Management Analytics and Social Insights

www.masi.reapress.com

Manag. Anal. Soc. Insights. Vol. 3, No. 1 (2026) 25–31.

Paper Type: Original Article

# The Role of Artificial Intelligence in the Learning and Teaching of a Foreign Language

**Ritesh Ranjan***

Department of French Studies Research Scholar, Banaras Hindu University, India; rishuranjan10@gmail.com.

**Citation:**

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| *Received: 19 September 2025*<br>*Revised: 25 November 2025*<br>*Accepted: 27 January 2026* | Ranjan, R. (2026). The role of artificial intelligence in the learning and teaching of a foreign language. *Management Analytics and Social Insights, 3*(1), 25-31. |

## Abstract

Artificial Intelligence (AI) has significantly transformed the landscape of foreign language learning and teaching. This paper examines how AI tools, such as Intelligent Tutoring Systems (ITS), Natural Language Processing (NLP), and speech recognition technologies, enhance pedagogical practices by offering personalized instruction, real-time feedback, and immersive learning environments. It also investigates the implications of these technologies on learner autonomy, teacher roles, and the challenges posed by over-reliance on automation and cultural contextualization. By evaluating current applications and emerging trends, the study underscores AI's potential to reshape foreign language education and identifies the pedagogical considerations necessary for its effective integration.

**Keywords:** Artificial intelligence, Language learning, Intelligent tutoring systems, Natural language processing, Educational technology, Foreign language pedagogy.

## 1 | Introduction

The incorporation of Artificial Intelligence (AI) into language education has revolutionized traditional learning frameworks. While earlier pedagogies emphasized classroom instruction, repetition, and instructor-led evaluation, AI technologies offer adaptive, learner-centric alternatives. These tools transcend the limitations of time and space, delivering personalized experiences that accommodate varied learning paces, styles, and goals [1]. With a growing number of AI-driven platforms like Duolingo, ELSA Speak, and Google Translate, educators and learners alike are rethinking the dynamics of foreign language instruction.

AI integration enables learners to control their pace and pathway through personalized feedback loops and content adaptation. Moreover, the pandemic accelerated the demand for remote, tech-supported education, highlighting the importance of AI as a tool not just for continuity but for innovation in pedagogy. The global

Corresponding Author: rishuranjan10@gmail.com
https://doi.org/10.22105/masi.v3i1.89

proliferation of internet access and mobile technologies further facilitates the reach and effectiveness of AI in language learning. The goal is not only to expedite acquisition but also to enhance engagement, inclusivity, and learner autonomy. However, the increasing integration of AI also presents challenges, including reduced human interaction, potential cultural misinterpretations, and dependence on technology.

# 2|Artificial Intelligence Technologies in Language Learning

## 2.1|Intelligent Tutoring Systems

Intelligent Tutoring Systems (ITS) deliver personalized instruction by adapting to a learner's responses and progress. Systems like Duolingo and Rosetta Stone use AI algorithms to adjust difficulty levels in real time. These platforms emulate human tutors by offering feedback, exercises, and reinforcement based on performance analytics [2], [3]. ITS can also generate individual learning trajectories, helping students visualize progress and understand their learning patterns. They are increasingly used in institutional settings to supplement in-class activities with personalized, asynchronous support.

## 2.2|Artificial Intelligence-Powered Speech Recognition and Pronunciation Feedback

### 2.2.1|Speech recognition and pronunciation feedback

Tools such as ELSA Speak utilize AI-driven speech recognition to evaluate pronunciation and suggest corrections. These systems detect nuances in phoneme articulation and provide targeted guidance, enabling independent learning. Advanced platforms can now model regional accents, intonation patterns, and even prosodic features, giving learners exposure to authentic and diverse pronunciation standards [4].

## 2.3|Natural Language Processing and Artificial Intelligence-Enhanced Translation Tools

### 2.3.1|Natural language processing and translation tools

Translation and language assistance tools like DeepL and Google Translate apply NLP to deliver fast, context-sensitive translations. Enhanced by machine learning, these platforms have significantly improved idiomatic and regional accuracy [5]. Furthermore, integrated NLP functions in AI writing assistants can provide sentence-level grammar checks, context-aware vocabulary suggestions, and automated summaries, facilitating comprehensive language production and comprehension support.

# 3|Pedagogical Implications of Artificial Intelligence Integration

## 3.1|Personalized and Adaptive Learning

AI systems adjust content based on proficiency level, learning style, and goal alignment. It ensures learners are neither overwhelmed nor under-challenged, fostering motivation and better outcomes [6]. Such adaptability promotes inclusive education by supporting learners with varied cognitive, linguistic, or socio-economic backgrounds. The ability to track learner data enables real-time intervention and long-term curriculum planning.

