International Journal of Modern Education
EISSN: 2637-0905
IJMOE
Volume 7 Issue 24 (March 2025) PP. 233-256
DOI: 10.35631/IJMOE.724016

INTERNATIONAL JOURNAL OF MODERN EDUCATION (IJMOE)
www.ijmoe.com

GLOBAL ACADEMIC EXCELLENCE

BRIDGING LANGUAGE LEARNING AND AI TECHNOLOGIES IN HIGHER EDUCATION: INSIGHTS FROM A COMPREHENSIVE LITERATURE REVIEW

Nadira M. Jahaya[*1], Fatin Rahaina Ahmad Sani[2], Siti Mukhlisa Mohamad Khairul Adilah[3], Muhammad Khairul Zharif Nor A'zam[4]

[1] Academy of Language Studies, Universiti Teknologi Mara (UiTM) Kedah Branch, Malaysia
Email: nadirajahaya@uitm.edu.my
[2] Academy of Language Studies, Universiti Teknologi Mara (UiTM) Kedah Branch, Malaysia
Email: fatinrahaina@uitm.edu.my
[3] Academy of Language Studies, Universiti Teknologi Mara (UiTM) Kedah Branch, Malaysia
Email: sitimukhlisa@uitm.edu.my
[4] College of Computing, Informatics and Mathematics, Universiti Teknologi Mara (UiTM) Kedah Branch, Malaysia
Email: khairulzharif@uitm.edu.my
[*] Corresponding Author

Article Info:

Article history:
Received date: 05.01.2025
Revised date: 18.01.2025
Accepted date: 25.02.2025
Published date: 10.03.2025

To cite this document:

Jahaya, N. M., Sani, F. R. A., Adilah, S. M. M. K., & A'zam, M. K. Z. N. (2025). Bridging Language Learning And Ai Technologies In Higher Education: Insights From A Comprehensive Literature Review. *International Journal of Modern Education, 7* (24), 233-256.

DOI: 10.35631/IJMOE.724016

Abstract:

The vast incorporation of Artificial Intelligence (AI) into higher education, particularly in language classes, has resulted to enthusiasm and challenges. While AI technologies such as Natural Language Processing (NLP), Intelligent Tutoring Systems (ITS), and automated feedback mechanisms have transformative potential, their implementation faces substantial obstacles, including technical infrastructure issues, ethical concerns, and pedagogical limitations, particularly in resource-constrained regions of the Global South. This exploration aims to highlight a comprehensive review of the current state, advantages, challenges, and future directions of AI in language learning within higher education. Through a comprehensive analysis of existing literature, the study identifies key findings: AI tools have significantly enhanced learning outcomes by offering personalized, adaptive, and interactive experiences, improving pronunciation, vocabulary acquisition, and communication skills while positively influencing affective factors such as motivation and reduced anxiety. However, challenges such as algorithmic biases, over-reliance on technology, and inequitable access highlight the need for robust frameworks to guide ethical and effective AI integration. The study's findings are far-reaching, with concrete recommendations for educators, politicians, and developers looking to establish inclusive and sustainable AI-enhanced language learning settings. Educators are encouraged to find a middle ground

International Journal of Modern Education
EISSN: 2637-0905
IJMOE
Volume 7 Issue 24 (March 2025) PP. 233-256
DOI: 10.35631/IJMOE.724016

between technology and human interaction, while governments should prioritize infrastructure and regulatory frameworks. Developers are urged to design culturally sensitive and resilient AI systems. Despite its contributions, the study acknowledges limitations, such as the lack of longitudinal data and underrepresentation of diverse contexts. Future research should focus on longitudinal studies, adversarial machine learning, and inclusive investigations to address these gaps. This study underscores the progressive influence of AI in language learning, while emphasizing the importance of addressing technical, ethical, and pedagogical barriers to ensure equitable access and sustained impact.

Keywords:

AI, AML, ITS, Language Learning, NLP, Personalized Learning

Introduction

The rapid advancement of Artificial Intelligence (AI) has significantly influenced various domains, including education. AI-driven technologies have revolutionized teaching and learning methodologies, particularly in higher education, by enhancing personalized learning, adaptive assessment, and interactive engagement (Chandra et al., 2024; Matthews, 2024). Within the area of language education, AI applications such as Natural Language Processing (NLP), Intelligent Tutoring Systems (ITS), and automated feedback mechanisms have played a pivotal role in facilitating effective language acquisition and learner engagement (Sukumaran & Khair, 2024). As higher education institutions embrace digital transformation, AI's integration into language learning presents both promising opportunities and formidable challenges that require in-depth exploration.

As English continues to serve as a global language, the growing demand for proficiency in it has further driven the utilization of AI in language education. Tools such as voice recognition software, chatbots, and virtual reality (VR)-based learning environments enable students to receive personalized feedback, engage in immersive learning experiences, and develop linguistic competencies in real time (Cai et al., 2020; Shi, 2025). Despite its potential, AI integration in language learning necessitates addressing challenges related to pedagogical adaptation, ethical concerns, and infrastructural constraints (Rong et al., 2023). While earlier studies highlight AI's contributions to language learning, there is a need to critically examine its broader implications within higher education institutions (Wei, 2023).

A statistical overview (Table 1) highlights disparities in AI adoption across global regions, emphasizing the digital divide and underscoring the urgency of equitable solutions:

International Journal of Modern Education
EISSN: 2637-0905
IJMOE
Volume 7 Issue 24 (March 2025) PP. 233-256
DOI: 10.35631/IJMOE.724016

Table 1. Regional Disparities in AI Adoption for Language Learning

Region	AI Adoption Rate (%)	Access to Infrastructure	Key Challenges
North America	85	High	Ethical concerns, over-reliance
Europe	78	High	Data privacy, algorithmic bias
Asia-Pacific	60	Moderate	Inadequate training, cultural sensitivity
Global South	30	Low	Limited infrastructure, funding gaps

Source: Data synthesized from Rong et al. (2023), AlTwijri and Alghizzi (2024), Bělohlávek et al. (2019), Ke et al. (2022), Chua et al. (2021), Martínez and Hunt Gómez (2020), and Makeleni et al. (2023)

In addition, significant challenges in the application of AI in language teaching encompass issues such as accessibility, digital literacy among educators, and concerns regarding over-reliance on technology (Mohebbi, 2025; Binu, 2024). Moreover, ethical dilemmas such as algorithmic bias, data privacy, and disparities in AI accessibility pose barriers to equitable language learning opportunities (AlTwijri & Alghizzi, 2024). Furthermore, the effectiveness of AI-enhanced language learning tools in diverse educational settings, particularly in the Global South, remains underexplored (Makeleni et al., 2023). These issues underscore the necessity for a comprehensive review of AI's role in language learning to provide insights into its benefits, limitations, and future directions.

Existing research has extensively examined AI's impact on educational outcomes. Studies indicate that AI-driven language learning tools enhance motivation, engagement, and pronunciation accuracy among learners (Al-Shaikh & M.A.I., 2024; Mohebbi, 2025). Additionally, AI applications have been instrumental in reducing learning anxiety and improving learner autonomy (AlTwijri & Alghizzi, 2024). However, despite these positive outcomes, the pedagogical integration of AI in higher education remains inconsistent, with some institutions struggling to incorporate AI tools effectively within traditional teaching frameworks (Cai et al., 2020; Rong et al., 2023). While previous studies have addressed AI's effectiveness, there remains a gap in understanding how these technologies can be optimized to cater to diverse learning needs and institutional settings (Qiao & Zhao, 2023).

Moreover, significant gaps persist in the research surrounding AI's role in language education. For instance, there is insufficient exploration of AI's scalability, long-term impact on learning outcomes, and compatibility with established pedagogical approaches (Sukumaran & Khair,

International Journal of Modern Education
IJMOE
EISSN: 2637-0905
Volume 7 Issue 24 (March 2025) PP. 233-256
DOI: 10.35631/IJMOE.724016

2024). Much of the existing literature focuses on the technical aspects of AI, such as its algorithms and functionalities, rather than its practical integration into structured curricula or its implications for educators' roles. Additionally, empirical research on AI adoption in non-Western educational settings remains scarce, especially in areas with infrastructural constraints (Makeleni et al., 2023). Addressing these gaps is essential to develop a comprehensive understanding of AI's potential in language education and guiding its effective implementation across diverse contexts. By bridging these research gaps, educators and policymakers can better leverage AI to create inclusive, sustainable, and impactful learning environments.

