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From Automated Feedback to Human-AI Collaboration: Mechanisms and Pathways of AI Integration in Foreign Language Education

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Abstract: Artificial intelligence (AI) is continuously transforming knowledge organization, teaching activity structure, and learning support mechanisms in foreign language education. Empirical studies in the past five years have shown that AI integration in foreign language education is not a linear process of single-technology application in classrooms, but an evolving trajectory deepening from automated feedback to intelligent interaction and further to human-AI collaboration. Early research mainly focused on automated writing evaluation, automatic speech recognition, machine translation, and basic chatbots, verifying their roles in reducing feedback delay, expanding practice opportunities, and alleviating teachers' repetitive workload. With the integration of large language models into teaching contexts, research has gradually shifted to higher-level issues such as writing ideation, oral interaction, learning engagement, self-regulation, and human-AI collaboration. Based on a review of representative empirical studies in the past five years, this paper analyzes the evolution, core application fields, main mechanisms, practical limitations, and future directions of AI integration in foreign language education. The study argues that the educational effectiveness of AI is not directly determined by technological advancement, but by the combined effects of task design, feedback arrangement, teacher intervention, learner literacy, and contextual adaptation. Future research should shift from verifying whether tools are effective to explaining how human-AI collaboration works effectively, and construct an interpretable and generalizable research framework in more authentic classroom ecologies, longer time spans, and a wider range of languages.

Keywords: Artificial intelligence; Foreign language education; Automated feedback; Human-AI collaboration

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1. Introduction

Artificial intelligence (AI) has rapidly entered the field of foreign language education and is deeply integrated with writing, speaking, assessment, and learning support. A systematic review of recent empirical studies by Li *et al.* [1] shows that higher education and English as a foreign language (EFL) settings remain the main focus of current research, with writing as the most concentrated application area. Zhu and Wang [2] further

pointed out that educational applications of AI have expanded from local skill support to more macro levels such as curriculum implementation, learning strategies, psychological variables, and classroom organization. It is clear that the current question is no longer simply listing available tools, but explaining how AI reshapes teaching relationships, learning methods, and classroom structures.

In terms of development, AI integration in foreign language education presents overlapping developmental orientations. The first stage is automated support, where technologies such as automated writing evaluation, automatic scoring, machine translation, and speech recognition enter classrooms, mainly performing error correction, repetitive feedback, and self-study assistance. The second stage is intelligent interaction, where chatbots and voice assistants gradually evolve from tools to interactive partners, with research focusing on willingness to communicate, anxiety reduction, and engagement improvement. The third stage is human-AI collaboration, where AI goes beyond one-way answer-giving to further participate in content ideation, text generation, expression reformulation, meaning negotiation, and learning reflection. Understanding this staged evolution helps grasp the inherent logic of technological integration, shifting from replacing partial labor to reconstructing overall teaching relationships.

2. Research evolution: From automated feedback to human-AI collaboration

The core value of early AI adoption in foreign language education lies in feedback automation. Its advantage lies in providing high-frequency, timely, and repeatable practice support at a relatively low cost, making writing and speaking the first beneficiaries. Link *et al.* [3] noted that automated writing evaluation can expand feedback coverage and promote text revision, yet cannot replace teachers' role in high-level writing guidance. Dizon *et al.* [4] also found in their research on intelligent voice assistants that although AI increases out-of-class autonomous practice opportunities and improves usability, its effects are still significantly constrained by task design and learners' active engagement. It is evident that the automated feedback stage mainly addresses technical usability and feedback efficiency, without truly delving into deep learning support.