## 3.2|Immersive Learning through Artificial Intelligence-Supported Virtual Reality and Augmented Reality Environments

Immersive learning through VR/AR: Virtual Reality (VR) and Augmented Reality (AR), supported by AI, create realistic scenarios that mimic real-world language use, such as navigating a marketplace or engaging in casual conversation abroad. These environments enhance cultural understanding alongside linguistic skills [7].

Immersive tools also reduce learner anxiety and improve retention by simulating authentic communication contexts in low-stress settings.

## 3.3 | Real-Time Feedback and Adaptive Assessment in Language Learning

Real-time feedback and assessment AI enable immediate evaluation of grammar, vocabulary, pronunciation, and syntax. Automated assessments support formative evaluation and facilitate timely pedagogical intervention [8]. Furthermore, AI-powered diagnostic tools can identify specific learning gaps, recommend targeted remedial content, and enable dynamic curriculum adjustments.

# 4 | Advantages and Challenges

AI-based platforms offer free or low-cost learning opportunities worldwide, significantly contributing to educational equity and inclusion [9]. Through cloud-based technologies and mobile accessibility, learners from under-resourced, rural, or conflict-affected regions can participate in high-quality language courses, virtual classrooms, and interactive modules without the constraints of traditional schooling systems. These platforms often include adaptive learning features that allow instruction to adjust to individual proficiency levels, learning speeds, and goals. Moreover, AI-driven translation and speech recognition tools help bridge linguistic divides, enabling learners to engage with global educational resources in their native or target languages. As a result, AI not only reduces geographical and financial barriers but also promotes lifelong learning and social mobility by democratizing access to language education.

## 4.1 | Advantages

### 4.1.1 | Accessibility

AI-based platforms offer free or low-cost learning worldwide, bridging gaps in educational equity [10]. Learners from under-resourced or remote regions can access high-quality instruction and interactive modules, reducing geographical and financial barriers to language education.

### 4.1.2 | Scalability

AI accommodates large cohorts without compromising instructional quality, making it ideal for institutions facing teacher shortages or increasing student numbers. Platforms can deliver individualized feedback and adapt to each learner's progress simultaneously across diverse contexts.

### 4.1.3 | Engagement

Gamified elements such as badges, streaks, leaderboards, and personalized challenges heighten learner motivation and sustained participation. Interactive interfaces and real-time rewards appeal particularly to digital-native learners, fostering a sense of achievement and progression.

### 4.1.4 | Efficiency

Automation of administrative tasks—such as grading, assessment, and progress tracking—allows educators to focus more on instructional design, learner support, and higher-order pedagogical interventions. AI also enables the quick generation of learning analytics, supporting data-driven decision-making in curriculum development.

### 4.1.5 | Personalization

AI customizes lesson content, pacing, and difficulty levels based on learner data, cognitive preferences, and performance trends. This dynamic adaptation enhances learning outcomes by addressing individual needs, fostering self-regulated learning behaviors, and accommodating diverse learning styles.

#### 4.1.6 | Consistency and objectivity

AI ensures unbiased feedback and evaluation by applying standardized criteria across learners. This consistency in assessment can promote transparency, fairness, and trust in learning outcomes, particularly in large-scale or high-stakes educational environments.

#### 4.1.7 | Lifelong learning support

AI-driven platforms often offer modular, on-demand learning options suitable for non-traditional learners, professionals, or adult education contexts. The flexibility of such systems supports continuous language learning across different life stages and career goals.

### 4.2 | Challenges

#### 4.2.1 | Limited human interaction

While AI tools are interactive, they lack the emotional intelligence and contextual awareness of human teachers. They cannot fully replicate the encouragement, empathy, or nuanced feedback that human instructors provide. This absence may hinder learners' development of pragmatic and sociolinguistic competence, which often relies on human engagement [11].

#### 4.2.2 | Over-reliance on technology

Excessive dependence on AI tools can limit learners' ability to practice real-time, unscripted conversations. Without structured opportunities for interpersonal communication, students may struggle with fluency, spontaneity, and cultural subtleties in real-world interactions. Moreover, passive reliance on correctional feedback can discourage critical thinking and self-editing skills.

#### 4.2.3 | Cultural and contextual limitations

Despite advancements in NLP, AI systems still struggle to interpret and generate culturally embedded language, idiomatic expressions, and local dialects. These shortcomings may lead to literal translations or generic responses that fail to reflect authentic communicative practices, thereby impeding learners' intercultural competence.

#### 4.2.4 | Data privacy and ethical concerns

AI platforms collect and analyze vast amounts of learner data, raising concerns about consent, data ownership, surveillance, and algorithmic bias. Misuse of personal information, especially among minors or vulnerable populations, can lead to serious ethical and legal implications. Transparency and ethical AI design must be prioritized to ensure learner safety.

#### 4.2.5 | Digital divide and infrastructure barriers

Not all learners have equal access to the necessary hardware, internet bandwidth, or digital literacy required to engage with AI tools. This digital divide can exacerbate existing inequalities in educational access and achievement, particularly in rural or underfunded regions.