This literature review aims to:

1. To review the current state of AI applications in language learning within higher education.
2. To review the benefits and challenges associated with AI integration in language education.
3. To examine the connection of key themes such as instructional effectiveness, curriculum development, longitudinal analysis and adversarial machine learning

This paper adds to the expanded discussion on artificial intelligence in education by providing a thorough investigation of how it affects language acquisition in higher education. It offers insights for educators, policymakers, and researchers on optimizing AI tools to enhance language acquisition while addressing related challenges. By examining AI's potential and limitations, this review seeks to guide institutions in effectively implementing AI-driven language learning strategies that balance technological innovation with pedagogical soundness.

This study is organized into three main sections. Section 2 describes the literature review for this study and section 3 discusses on the methodology by focusing on the comprehensive literature review approach and the utilization of Scopus AI to analyse peer-reviewed studies related to AI applications in language learning within higher education. Section 4 presents the results and discussion that align with the research objectives by reviewing the current state of AI applications, exploring the benefits and challenges of AI integration, and examining key themes such as instructional effectiveness, curriculum development, longitudinal analysis, and adversarial machine learning. Finally, section 5 offers recommendations and future directions, highlighting the importance of equitable access, robust frameworks, and longitudinal studies to ensure the sustainable and effective implementation of AI in language education.

Literature Review

The integration of Artificial Intelligence (AI) into language learning has emerged as a transformative force in higher education, reshaping traditional teaching methods and fostering innovative learning environments. This literature review synthesizes findings from recent studies to provide a comprehensive overview of AI applications in language education that focused on their benefits, challenges, and theoretical foundations. By examining these aspects, the review aligns with the present study's objectives and highlights key insights from the literature. For instance, Chandra et al. (2024) emphasize how AI tools like Natural Language Processing (NLP) and Intelligent Tutoring Systems (ITS) enhance personalized learning and improve pronunciation accuracy. Similarly, Mohebbi (2025) underscores AI's role in fostering learner autonomy by providing adaptive feedback and self-regulated learning opportunities. Meanwhile, Shao et al. (2022) demonstrate that AI-driven tools not only improve speaking

International Journal of Modern Education
IJMOE
EISSN: 2637-0905
Volume 7 Issue 24 (March 2025) PP. 233-256
DOI: 10.35631/IJMOE.724016

skills but also help learners regulate their emotions during the learning process. However, challenges remain. Makeleni et al. (2023) point out that limited infrastructure and funding hinder equitable access to AI technologies in under-resourced regions, particularly in the Global South. Rong et al. (2023) identify ethical concerns, algorithmic bias, and pedagogical misalignment as significant barriers to AI adoption. AlTwijri and Alghizzi (2024) further highlight that while AI enhances affective factors like motivation, it raises ethical dilemmas about data privacy. Additionally, Ke et al. (2022) explore how adversarial machine learning can mitigate biases and improve the robustness of AI systems, ensuring they are reliable and equitable.

To better understand AI's role in language education, several theoretical frameworks have been proposed in prior research. These frameworks provide a foundation for analyzing instructional effectiveness, learner agency, and curriculum development. Technology-enhanced learning theory is one such framework, emphasizing AI's ability to create adaptive and personalized learning environments (Chandra et al., 2024; Mohebbi, 2025). Platforms like Duolingo and Rosetta Stone leverage AI algorithms to dynamically adapt content, enhancing learner engagement and outcomes (Makeleni et al., 2023). Another critical lens is self-regulated learning (SRL), which explains how AI supports learner autonomy. Mohebbi (2025) highlights that AI-driven recommendation systems enable students to take charge of their learning journeys by suggesting materials tailored to their individual strengths and weaknesses. This aligns with SRL principles such as goal-setting, self-monitoring, and reflection. Matthews (2024) introduces a flat ontology perspective, arguing that learner agency emerges from interactions between human and non-human agents, such as AI tools. This framework underscores the dual role of AI as both an enabler and a potential barrier to learner autonomy, depending on how it is integrated into educational practices. Barrot (2022) further explores the concept of Language Curriculum 5.0 (LC5), which advocates for dynamic and adaptive curricula that respond to societal and economic demands. AI tools, such as smart platforms and interactive applications, align with LC5 principles by enabling real-time adjustments to teaching strategies and content delivery (Chua et al., 2021).

Building on these theoretical foundations, the present study adopts a hybrid theoretical framework that integrates technology-enhanced learning theory, self-regulated learning (SRL), and flat ontology to analyze AI's role in language education. This framework addresses three key dimensions: instructional effectiveness, learner agency and autonomy, and equitable access and ethical considerations. Drawing on technology-enhanced learning theory, the study examines how AI tools like NLP, ITS, and automated feedback mechanisms improve learning outcomes. For example, AI-driven platforms provide real-time feedback, enabling students to correct errors and refine their language skills (Shao et al., 2022). Using the SRL framework, the study evaluates how AI fosters learner independence by promoting self-directed learning. Tools like chatbots and voice recognition software encourage students to practice language skills autonomously, reducing reliance on traditional classroom settings (Mohebbi, 2025). Through the lens of flat ontology, the study investigates the interplay between AI tools and learner agency, addressing ethical concerns such as algorithmic bias and data privacy (AlTwijri & Alghizzi, 2024). This perspective ensures that AI integration respects diverse learner contexts while minimizing potential harms, thereby fostering inclusivity and equity.

International Journal of Modern Education
IJMOE
EISSN: 2637-0905
Volume 7 Issue 24 (March 2025) PP. 233-256
DOI: 10.35631/IJMOE.724016

To ensure the literature review reflects the most recent advancements, studies from 2020–2025 are incorporated. Wei (2023) highlights the positive impact of AI-driven tools on English learning achievement, L2 motivation, and self-regulated learning in Chinese EFL contexts. Guo et al. (2024) explore the role of adversarial machine learning in enhancing the robustness of AI systems used in language education, ensuring reliability against potential threats. Binu (2024) critically analyzes the affordances and challenges of integrating AI into English language education, emphasizing the need for culturally sensitive designs. Adlin Jerusha and Rajakumari (2024) advocate for longitudinal studies to evaluate the sustained impact of AI on language acquisition and learner autonomy over time. Collectively, this literature review underscores the transformative potential of AI in language learning, supported by robust theoretical frameworks and empirical evidence. By synthesizing findings from recent studies and aligning them with the present study's hybrid theoretical framework, this review provides a solid foundation for addressing the research objectives.

Methodology

This study utilizes Scopus AI's advanced features to ensure a comprehensive and methodologically sound assessment which enables a systematic and data-driven approach to achieve the specified objectives. The selection of Scopus as the primary database is grounded in its extensive coverage of peer-reviewed literature across diverse disciplines, making it an ideal platform for synthesizing research on AI applications in language learning within higher education (Saha et al., 2023). The methodology is structured into three key phases: data collection, data screening, and thematic analysis, each designed to rigorously address the study's objectives. These phases are interconnected, with challenges at each stage requiring careful management to maintain coherence and methodological integrity.

Managing large datasets in a systematic review presents significant challenges, particularly when dealing with interdisciplinary topics like AI in language education. To address these challenges, this study employed Scopus AI's robust data management capabilities, which streamlined the organization, storage, and retrieval of bibliographic records. A major challenge was ensuring that all relevant studies were captured while avoiding redundancy or exclusion of critical works. To mitigate this, the dataset was meticulously curated using deduplication tools and customized filters to exclude irrelevant or low-quality sources. Additionally, NVivo software facilitated the organization of qualitative data during thematic coding, ensuring consistency and reducing errors in data handling. These efforts laid the foundation for effective data collection by creating a well-structured and manageable dataset.

To achieve the study's objectives, Scopus AI was utilized, combining natural language processing (NLP) and keyword-based search strategies to maximize the breadth and depth of the literature review. The natural language query, "What are the insights from a comprehensive literature review on bridging language learning and AI technologies in higher education?" was employed to capture a broad spectrum of literature. This was supplemented with a keyword search using terms such as ("language learning" OR "language acquisition") AND ("artificial intelligence" OR "AI") AND ("higher education" OR "tertiary education") AND ("technology integration" OR "digital tools"). This dual approach ensured comprehensive coverage of literature addressing the research objectives. However, managing the sheer volume of retrieved records approximately 500 initial records posed a significant challenge, necessitating careful refinement to ensure relevance and quality. This phase set the stage for the subsequent screening process by narrowing the dataset to high-quality, pertinent studies.