With the development of chatbots and conversational systems, AI's role in foreign language education has shifted from a mere feedback tool to a dynamic interactive partner. Du and Daniel [5] showed that chatbots have exhibited steady positive effects in improving oral performance, boosting learning engagement, enhancing motivation, and reducing anxiety. After embedding chatbots into in-class debate tasks, Guo *et al.* [6] found significant improvements in students' argument development, idea organization, and task motivation, indicating that AI is no longer limited to surface-level error correction but has entered higher-order interactive and cognitive activities. Similarly, Tai and Chen's [7] research on oral English teaching in primary schools shows that generative chatbots can improve students' oral performance and reduce expression pressure through anthropomorphic interaction. Thus, the key breakthrough of the intelligent interaction stage is that AI begins to intervene in the whole learning process through continuous interaction.

With the development of generative AI, the scope of human-AI collaboration has been further expanded. Hwang *et al.* [8] found that learners frequently use generative tools for conception and content construction in the pre-writing phase, followed by language polishing and expression correction. This indicates that generative AI has expanded from an end-stage feedback tool to an ongoing cognitive scaffold, participating not only in error correction but also in content development, discourse expansion, idea organization, and continuous revision.

3. Core research fields and main findings

From the perspective of core application fields, writing research remains the most evidence-concentrated and fruitful direction. Early automated writing evaluation mainly focused on error correction efficiency and revision behaviors, and later gradually expanded to psychological variables such as writing self-efficacy, self-regulation, and anxiety. Sari and Han [9] found that automated writing evaluation not only affects text quality but also indirectly improves writing performance by enhancing self-regulation and alleviating anxiety. Steiss *et al.* [10] pointed out that although AI feedback has obvious advantages in immediacy, accessibility, and operability, it still cannot fully replace teachers in contextual understanding, feedback stability, and high-order judgment. Asadi *et al.* [11] further confirmed that learners' writing performance is usually better when combining AI feedback with teacher feedback than receiving single feedback, showing that writing research has shifted from whether technology is effective to how mixed feedback works better.

Accordingly, oral interaction research has grown rapidly in recent years. With the characteristics of low threat, repeatability, and instant response, AI provides learners with a more sustainable practice space. Zhang [12] found that intelligent oral assistants can enhance foreign language enjoyment and willingness to communicate while reducing anxiety. Wang *et al.* [13] noted that systems with stronger social presence and voice interaction features are more advantageous in improving perceived communicative competence and willingness to communicate. Fathi *et al.* [14] further found that AI-mediated interactions improved EFL learners' speaking skills and willingness to communicate.

At a broader teaching ecology level, AI is driving foreign language learning from single-classroom support to integrated in-class and out-of-class learning. Kohnke *et al.* [15] pointed out that although generative technology facilitates autonomous learning, improved resource accessibility, and personalized feedback, it also brings problems such as increased judgment costs, higher dependency risks, and fluctuating cognitive load. This indicates that technological empowerment does not equal natural optimization of the learning process, but brings teachers and students into a new teaching ecology requiring continuous identification, dynamic selection, and self-regulation.

4. Mechanisms of action: How AI supports learning

Synthesizing existing research, AI-supported learning outcomes in foreign language education may arise through multiple mechanisms.

First, the immediate feedback mechanism. Compared with the common feedback delay in traditional classrooms, AI can quickly provide suggestions after learners complete expressions, significantly shortening the cycle of output, feedback, and revision. Link *et al.* [3] and Sari and Han [9] noted that this immediacy is particularly beneficial for rapid correction and repeated practice at the linguistic form level. For writing, it helps correct errors before they solidify; for speaking, it maintains communicative coherence and enhances expression confidence.

Second, the low-threat interaction mechanism. Foreign language expression in real classrooms is often accompanied by strong evaluation pressure, especially in oral tasks, where learners tend to avoid expression for fear of making mistakes. Studies by Zhang [12] and Tai and Chen [7] show that AI enhances willingness to communicate, increases enjoyment, and reduces anxiety largely because it provides a relatively safe practice space. Learners do not need to face direct scrutiny from teachers and peers in human-AI interaction, so they

are more willing to try, make mistakes, and keep expressing.

