concerns about education commodification and potential student data use for commercial purposes beyond immediate educational contexts.

6. A Human-Centred Framework for GenAI Integration

Developing a human-centred framework for GenAI integration must begin with clear ethical principles prioritising student welfare, educational integrity, and social justice. The principle of student agency emphasises that AI tools should enhance rather than replace student autonomy and decision-making.

Transparency and explainability represent another fundamental principle. Students and educators should understand how AI systems work, what data they collect, and how they generate outputs. The



principle of pedagogical purposefulness requires that AI integration be driven by clear educational objectives rather than technological novelty.

Hence, successful GenAI integration requires comprehensive GenAI literacy development for both educators and learners. For educators, GenAI literacy involves understanding current GenAI system capabilities and limitations, developing skills for evaluating AI-generated content, and learning to integrate AI tools effectively into pedagogical practice.

For learners, GenAI literacy involves developing an understanding of how AI systems work, learning to evaluate AI-generated content critically, and developing strategies for using AI tools to support rather than replace learning. Critical evaluation skills are essential for both educators and learners, including the ability to assess AI-generated content accuracy, appropriateness, and cultural sensitivity.

GenAI integration also necessitates fundamental assessment practice reconsideration. Traditional assessment methods relying heavily on controlled, timed writing tasks or isolated grammar exercises may become less relevant when AI tools are readily available for language support. Instead, assessment should focus on skills remaining uniquely human and the ability to use AI tools effectively and ethically.

Authentic assessment practices should emphasise real-world language use contexts where AI tools are naturally integrated. Process-focused assessment can provide insights into student learning not captured by traditional product-focused approaches. Metacognitive assessment strategies can help students develop awareness of their own learning processes and AI tool use.

7. Implications for Practice and Future Directions

7.1 Classroom Implementation and Curriculum Development

Practical GenAI implementation requires thoughtful planning and gradual integration, allowing educators and students to develop familiarity while maintaining focus on learning objectives. Scaffolded introduction of AI tools can help students develop appropriate use patterns and avoid over-reliance.

Curriculum development for AI-integrated language education must balance technological innovation with established pedagogical principles. Task-based learning approaches can be enhanced through AI integration providing authentic contexts for language use, while cross-curricular connections help students understand broader AI technology implications.

7.2 Professional Development and Policy

GenAI integration requires comprehensive teacher preparation and ongoing professional development addressing both technical skills and pedagogical applications. Pre-service teacher preparation should include hands-on AI tool experience, educational application exploration, and ethical consideration discussion.

Educational institutions must develop comprehensive policies and infrastructure supporting effective and ethical AI integration. These policies should address academic integrity, data privacy, accessibility, and professional development while providing clear guidance for educators and students.

7.3 Limitations and Research Priorities

This review identifies distinct areas where GenAI shows notable promise: supplying instantaneous, detailed writing assessment, creating realistic content for reading and listening practice, and adjusting communicative approaches to match student ability levels while providing customised educational support. However, the literature also reveals significant challenges [28].

Despite growing interest in GenAI for language education, the dynamic relationships between learner variables, technological design, pedagogical implementation, and contextual conditions determining learning outcomes remain understudied and, in the opinion of this author, and other scholars (such as Zhang and Dong [29]), poorly understood.



The integration of GenAI into language education opens numerous research avenues informing evidence-based practice and policy development. Priority areas include learning outcome studies, ethical and social implication investigations, and innovative pedagogical approach exploration.

Learning outcome research should examine AI-integrated instruction effectiveness compared to traditional approaches across various contexts and populations. Longitudinal studies are needed to understand long-term AI integration effects on language learning and development.

In this review and other studies [30] (including much of the empirical research) predominantly focused on the use of GenAI in EFL contexts and within higher education settings, with systematic reviews revealing that writing emerged as the primary focus while speaking, listening, and reading skills received comparatively less attention. This narrow emphasis limits the generalisability of findings and neglects the pedagogical opportunities GenAI might offer for teaching other languages beyond English across diverse educational levels.

To broaden the relevance and reach of research, it would be therefore beneficial to also examine the role of GenAI in supporting the teaching of other languages (e.g., Italian, Spanish, or French) across different educational levels, including primary and secondary education [31].

8. Conclusion

The empirical research confirms that language teachers are already using GenAI to create reading materials, listening exercises, and conversation prompts matching learners' interests, cultural backgrounds, and proficiency levels. This personalisation increases motivation and engagement by making learning materials more relevant and accessible. The scalability of personalised instruction addresses critical challenges in providing individualised attention in large classes or resource-constrained environments [32], [33].

GenAI integration into language education represents both a significant opportunity and a complex challenge requiring thoughtful, evidence-based approaches. The challenges are equally significant, requiring careful consideration. Academic integrity concerns, bias and misinformation, over-dependence, and privacy represent serious risks demanding comprehensive policies, continuous professional development, and ethical guidelines.

The human-centred framework proposed emphasises maintaining focus on human agency, educational integrity, and social justice while leveraging AI technology benefits. The proposed framework recognises that AI tools should augment rather than replace human educators, with language education goals remaining the development of skilled, autonomous, and culturally competent language users.

Successful GenAI integration in language teaching and learning requires collaborative effort among educators, students, administrators, policymakers, and technology developers. This collaboration must be grounded in clear ethical principles, informed by empirical research, and responsive to diverse learner and community needs.

The metaphor of a "calculator moment" in 2L and FL language teaching and learning, provides a compelling framework for understanding the current GenAI disruption, as it encapsulates not merely the technological transformation itself but, more significantly, the pedagogical opportunity to realign educational priorities toward the development of higher-order thinking skills and the cultivation of authentic learning experiences.

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