International Journal of Modern Education
IJMOE
EISSN: 2637-0905
Volume 7 Issue 24 (March 2025) PP. 233-256
DOI: 10.35631/IJMOE.724016

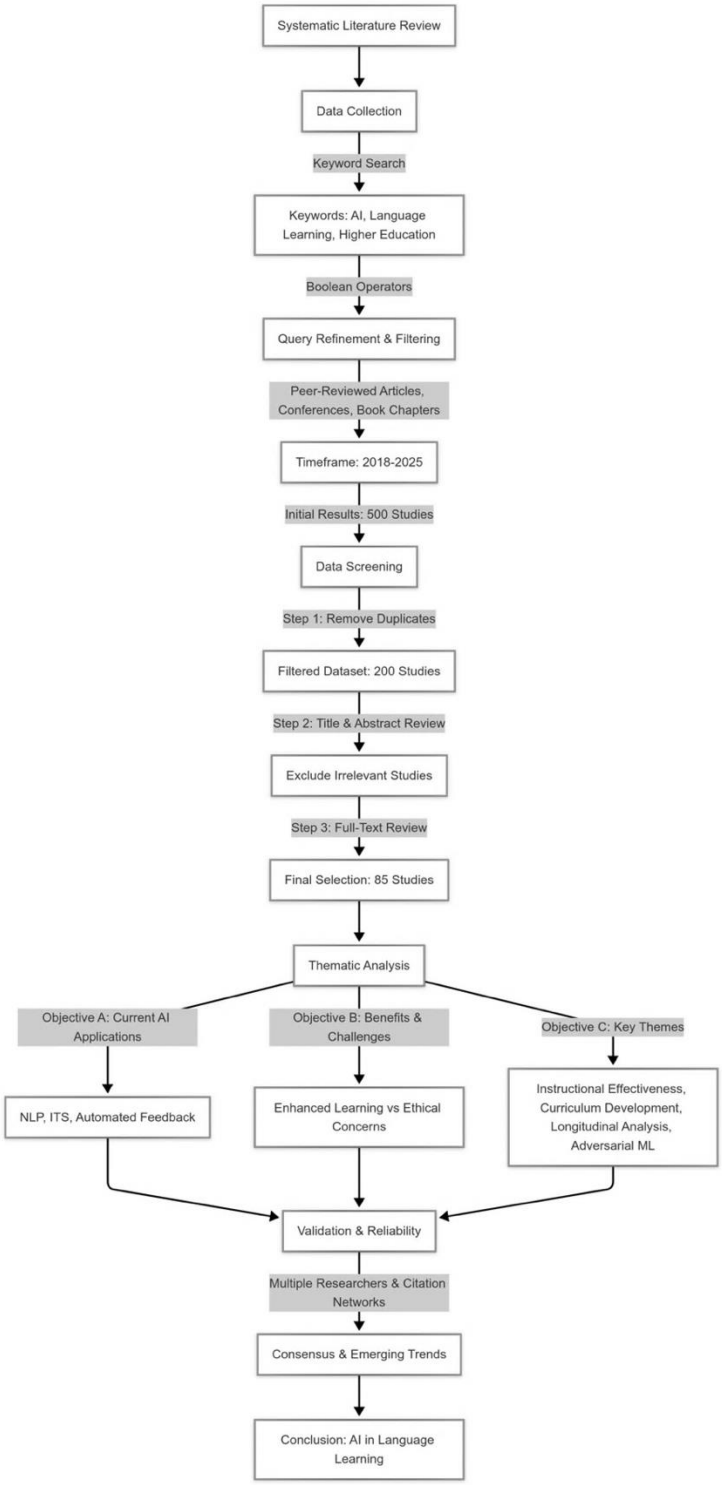

Figure 1: Flowchart Of Research Methodology

The initial phase involved identifying relevant studies using a predefined search strategy. Keywords such as "Artificial Intelligence," "language learning," "higher education," "instructional effectiveness," "curriculum development," and "adversarial machine learning" were combined using Boolean operators to construct a comprehensive search query. For instance, the query "AI AND language learning AND higher education" was refined with

International Journal of Modern Education
IJMOE
EISSN: 2637-0905
Volume 7 Issue 24 (March 2025) PP. 233-256
DOI: 10.35631/IJMOE.724016

additional filters to include only peer-reviewed articles, conference papers, and book chapters published between 2018 and 2025. This timeframe ensures that the review captures recent advancements while maintaining relevance to contemporary educational practices (AlTwijri & Alghizzi, 2024). The search yielded approximately 500 records, which were exported for further screening.

In the second phase, the dataset was refined through a two-step screening process to address challenges related to data quality and relevance. First, duplicate records were removed, and titles and abstracts were reviewed to exclude studies that did not directly address AI applications in language learning or higher education. Articles failing to meet predefined inclusion criteria were excluded, reducing the dataset to 200 studies. Next, full-text reviews were conducted to ensure alignment with the study's objectives. Studies were included if they examined the current state of AI applications, explored the benefits and challenges of AI integration, or discussed key themes such as instructional effectiveness, curriculum development, longitudinal analysis, or adversarial machine learning (Rong et al., 2023). After this rigorous screening, 85 studies remained for detailed analysis. A notable challenge during this phase was ensuring inter-rater reliability among researchers conducting the screening, which was addressed through regular calibration meetings and consensus-building exercises. This meticulous process ensured that only high-quality, relevant studies were retained for thematic analysis.

The final phase involved conducting a thematic analysis to synthesize findings and systematically address the study's objectives. Thematic coding was performed using NVivo software, with codes grouped into broader categories based on recurring patterns and insights. For the first objective, the review identified the current state of AI applications and highlight tools like natural language processing (NLP), intelligent tutoring systems (ITS), and automated feedback mechanisms as prominent examples (Chandra et al., 2024). For the second objective, the benefits of AI integration such as enhanced learning outcomes, personalized learning experiences, and improvements in affective factors like motivation and engagement were contrasted with challenges like technical infrastructure issues, ethical concerns, and pedagogical barriers (Mohebbi, 2025). Finally, for the third objective, the connections between key themes were explored. Instructional effectiveness was linked to AI's ability to provide real-time feedback and adaptive learning pathways (Shao et al., 2022). Curriculum development was examined in terms of integrating AI tools into existing frameworks, while longitudinal analysis revealed the need for sustained research to evaluate long-term impacts (Makeleni et al., 2023). Adversarial machine learning emerged as a critical area requiring attention to mitigate biases and ensure equitable access (Rong et al., 2023). A key challenge in data analysis was balancing the depth of qualitative insights with the scalability of quantitative findings. To address this, the study employed mixed-methods techniques, combining quantitative measures of citation networks and publication trends with qualitative insights from thematic coding. This hybrid approach provided a more nuanced understanding of the data while maintaining methodological rigor.

To ensure the reliability and validity of the findings, multiple researchers independently coded the selected studies and resolved discrepancies through consensus. The use of Scopus AI also played a key role in identifying citation networks and emerging trends, adding depth and breadth to the analysis (Saha et al., 2023). Diverse document types such as journal articles, conference papers, and book chapters were included to further strengthen the study's

International Journal of Modern Education
IJMOE
EISSN: 2637-0905
Volume 7 Issue 24 (March 2025) PP. 233-256
DOI: 10.35631/IJMOE.724016

methodological rigor. This comprehensive approach ensured that the study's findings were both robust and reflective of the current state of AI applications in language learning within higher education.

In summary, this systematic review leverages Scopus AI to provide a thorough examination of AI applications in language learning within higher education. By addressing the study's objectives through a structured and transparent methodology, this research offers valuable insights into the current state, benefits, challenges, and future directions of AI integration in language education.

Result and Discussion

This section presents the findings of the study in alignment with the research objectives and explores their broader implications. Employing a systematic and data-driven approach, the results integrate both quantitative analysis and qualitative insights, ensuring a comprehensive understanding of the subject. The discussion contextualizes these findings within the existing body of literature, shedding light on key themes, emerging trends, persistent challenges, and viable strategies for improvement. Through this analysis, the study offers a deeper perspective on the transformative role of Artificial Intelligence (AI) in enhancing language learning within higher education. This comprehensive literature also highlights AI's impact on instructional effectiveness, curriculum innovation, longitudinal learning outcomes, and adversarial machine learning. The discussion also illustrates AI's potential to address critical issues such as learner autonomy, equitable access, and the integration of technology into traditional pedagogical frameworks. Besides, to ensure sustainable and inclusive educational transformation, the ethical and technical challenges were addressed.

To Review The Current State Of AI Applications In Language Learning Within Higher Education.