Third, the repeatable scaffolding mechanism. AI can be frequently invoked for explanation, demonstration, paraphrasing, questioning, and comparison. Hwang *et al.* [8] found that learners repeatedly use generative tools to verify expressions, supplement content, and adjust structures during writing. Unlike one-time feedback, such scaffolds are retrospective, repeatable, and usable at one's own pace, better supporting learners' autonomous trial and error and dynamic adjustment.

Fourth, the meaning-negotiation mechanism. The value of generative models lies not only in providing single suggestions but also in continuously generating materials, explaining reasons, offering alternative expressions, and conducting multiple rounds of negotiation with learners around task goals. Studies by Steiss *et al.* [10], Asadi *et al.* [11], and Kohnke *et al.* [15] suggest that AI becomes a meaningful learning resource only when learners integrate machine feedback into their own judgment framework and cross-validate it with teacher guidance, peer advice, and task requirements. Thus, the key is not generating more content, but enabling higher-quality comparison, judgment, and reconstruction.

5. Practical limitations and key challenges

Despite substantial progress in AI-supported foreign language education, its practical limitations remain evident. Existing research subjects are still highly concentrated in higher education and EFL settings. Li *et al.* [1] and Zhu and Wang [2] both pointed out that research in basic education, vocational education, postgraduate academic writing, and less commonly taught languages is still insufficient, making many conclusions highly context-dependent. Meanwhile, skill distribution is unbalanced: writing research is the most concentrated, oral research grows rapidly, while evidence for reading, listening, cross-modal integration, and comprehensive language proficiency development remains weak. Most studies are short-cycle experiments and local classroom interventions, lacking long-term longitudinal observations in authentic curriculum ecologies.

Beyond sample and duration constraints, the large-scale adoption of generative AI has brought new governance issues. As models deeply participate in conception, expression, and revision, risks such as academic integrity, cognitive offloading, feedback authenticity, information bias, and privacy protection continue to emerge. Kohnke *et al.* [15] noted that although ChatGPT offers pedagogical affordances, its responsible use requires teachers and learners to recognize its limitations and critically evaluate its output. Steiss *et al.* [10] further warned that system feedback is not always stable and accurate; without teacher guidance and clear evaluation criteria, learners can easily be misled by superficial fluency.

6. Future directions: From tool effectiveness to effective human-AI collaboration

Future research on AI integration in foreign language education needs continuous deepening in multiple aspects.

First, the research focus should shift from verifying surface effects to explaining deep-seated mechanisms. Most existing studies focus on performance changes or perceived improvements after technological intervention; future research should better answer: under what tasks, for which learners, with what feedback combinations, and under what teacher interventions can AI truly exert educational effectiveness. Only by integrating feedback characteristics, interaction forms, learner differences, teacher

roles, and task goals into a unified analytical framework can its boundary conditions be accurately revealed.

Second, research and practice should shift from isolated application to curriculum integration, while promoting digital literacy and ethical governance. AI should not be regarded merely as an additional tool, but embedded into the curriculum to support ideation, draft refinement, language calibration, simulated communication, and post-class review. Meanwhile, both teachers and students need to develop high-level AI literacy, including identifying technological limitations, comparing multi-source information, judging feedback credibility, and complying with academic norms. Teachers should also transform from mere knowledge transmitters to learning path designers, feedback coordinators, and AI ethics guides.

7. Conclusion

Overall, research on AI in foreign language education has gradually expanded from automated feedback to human-AI collaboration. The automation stage solved feedback accessibility and practice frequency; the intelligent interaction stage improved engagement and willingness to communicate; generative systems support core cognitive processes such as conception, negotiation, and reflection. Existing research has demonstrated that AI has significant educational potential, but its value is not naturally determined by technological advancement, but jointly shaped by task design, feedback arrangement, interaction quality, teacher intervention, learners' evaluative judgment, and ethical boundaries.

The real question for future foreign language education research is no longer whether to use AI, but how to organize human-AI collaboration pedagogically, so as to enhance learning efficiency while maintaining learner agency, critical thinking, and long-term language development capacity.

Disclosure statement

The authors declare no conflict of interest.

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