#### 4.2.6 | Teacher resistance and training gaps

Many educators face difficulties integrating AI tools due to limited digital training, lack of institutional support, or pedagogical skepticism. Without proper professional development, teachers may underuse or misuse AI, reducing its effectiveness and perpetuating resistance to innovation.

#### 4.2.7 | Language and representation bias

AI systems trained on unbalanced datasets may reinforce stereotypes or fail to represent diverse linguistic and cultural realities. Such biases can skew learning experiences, limit exposure to language varieties worldwide, and perpetuate inequities in content delivery and feedback mechanisms.

# 5 | Future Trends and Pedagogical Shifts

## 5.1 | Evolving Role of Educators

The integration of AI is expected to transform the educator's role from a primary source of knowledge to that of a learning facilitator or coach. Teachers will be instrumental in guiding students to effectively navigate AI tools, interpret feedback, and develop metacognitive skills. Professional development programs will need to evolve to focus on digital fluency, AI literacy, and blended learning methodologies [7], [8].

## 5.2 | Emotion-Aware and Adaptive Learning Systems

### 5.2.1 | Emotion-aware and adaptive systems

Emerging AI applications are being designed with emotion-recognition capabilities that can interpret a learner's facial expressions, tone of voice, and engagement patterns. These affective computing systems can adjust difficulty levels, offer encouragement, or provide rest suggestions, tailoring the emotional tone of instruction to the learner's state [12].

## 5.3 | Blockchain-Based Credential

### 5.3.1 | Blockchain and credentialing

Blockchain technology may soon be used to authenticate micro-credentials earned via AI learning platforms. Learners will be able to store and share verifiable digital certificates and progress markers, facilitating global recognition of informal and non-traditional learning achievements [1].

## 5.3 | Multilingual Artificial Intelligence and Cross-Language Learning for Global Education

Multilingual AI and cross-language learning: Next-generation AI tools are being developed to enable real-time translation and multilingual interaction, allowing learners to engage with peers and content across languages. Such capabilities could foster greater inclusivity and support global citizenship education [6].

## 5.4 | Biometric and Behavioral Analytics for Personalized Learning

### 5.4.1 | Biometric and behavioral analytics

Biometric data such as eye-tracking, typing rhythm, and response time may be used to assess learner concentration, fatigue, or cognitive load. This data will inform adaptive learning pathways and content pacing, promoting more personalized instruction [13].

## 5.5 | Collaborative Artificial Intelligence Systems for Enhanced Group Learning

### 5.5.1 | Collaborative artificial intelligence systems

Future systems may include collaborative AI tutors capable of supporting group work, role-playing, and peer-feedback processes. These systems could scaffold communication tasks, simulate intercultural dialogues, and offer just-in-time support within group learning environments [2].

## 5.6 | Pedagogical Challenges and Considerations in Artificial Intelligence-Enhanced Language Education

### 5.6.1 | Pedagogical challenges and considerations

Despite the advancements, integrating AI into language education requires critical pedagogical reflection. Key challenges include ensuring equitable access, maintaining learner agency, and preserving the humanistic

dimensions of education. Educators must question when, why, and how to use AI—not simply adopt it for its novelty. Furthermore, curriculum design must align technological capabilities with Communicative Language Teaching (CLT) principles, emphasizing interaction, fluency, and real-world relevance [14].

Robust teacher training, ethical AI frameworks, and student-centered design must underpin future implementations to ensure that AI serves as an enabler, not a substitute, of meaningful language learning.

# 6 | Conclusion

Artificial Intelligence is ushering in a paradigm shift in foreign language education by offering unprecedented levels of personalization, feedback, and access. The integration of AI technologies such as ITS, speech recognition, and natural language

Language processing has empowered learners to practice autonomously, receive instant evaluation, and engage in immersive, context-rich environments.

However, while the benefits are manifold, AI in language learning is not without its limitations. Challenges such as diminished human interaction, cultural misrepresentation, ethical concerns around data privacy, and the digital divide necessitate careful implementation and oversight. Addressing these challenges requires a balanced approach that combines the efficiency of AI with the empathy, adaptability, and social interaction provided by human educators.

Looking ahead, the role of teachers will continue to evolve. Educators must be equipped not only with technological know-how but also with the pedagogical insight to leverage AI in meaningful ways. Future developments such as emotion-aware systems, multilingual AI, and blockchain-based credentialing will further reshape the learning landscape. Still, their successful adoption depends on inclusive design, ethical deployment, and ongoing teacher training.

Ultimately, AI should not be seen as a replacement for traditional pedagogy but as a powerful tool to enhance it. The future of foreign language education lies in thoughtfully integrating AI to support diverse learner needs, encourage lifelong learning, and promote global communication. With critical reflection, inclusive strategies, and human-centered values at the forefront, AI has the potential to democratize and enrich language education on a global scale.

# Funding

This paper received no external funding.

# Data Availability

The data used and analyzed during the current study are available from the corresponding author upon reasonable request.

# Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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