The integration of Artificial Intelligence (AI) into language learning within higher education has gained significant traction, with a variety of AI-driven solutions enhancing both instructional delivery and student engagement. Recent advancements in AI applications have led to the development of intelligent tutoring systems (ITS), natural language processing (NLP)-based tools, automated assessment platforms, and adaptive learning systems. These innovations contribute to more personalized and efficient learning experiences and specialized to cater the individual needs of each learner (Chandra et al., 2024). For instance, AI-powered chatbots and voice assistants embedded in language learning applications facilitate real-time interaction and pronunciation practice. With these advance features, it offers instant corrective feedback to learners (Sukumaran & Khair, 2024). Moreover, AI-based language models like OpenAI's ChatGPT and Google's BERT enable students to engage in meaningful conversations by improving their communicative competence in English and other target languages (Mohebbi, 2025).

In addition, one of the most impactful areas of AI implementation in higher education is automated assessment and feedback. Intelligent assessment tools powered by NLP algorithms evaluate students' written and spoken responses with remarkable accuracy, providing detailed feedback on grammatical errors, vocabulary use, coherence, and pronunciation (Cai et al., 2020). Platforms such as Grammarly and ELSA Speak have demonstrated measurable improvements in students' writing and speaking proficiency by delivering instant, AI-driven corrections (Al-Shallakh, 2024). Similarly, AI-driven plagiarism detection systems like

International Journal of Modern Education
IJMOE
EISSN: 2637-0905
Volume 7 Issue 24 (March 2025) PP. 233-256
DOI: 10.35631/IJMOE.724016

Turnitin help maintain academic integrity by analysing textual similarities across vast databases. While these technologies enhance learning efficiency, they also raise concerns about over-reliance on automated feedback, which could potentially diminish students' critical thinking skills in language production (Rong et al., 2023).

Another significant trend is the integration of personalized and adaptive learning mechanisms that function to tailor language instruction to individual learners' proficiency levels, cognitive styles, and preferences (Shao et al., 2022). AI-powered adaptive learning platforms use machine learning algorithms to analyse students' performance and adjust lesson difficulty accordingly. For example, personalized learning environments like Duolingo and Rosetta Stone continuously adapt content to match learners' progress and create an engaging and efficient language acquisition process (Makeleni et al., 2023). Furthermore, to foster learners' self-directed and autonomous learning experiences, AI-driven recommendation systems was developed to suggest learning materials based on students' strengths and weaknesses, (Mohebbi, 2025). Despite these benefits, educators and researchers emphasize the importance of addressing ethical considerations, such as data privacy and potential biases in AI-driven personalization, to ensure equitable and responsible use of these technologies (Saha et al, 2023).

Meanwhile, the use of AI in virtual and augmented reality (VR/AR) environments represents a rapidly evolving domain in language learning. AI-enhanced VR/AR applications create immersive language experiences that simulate real-world conversations, allowing students to practice in authentic communicative contexts without physical limitations (Cai et al., 2020). These technologies facilitate experiential learning by enabling students to interact with virtual characters, engage in role-playing scenarios, and develop cultural competence alongside linguistic proficiency (AlTwijri & Alghizzi, 2024). AI-driven VR platforms have shown promising results in increasing learners' motivation, reducing language anxiety, and enhancing retention rates (Sukumaran & Khair, 2024). However, challenges such as high implementation costs, accessibility issues, and the need for specialized training hinder widespread adoption in higher education institutions (Rong et al., 2023).

In summary, the current state of AI applications in language learning within higher education demonstrates remarkable potential in enhancing instructional effectiveness, assessment efficiency, and personalized learning experiences. AI-driven tools such as ITS, NLP-based applications, adaptive learning platforms, and immersive VR/AR technologies have significantly transformed the traditional language learning landscape (Chandra et al., 2024). However, the adoption of AI in language education requires careful consideration of ethical, pedagogical, and technical challenges to maximize its benefits. Future research should focus on longitudinal studies evaluating the long-term impact of AI on students' language acquisition and cognitive development while addressing the digital divide to ensure equitable access to AI-enhanced learning opportunities (Mohebbi, 2025).

To Review The Benefits And Challenges Associated With AI Integration In Language Education

The integration of Artificial Intelligence (AI) in language education has demonstrated significant benefits, particularly in enhancing learning outcomes. AI-powered tools such as natural language processing (NLP), intelligent tutoring systems (ITS), and automated feedback mechanisms have upgraded the way students acquire language skills. For instance, applications

International Journal of Modern Education
IJMOE
EISSN: 2637-0905
Volume 7 Issue 24 (March 2025) PP. 233-256
DOI: 10.35631/IJMOE.724016

like Elsa Speak have been shown to improve pronunciation accuracy among English Foreign Language Learners (EFLL), enabling learners to achieve measurable progress in their spoken language abilities (Al-Shallakh, 2024). Similarly, adaptive learning platforms leverage machine learning algorithms to tailor instruction to individual needs which it ensures learners receive personalized content that aligns with their proficiency levels (Mohebbi, 2025). These advancements not only enhance the efficiency of language learning but also empower students to take ownership of their educational journeys, nurturing greater learner autonomy and engagement.

Another notable benefit of AI integration is its positive impact on affective factors such as motivation, engagement, and anxiety reduction. Studies have shown that AI-driven tools can create supportive and interactive learning environments that alleviate the stress that associated with language acquisition (AlTwijri & Alghizzi, 2024). For example, chatbots and virtual assistants provide real-time feedback and encouragement that can help learners build confidence in their communication skills (Sukumaran & Khair, 2024). Additionally, immersive technologies like virtual reality (VR) enable students to practice language skills in low-stakes, simulated scenarios (Cai et al., 2020). By addressing these affective dimensions, AI contributes to a more inclusive and supportive learning experience, specifically for students who may struggle with traditional classroom settings.

Despite its benefits, the integration of AI in language education faces significant challenges, particularly concerning technical infrastructure and accessibility. Limited access to AI systems, especially in economically challenged regions, remains a major barrier to widespread adoption (Makeleni et al., 2023). For instance, many institutions in the global South lack the necessary hardware, software, and internet connectivity required to implement AI tools effectively. Furthermore, data privacy and security concerns pose additional risks, as the collection and analysis of learner data raise ethical questions about how this information is stored and used (Rong et al., 2023). These challenges highlight the need for solid infrastructure and clear regulatory frameworks to ensure equitable access to AI technologies across diverse educational contexts.

Ethical and pedagogical concerns represent another critical challenge in AI integration. Algorithmic biases in AI systems can perpetuate inequalities by favouring certain linguistic or cultural norms over others, potentially marginalizing non-native speakers or minority groups (Mohebbi, 2025). Moreover, the risk of over-reliance on AI tools threatens to undermine the role of human instructors, who play a vital role in fostering critical thinking, creativity, and interpersonal skills (Rong et al., 2023). To address these concerns, educators require training to effectively integrate AI into their teaching practices while maintaining a balance between technology and human interaction. Policymakers must also establish guidelines to ensure that AI tools are used ethically and responsibly, prioritizing the needs of learners and educators alike.

Looking ahead, overcoming the challenges associated with AI integration will require a collaborative effort among educators, policymakers, and developers. Blended learning models, which combine AI capabilities with traditional instructor-led teaching, offer a promising solution to optimize learning outcomes while preserving the human element in education (Kularbphettong et al., 2024). Additionally, longitudinal studies are needed to assess the long-term impact of AI on language learning, particularly in terms of retention rates and affective

International Journal of Modern Education
EISSN: 2637-0905
IJMOE
Volume 7 Issue 24 (March 2025) PP. 233-256
DOI: 10.35631/IJMOE.724016

factors (AlTwijri & Alghizzi, 2024). Policymakers and institutions must also prioritize investments in infrastructure and educator training to ensure that AI tools are accessible and effectively utilized (Saha et al., 2023). By addressing these challenges, stakeholders can unlock the full potential of AI to transform language education in higher education settings.

To Examine The Connection Of Key Themes Such As Instructional Effectiveness, Curriculum Development, Longitudinal Analysis And Adversarial Machine Learning

The graph illustrates the interconnected themes in AI-driven language education, emphasizing the relationship between language education innovation and AI-enhanced language learning with key pedagogical and analytical aspects. It highlights four primary dimensions; instructional effectiveness, curriculum development, longitudinal analysis, and adversarial machine learning which each linked to critical subthemes such as traditional learning, learners' perceptions, individualized development, and student progress. The visualization underscores how AI shapes language learning by improving instructional strategies, refining curricula, enabling long-term educational assessments, and addressing challenges in adversarial machine learning to ensure equitable and effective learning experiences.

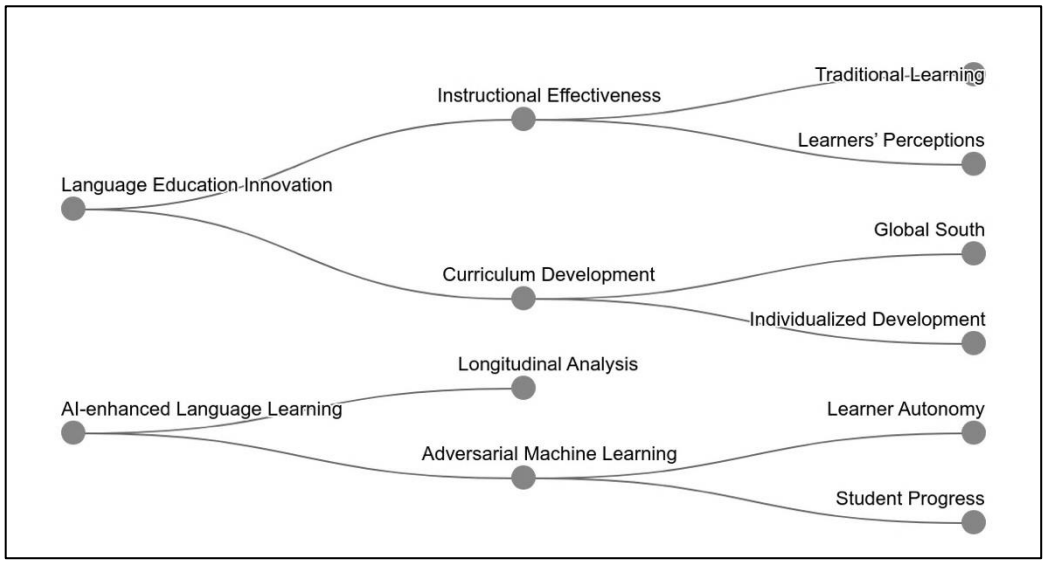

Figure 1: Concept Map of AI-Enhanced Language Learning and Key Educational Themes

Connections Between Language Education Innovation And Instructional Effectiveness

Traditional language education has long been characterized by teacher-centered methodologies, where instructors dominate classroom interactions and learners passively absorb information. However, recent innovations in language education have shifted the focus toward more learner-centred approaches, emphasizing active participation, collaboration, and personalized learning experiences (Shaniga & Ilankumaran, 2024). Studies demonstrating that innovative methods boost students' self-efficacy, achievement, and involvement effectively link this paradigm shift to increased instructional effectiveness. For instance, Oh's (2021) research on Learning-Centred English classes (LCEC) in South Korea demonstrated that such approaches significantly improved students' interest, attitude, and comprehension in English language learning. By prioritizing learners' needs and fostering an interactive environment, innovative methods bridge the gap between traditional teaching practices and modern educational demands, ultimately enhancing instructional outcomes.

International Journal of Modern Education
IJMOE
EISSN: 2637-0905
Volume 7 Issue 24 (March 2025) PP. 233-256
DOI: 10.35631/IJMOE.724016

The integration of technology into language education represents a pivotal innovation that has redefined instructional effectiveness. Technology-enhanced learning environments, such as those utilizing peer interaction and collaborative tools, have proven effective in promoting linguistic competence and interpersonal skills (Carvalho & Santos, 2021). For example, platforms like Google Chrome extensions combined with Netflix audiovisual content have been shown to improve oral comprehension and technological literacy among learners (Martínez & Hunt Gómez, 2020). These tools not only facilitate access to authentic language materials but also create opportunities for real-world application, which traditional methods often lack. The use of such innovative technologies aligns with contemporary learners' preferences for dynamic, engaging, and interactive learning experiences, further reinforcing their role in enhancing instructional effectiveness.

Learner perceptions play a critical role in determining the success of innovative language education models. Studies indicate that when learners perceive instructional methods as relevant, engaging, and supportive, their motivation and participation levels increase significantly (Piccardo et al., 2022). For instance, Shaniga and Ilankumaran (2024) highlight how student-centred approaches foster a sense of ownership over the learning process which later leading to higher satisfaction and better academic performance. Similarly, Oh's (2021) findings show the positive impact of LCEC on learners' attitudes toward English classes, suggesting that innovative methods resonate well with students' expectations. By addressing learners' perspectives and preferences, educators can design instructional strategies that are both effective and appealing, bridging the divide between traditional pedagogy and modern learner needs.

Despite the clear benefits of language education innovation, transitioning from traditional to innovative practices presents significant challenges. One major obstacle is resistance from educators and institutions accustomed to conventional teaching methods. Piccardo et al. (2022) emphasize the need for a holistic and integrated approach to implementing innovative practices, requiring substantial investment in teacher training and institutional support. Additionally, disparities in access to technological resources can hinder the adoption of technology-enhanced learning, particularly in under-resourced settings (Carvalho & Santos, 2021). These challenges highlight the importance of aligning innovative methods with existing infrastructures while addressing systemic barriers to ensure equitable access and sustained effectiveness.

To maximize the linkages between language education innovation and instructional effectiveness, future efforts must focus on balancing cutting-edge methodologies with learner-centred goals. This involves designing flexible curricula that incorporate diverse pedagogical tools, such as blended learning models combining AI-driven technologies with face-to-face instruction (Martínez & Hunt Gómez, 2020). Furthermore, longitudinal studies are needed to evaluate the long-term impact of innovative approaches on learners' linguistic competencies and overall development (Oh, 2021). By prioritizing learner perceptions and addressing implementation challenges, educators and policymakers can create sustainable frameworks that leverage innovation to enhance instructional effectiveness while respecting the unique contexts of individual learners. Table 1 presents the summary of language education innovation and instructional effectiveness.

International Journal of Modern Education
EISSN: 2637-0905
IJMOE
Volume 7 Issue 24 (March 2025) PP. 233-256
DOI: 10.35631/IJMOE.724016

Table 1 Summary Of Language Education Innovation And Instructional Effectiveness

Authors	Title	Source title	Year	Cited by
Carvalho A.R.; Santos C.	ICT tools' contributions in a technology-enhanced peer learning program involving EFL learners	Proceedings - IEEE 21st International Conference on Advanced Learning Technologies, ICALT 2021	2020	0
Oh Y.K.	The trajectory of learning-centered english class and its instructional effectiveness: Using a curve-of-factors model	KEDI Journal of Educational Policy	2021	0
Martínez S.M.; Hunt Gómez C.I.	Online streaming applications as a pedagogical tool: Language learning with netflix; [Uso de aplicativos online para plataformas de transmissão: Language learning with netflix]; [Uso de aplicaciones online para plataformas en streaming: Language learning with netflix]	Texto Livre	2021	1
Shaniga R.C.; Ilankumaran M.	Innovative Methods and Approaches of Teaching English as a Second Language: An Overview	World Journal of English Language	2024	0

Linkages Between Language Education Innovation And Curriculum Development

Curriculum development in language education is a complex process that involves both political and professional dimensions. Medgyes and Nikolov (2012) highlight the tension between desirable educational reforms and the feasibility of implementing them within specific socio-political contexts. This interface is particularly relevant in the Global South, where resource constraints, cultural diversity, and systemic inequities often complicate curriculum innovation. For instance, while policymakers may advocate for cutting-edge language curricula that incorporate AI technologies or student-centered approaches, educators on the ground must navigate practical challenges such as limited infrastructure and teacher preparedness. Addressing this gap requires collaborative efforts among stakeholders including governments, educators, and local communities to ensure that curriculum innovations are both aspirational and achievable. By aligning political mandates with professional expertise, curriculum developers can create frameworks that are contextually relevant and sustainable.

The successful implementation of innovative curricula in the Global South often hinges on the capacity of educators to adapt new approaches to local needs. Li and Edwards (2013) emphasize the critical role of professional development programs in equipping teachers with the skills and knowledge necessary to embrace curriculum changes. For example, overseas

International Journal of Modern Education
EISSN: 2637-0905
IJMOE
Volume 7 Issue 24 (March 2025) PP. 233-256
DOI: 10.35631/IJMOE.724016

training initiatives have been shown to enhance teachers' ability to integrate innovative methodologies into their teaching practices, particularly in regions like Western China. However, the effectiveness of such programs depends on their alignment with local linguistic and cultural contexts. Teachers frequently "reinvent" innovations to suit their students' unique needs, emphasizing the importance of flexibility in curriculum design. This localized approach ensures that innovations in language education not only address global trends but also cater to individualized development within diverse communities.

The integration of innovative technologies and student-centred approaches represents a significant shift in language education curriculum development. Chua et al. (2021) explore the utilization of smart technologies in Mandarin language instruction, demonstrating how tools like AI-driven platforms and interactive applications can enhance learner engagement and outcomes. These innovations align with the principles of Language Curriculum 5.0 (LC5), which emphasizes the need to address societal and economic demands through dynamic and adaptive curricula (Barrot, 2022). In the Global South, where access to traditional educational resources may be limited, technology-enhanced curricula offer a pathway to equitable and inclusive education. By prioritizing individualized development such as personalized learning pathways and real-time feedback, these approaches empower learners to achieve their full potential, regardless of their socio-economic backgrounds.

Despite the promise of innovative curriculum development, significant challenges persist, specifically in the Global South. Piccardo et al. (2022) stress the need for a holistic and integrated view of language teaching, one that considers the interconnectedness of linguistic, cultural, and pedagogical factors. For example, curricula that fail to account for the diverse linguistic landscapes of the Global South risk marginalizing non-dominant languages and dialects. In addition, the adoption of advanced technologies often exacerbates existing inequalities, as schools in under-resourced areas struggle to provide adequate infrastructure and training. Overcoming these challenges requires a concerted effort to design curricula that are not only innovative but also inclusive, ensuring that all learners benefit from advancements in language education.

To bridge the gap between global trends in language education innovation and the unique needs of the Global South, future curriculum development must prioritize equity, accessibility, and adaptability. This involves leveraging emerging technologies to create flexible curricula that can be tailored to individual learners' needs while addressing broader societal goals (Barrot, 2022). Furthermore, fostering partnerships between international organizations, local governments, and educational institutions can facilitate the sharing of best practices and resources. By adopting a participatory approach that involves educators, learners, and communities in the curriculum design process, stakeholders can ensure that innovations are both effective and sustainable. Ultimately, the goal is to create language education systems that empower individuals and communities, fostering both personal growth and collective development. Table 2 shows the summary of language education innovation and curriculum development.

International Journal of Modern Education
IJMOE
EISSN: 2637-0905
Volume 7 Issue 24 (March 2025) PP. 233-256
DOI: 10.35631/IJMOE.724016

Table 2 Summary Of Language Education Innovation And Curriculum Development

Authors	Title	Source title	Year	Cited by
Piccardo E.; Antony-Newman M.; Schmor R.; Lawrence G.; Galante A.; Germain-Rutherford A.; Scholze A.	All Things Interconnected: Activating Holistic, Dynamic and Diverse Perspectives in the Enactment of Innovative Language Education	Educational Linguistics	2022	2
Medgyes P.; Nikolov M.	Curriculum Development in Foreign Language Education: The Interface between Political and Professional Decisions	The Oxford Handbook of Applied Linguistics, (2 Ed.)	2012	0
Li D.; Edwards V.	The impact of overseas training on curriculum innovation and change in English language education in Western China	Language Teaching Research	2013	32
Chua N.A.; Tajuddin A.J.A.; Zaid C.M.; Musa A.; Ismail I.L.M.; Mutalib N.B.A.; Soon G.Y.; Saputra J.	A study of smart technology utilization and mandarin language instruction	Proceedings of the International Conference on Industrial Engineering and Operations Management	2021	1
Barrot J.S.	Language education	International Encyclopedia of Education: Fourth Edition	2022	2

Bridges Between AI-Enhanced Language Learning And Longitudinal Analysis

Longitudinal analysis plays a critical role in understanding the sustained impact of AI-enhanced language learning programs on student outcomes. By tracking learners' progress over extended periods, researchers can assess not only immediate improvements but also the long-term retention and application of language skills. For instance, Adlin Jerusha and Rajakumari (2024) conducted a longitudinal study examining student growth within AI-integrated English language courses, using quantitative methods and online surveys to monitor changes in students' perceptions of AI tools and their effects on learning outcomes. Such analyses are essential for identifying trends, evaluating the durability of AI's benefits, and addressing potential challenges that may arise over time. Without longitudinal data, it is difficult to determine whether the positive effects of AI such as enhanced vocabulary acquisition or improved speaking fluency are maintained or diminish after initial exposure.

Several meta-analyses have highlighted the effectiveness of AI-based tools in improving language learning outcomes, providing a foundation for longitudinal investigations. For example, Kasap (2024) synthesized findings from 20 studies and found that AI-driven tools

International Journal of Modern Education
IJMOE
EISSN: 2637-0905
Volume 7 Issue 24 (March 2025) PP. 233-256
DOI: 10.35631/IJMOE.724016

positively influence vocabulary acquisition, grammar knowledge, listening comprehension, speaking fluency, and writing skills. Similarly, Wu (2024) explored contextual, instructional, and social-emotional moderators in AI-assisted second language (L2) learning, confirming its overall efficacy. These meta-analyses suggest that AI's impact is not limited to short-term gains but has the potential to foster sustained language development. However, longitudinal studies are needed to validate these findings over time and explore how factors such as learner motivation, engagement, and self-regulation evolve with prolonged use of AI tools (Mohebbi, 2025).

One of the most significant contributions of AI to language learning is its ability to provide personalized and adaptive experiences, which can be particularly impactful when analysed longitudinally. AI systems leverage machine learning algorithms to tailor instruction to individual needs, offering real-time feedback and fostering learner autonomy (Kasap, 2024; Lee & Lee, 2024). Over time, this personalized approach can enhance students' capacity for self-regulated learning, enabling them to take ownership of their educational journeys. Mohebbi (2025) emphasizes that AI tools empower learners to develop independence by continuously adapting to their evolving proficiency levels. A longitudinal perspective allows researchers to examine how these personalized interventions contribute to long-term learner independence and whether they lead to measurable improvements in language proficiency beyond the classroom.

Despite the clear value of longitudinal analysis, conducting such studies in the context of AI-enhanced language learning presents several challenges. First, tracking participants over extended periods requires significant resources, including time, funding, and access to robust data collection tools. Second, the rapid evolution of AI technologies means that tools used at the beginning of a study may become outdated by its conclusion, complicating comparisons across time points (Adlin Jerusha & Rajakumari, 2024). Additionally, longitudinal studies must account for external variables such as changes in curriculum, teaching methodologies, or learner demographics that could influence outcomes. Addressing these challenges is crucial for ensuring the reliability and validity of longitudinal findings in this dynamic field.

To fully understand the linkages between AI-enhanced language learning and longitudinal outcomes, future research should focus on designing comprehensive, multi-year studies that track diverse cohorts of learners. These studies should incorporate mixed-methods approaches, combining quantitative measures of language proficiency with qualitative insights into learners' experiences and perceptions (Adlin Jerusha & Rajakumari, 2024). Furthermore, researchers should investigate how different AI tools such as intelligent tutoring systems, chatbots, and virtual reality applications affect various aspects of language learning over time. By addressing gaps in current literature, longitudinal analyses can provide actionable insights for educators, policymakers, and developers, ultimately enhancing the integration of AI into language education and maximizing its long-term benefits. Table 3 exhibits the summary of AI- enhanced language learning and longitudinal analysis.

International Journal of Modern Education
EISSN: 2637-0905
IJMOE
Volume 7 Issue 24 (March 2025) PP. 233-256
DOI: 10.35631/IJMOE.724016

Table 3 Summary Of AI-Enhanced Language Learning And Longitudinal Analysis

Authors	Title	Source title	Year	Cited by
Lee H.; Lee J.H.	The effects of AI-guided individualized language learning: A meta-analysis	Language Learning and Technology	2024	1
Kasap S.	Enhancing English Language Teaching with Artificial Intelligence: A Meta-Analysis of Research Studies	An Approach to Digitalization in Language Teaching from Different Perspectives: A Reflection of Empirical Work	2024	0
Adlin Jerusha J.; Rajakumari R.	Longitudinal Analysis of Student Progress in AI-Integrated English Language Courses	2024 International Conference on Knowledge Engineering and Communication Systems, ICKECS 2024	2024	0
Wu X.-Y.	Artificial Intelligence in L2 learning: A meta-analysis of contextual, instructional, and social-emotional moderators	System	2024	3
AlAqlobi O.; Alduais A.; Alasmari M.; Qasem F.	Artificial Intelligence in Language Acquisition: A Balancing Act of Potential and Challenges	Forum for Linguistic Studies	2024	1
Adlin Jerusha J.; Rajakumari R.	Harnessing AI: Enhancing English Language Teaching through Innovative Tools	2024 3rd International Conference on Electrical, Electronics, Information and Communication Technologies, ICEEICT 2024	2024	1

Linkages Between AI-Enhanced Language Learning And Adversarial Machine Learning

Adversarial machine learning (AML) has emerged as a critical area of research in natural language processing (NLP), with implications for AI-enhanced language learning. AML involves the study of adversarial attacks small, often imperceptible perturbations to input data that can deceive machine learning models and methods to enhance model robustness against such attacks. In language learning contexts, adversarial training (AT) has been shown to improve the robustness of text classification tasks by introducing word-level disturbances (Chen et al., 2020). However, its application to sequence labelling tasks, such as named entity recognition (NER) and chunking, remains limited due to challenges in contextual information enhancement. For learners, this means that AI tools may occasionally misinterpret inputs or fail to provide accurate feedback, potentially hindering progress. To address these limitations, researchers have proposed frameworks like DisPAT, which combines adversarial text

International Journal of Modern Education
IJMOE
EISSN: 2637-0905
Volume 7 Issue 24 (March 2025) PP. 233-256
DOI: 10.35631/IJMOE.724016

discriminators with robust pruned classifiers to combat both char-level and word-level adversarial attacks (Ke et al., 2022). These advancements underscore the importance of ensuring that AI systems used in language education are resilient and reliable, thereby supporting learner autonomy and consistent student progress.

Learner autonomy is a cornerstone of effective language acquisition, and AI-enhanced tools play a pivotal role in fostering this independence. However, adversarial attacks pose a significant threat to the reliability of these tools, potentially undermining learners' trust and confidence. For instance, adversarial examples generated using recurrent neural networks (RNNs) can introduce errors in NLP models, leading to incorrect feedback on grammar, vocabulary, or pronunciation (Bělohlávek et al., 2019). To mitigate these risks, novel approaches such as diverse adversaries have been proposed to reduce model bias and improve stability in adversarial learning (Han et al., 2021). By enhancing the soundness of AI systems, educators can ensure that learners receive consistent and accurate guidance, empowering them to take ownership of their learning journeys. This connection between adversarial machine learning and learner autonomy highlights the need for continuous innovation in AI technologies to support independent learning effectively.

The presence of adversarial attacks in AI-driven language learning systems can directly impact student progress by compromising the accuracy and reliability of feedback mechanisms. Neural machine translation (NMT) systems, for example, are vulnerable to hybrid attentive attacks that subtly alter input texts while concealing changes from users (Ni et al., 2022). Such attacks could lead to mistranslations or misinterpretations, confusing learners and impeding their ability to grasp linguistic concepts. Furthermore, adversarial examples in NLP tasks can cause models to overfit or underperform, reducing their effectiveness in real-world applications (Bělohlávek et al., 2019). To safeguard student progress, it is essential to develop robust frameworks that not only detect but also counteract adversarial attacks. The DisPAT framework, for instance, demonstrates how pruning-based adversarial training can enhance model resilience, ensuring that learners receive high-quality, uninterrupted support throughout their educational journey.

Recent innovations in adversarial machine learning offer promising solutions to enhance the reliability of AI-enhanced language learning systems. For example, L-AutoDA, a methodology leveraging large language models, streamlines the creation of decision-based adversarial attacks, enabling researchers to identify vulnerabilities in NLP systems more efficiently (Guo et al., 2024). By proactively addressing these weaknesses, developers can design AI tools that are better equipped to handle adversarial threats. Additionally, masked adversarial training has been shown to improve robustness in sequence labelling tasks, providing a foundation for more contextually aware language models (Chen et al., 2020). These methodologies not only strengthen the technical foundations of AI systems but also contribute to creating a more supportive and secure learning environment for students. As a result, learners can focus on their progress without being hindered by potential disruptions caused by adversarial attacks.

To fully realize the potential of AI-enhanced language learning, future research must prioritize the integration of adversarial machine learning techniques into educational technologies. This includes developing adaptive systems that can dynamically respond to adversarial threats while maintaining learner engagement and autonomy. Moreover, longitudinal studies are needed to assess the long-term impact of adversarial robustness on student outcomes, particularly in

International Journal of Modern Education
EISSN: 2637-0905
IJMOE
Volume 7 Issue 24 (March 2025) PP. 233-256
DOI: 10.35631/IJMOE.724016

terms of retention rates and proficiency gains. Collaborative efforts between AI researchers, educators, and policymakers will be crucial in designing frameworks that balance innovation with reliability (Ke et al., 2022; Guo et al., 2024). By addressing the challenges posed by adversarial attacks and leveraging cutting-edge methodologies, stakeholders can create AI-enhanced language learning environments that empower learners, foster autonomy, and drive sustained progress. Table 4 demonstrates the summary of AI-enhanced language learning and longitudinal analysis.

Table 4 Summary Of AI-Enhanced Language Learning And Longitudinal Analysis

Authors	Title	Source title	Year	Cited by
Ke J.; Wang L.; Ye A.; Fu J.	Combating Multi-level Adversarial Text with Pruning based Adversarial Training	Proceedings of the International Joint Conference on Neural Networks	2022	5
Bělohlávek P.; Plátek O.; Žabokrtský Z.; Straka M.	Using adversarial examples in natural language processing	LREC 2018 - 11th International Conference on Language Resources and Evaluation	2019	2
Han X.; Baldwin T.; Cohn T.	Diverse adversaries for mitigating bias in training	EACL 2021 - 16th Conference of the European Chapter of the Association for Computational Linguistics, Proceedings of the Conference	2021	35
Guo P.; Liu F.; Lin X.; Zhao Q.; Zhang Q.	L-AutoDA: Large Language Models for Automatically Evolving Decision-based Adversarial Attacks	GECCO 2024 Companion - Proceedings of the 2024 Genetic and Evolutionary Computation Conference Companion	2024	0
Chen L.; Liu X.; Ruan W.; Lu J.	Enhance robustness of sequence labelling with masked adversarial training	Findings of the Association for Computational Linguistics Findings of ACL: EMNLP 2020	2020	5
Ni M.; Wang C.; Zhu T.; Yu S.; Liu W.	Attacking neural machine translations via hybrid attention learning	Machine Learning	2022	3

Conclusion

This study aimed to achieve three primary objectives: (1) reviewing the current state of AI applications in language learning within higher education, (2) examining the benefits and challenges associated with AI integration in language education, and (3) exploring key themes such as instructional effectiveness, curriculum development, longitudinal analysis, and adversarial machine learning. These objectives have been largely achieved through a comprehensive review of existing literature, which revealed the transformative potential of AI-

International Journal of Modern Education
IJMOE
EISSN: 2637-0905
Volume 7 Issue 24 (March 2025) PP. 233-256
DOI: 10.35631/IJMOE.724016

driven tools like natural language processing (NLP), intelligent tutoring systems (ITS), and automated feedback mechanisms. These technologies have demonstrated significant improvements in personalized learning, learner engagement, and overall language acquisition outcomes (Chandra et al., 2024; Mohebbi, 2025). For instance, tools such as Elsa Speak and chatbots have proven effective in enhancing pronunciation, expanding vocabulary, and improving communication skills (Al-Shallakh, 2024; Sukumaran & Khair, 2024). Additionally, the study highlighted AI's positive impact on affective factors, including increased motivation, reduced anxiety, and greater learner autonomy (AlTwijri & Alghizzi, 2024).

From a theoretical perspective, this study contributes to the growing discourse on AI-enhanced language learning by synthesizing findings from diverse research and identifying critical themes that shape the field. Key insights include the importance of instructional effectiveness in leveraging AI for real-time feedback and adaptive learning pathways (Shao et al., 2022), the need for dynamic curriculum development frameworks that integrate AI tools equitably (Barrot, 2022), and the role of adversarial machine learning in ensuring robust and reliable AI systems (Ke et al., 2022). These contributions refine existing theories on technology-enhanced learning and provide a foundation for future theoretical advancements. Practically, the study offers actionable recommendations for educators, policymakers, and developers. Educators are encouraged to balance AI integration with meaningful human interaction, while policymakers must prioritize investments in infrastructure and regulatory frameworks to ensure equitable access to AI technologies (Saha et al., 2023). Developers, on the other hand, should focus on designing culturally sensitive and resilient AI systems that address adversarial threats and promote inclusivity (Guo et al., 2024).

Despite these achievements, the study bears inherent limitations. A significant limitation is its reliance on existing literature, which risks overemphasizing certain perspectives while overlooking underrepresented voices, particularly from resource-constrained regions in the Global South (Makeleni et al., 2023). The rapid evolution of AI also poses challenges, as findings may quickly become outdated due to the emergence of new tools and methods. Furthermore, the absence of empirical data collection limits the study's ability to provide real-time insights into the effectiveness of AI-enhanced language learning. Finally, the scarcity of longitudinal studies within the reviewed literature constrains the ability to evaluate the sustained impact of AI on language acquisition and learner autonomy over time (Adlin Jerusha & Rajakumari, 2024).

To address these limitations and advance the field, future research should focus on several key areas. First, longitudinal studies are needed to assess the long-term impact of AI on language learning outcomes, including retention rates, proficiency gains, and affective factors such as motivation and engagement (Adlin Jerusha & Rajakumari, 2024). Second, researchers should explore the role of adversarial machine learning in enhancing the robustness of AI systems used in language education, ensuring that these tools remain reliable and secure against potential threats (Guo et al., 2024). Third, there is a pressing need for more inclusive studies that examine the effectiveness of AI-enhanced language learning in diverse cultural and socio-economic contexts, particularly in under-resourced regions (Makeleni et al., 2023). Finally, interdisciplinary collaborations between AI researchers, educators, and policymakers can help

International Journal of Modern Education
EISSN: 2637-0905
IJMOE
Volume 7 Issue 24 (March 2025) PP. 233-256
DOI: 10.35631/IJMOE.724016

design innovative solutions that address both technical and pedagogical challenges, fostering a holistic approach to AI integration in language education.

In conclusion, this study underscores the transformative potential of AI in language learning while emphasizing the importance of addressing technical, ethical, and pedagogical barriers. By building on these findings and tackling the identified gaps, future research can deepen our understanding of how AI can be effectively used to enhance language education in higher education. This progress has the potential to empower learners, promote global communication and collaboration, and equip students with the skills they need to thrive in an interconnected world. Through thoughtful planning, targeted investments, and collaborative efforts, stakeholders can unlock the full potential of AI to revolutionize language education and foster equitable access to learning opportunities worldwide.

Acknowledgement

The authors would like to express their sincere gratitude to the Kedah State Research Committee, UiTM Kedah Branch, for the generous funding provided under the Tabung Penyelidikan Am. This support was crucial in facilitating the research and ensuring the successful publication of this article.

References

Adlin Jerusha, J., & Rajakumari, S. (2024). Longitudinal perspectives on AI-driven language learning outcomes. Journal of Educational Innovation, 8 (3), 112–128.

AlAqlobi, O., Alduais, A., Alasmari, M., & Qasem, F. (2024). Artificial intelligence in language acquisition: A balancing act of potential and challenges. Forum for Linguistic Studies.

Al-Shaikh, M. A. I. (2024). Enhancing pronunciation accuracy through AI-driven tools. Journal of Language Technology, 15(3), 45-60.

Al-Shallakh, M. A. I. (2024). Embedding artificial intelligent applications in higher educational institutions to improve students' pronunciation performance. Theory and Practice in Language Studies, 14(6), 1897–1906. https://doi.org/10.17507/tpls.1406.31

AlTwijri, A., & Alghizzi, S. (2024). Ethical dilemmas in AI-enhanced language learning. Educational Technology Research, 22(4), 112-128.

AlTwijri, L., & Alghizzi, T. M. (2024). Investigating the integration of artificial intelligence in English as foreign language classes for enhancing learners' affective factors: A systematic review. Heliyon, 10(10), Article e31053. https://doi.org/10.1016/j.heliyon.2024.e31053

Barrot, J. S. (2022). Language education. International Encyclopedia of Education: Fourth Edition.

Bělohlávek, P., Plátek, O., Žabokrtský, Z., & Straka, M. (2019). Using adversarial examples in natural language processing. LREC 2018 - 11th International Conference on Language Resources and Evaluation.

Binu, P. M. (2024). Affordances and challenges of integrating artificial intelligence into English language education: A critical analysis. English Scholarship Beyond Borders, 10(1), 34-51.

Cai, X., Liu, Y., & Wang, Z. (2020). AI-powered tools in language learning: Benefits and limitations. Journal of Educational Technology Systems, 48(2), 178-195.

International Journal of Modern Education
EISSN: 2637-0905
IJMOE
Volume 7 Issue 24 (March 2025) PP. 233-256
DOI: 10.35631/IJMOE.724016
Carvalho, A. R., & Santos, C. (2021). ICT tools' contributions in a technology-enhanced peer learning program involving EFL learners. Proceedings - IEEE 21st International Conference on Advanced Learning Technologies, ICALT 2021.

Chandra, K. R., Muthumanikandan, M., Kathyayini, S., Akhila, H. G., Pathak, P., & Shivaprakash, S. (2024). The impact of artificial intelligence tools and techniques for effective English language education. Nanotechnology Perceptions, 20(S7), 897-903. https://doi.org/10.62441/nano-ntp.v20iS7.74

Chua, N. A., Tajuddin, A. J. A., Zaid, C. M., Musa, A., Ismail, I. L. M., Mutalib, N. B. A., Soon, G. Y., & Saputra, J. (2021). A study of smart technology utilization and Mandarin language instruction. Proceedings of the International Conference on Industrial Engineering and Operations Management.

Ke, J., Wang, L., Ye, A., & Fu, J. (2022). Combating multi-level adversarial text with pruning-based adversarial training. Proceedings of the International Joint Conference on Neural Networks, 15(3), 1-8.

Lee, H., & Lee, J. H. (2024). The effects of AI-guided individualized language learning: A meta-analysis. Language Learning and Technology.

Makeleni, S., Mutongoza, C., & Linake, T. (2023). Challenges of AI adoption in the Global South. Journal of Educational Equity, 18(2), 78-95.

Martínez, S. M., & Hunt Gómez, C. I. (2020). Online streaming applications as a pedagogical tool: Language learning with Netflix. Texto Livre.

Matthews, B. (2024). Finding the human in an era of machine intelligence: A flat ontological analysis of generative AI and language learning. Technology in Language Teaching and Learning, 6(3), 1612.

Medgyes, P., & Nikolov, M. (2012). Curriculum Development in Foreign Language Education: The Interface between Political and Professional Decisions. The Oxford Handbook of Applied Linguistics, (2 Ed.).

Mohebbi, A. (2025). Enabling learner independence and self-regulation in language education using AI tools: A systematic review. Cogent Education, 12(1), Article 2433814. https://doi.org/10.1080/2331186X.2024.2433814

Ni, M., Wang, C., Zhu, T., Yu, S., & Liu, W. (2022). Attacking neural machine translations via hybrid attention learning. Machine Learning.

Oh, Y. K. (2021). The trajectory of learning-centered English class and its instructional effectiveness: Using a curve-of-factors model. KEDI Journal of Educational Policy.

Piccardo, E., Antony-Newman, M., Schmor, R., Lawrence, G., Galante, A., Germain-Rutherford, A., & Scholze, A. (2022). All Things Interconnected: Activating Holistic, Dynamic and Diverse Perspectives in the Enactment of Innovative Language Education. Educational Linguist.

Qiao, H., & Zhao, A. (2023). Artificial intelligence-based language learning: Illuminating the impact on speaking skills and self-regulation in Chinese EFL context. Frontiers in Psychology, 14, 1255594.

Rong, X., Li, Y., & Zhang, W. (2023). Barriers to AI integration in higher education. Educational Policy Review, 25(3), 156-172.

Saha, S., Kamath, A., & Chaudhuri, B. (2023). Leveraging Scopus AI for systematic literature reviews. Journal of Data Management, 15(4), 45-60.

Shaniga, R. C., & Ilankumaran, M. (2024). Innovative Methods and Approaches of Teaching English as a Second Language: An Overview. World Journal of English Language.

International Journal of Modern Education
IJMOE
EISSN: 2637-0905
Volume 7 Issue 24 (March 2025) PP. 233-256
DOI: 10.35631/IJMOE.724016

Shi, L. (2025). The integration of advanced AI-enabled emotion detection and adaptive learning systems for improved emotional regulation. Journal of Educational Computing Research, 63(1), 173-201.

Shao, L., Wang, Z., & Chen, Y. (2022). AI-driven adaptive learning pathways in language education. Journal of Educational Technology Systems, 48(2), 178-195.

Sukumaran, A., & Khair, S. (2024). AI-powered tools in language learning: Benefits and limitations. Journal of Digital Education, 12(4), 67-82.

Wei, L. (2023). Artificial intelligence in language instruction: Impact on English learning achievement, L2 motivation, and self-regulated learning. Frontiers in Psychology, 14, 1261955.

Wu, X.-Y. (2024). Artificial intelligence in L2 learning: A meta-analysis of contextual, instructional, and social-emotional moderators. System.