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Article

Designing a Human–AI Collaborative Blended Learning Framework for EFL Speaking Development

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A B S T R A C T

While artificial intelligence (AI) technologies such as conversational chatbots and speech recognition systems are increasingly adopted in language education, existing research focuses predominantly on isolated tools rather than integrated instructional models. This study proposes and evaluates a Human–AI Collaborative Blended Learning Framework for the development of English as a Foreign Language (EFL) speaking skills. Using a two-phase research design, the study first synthesizes contemporary literature to establish a 7-layer conceptual framework that connects stakeholder participation, learner profiling, a Human–AI collaboration engine, blended activities, adaptive speaking services, teacher facilitation, and continuous learning analytics. Second, the framework was evaluated through an expert validation survey involving 52 specialists in language education, applied linguistics, and educational technology (40.4% PhDs, 57.7% Master's). Quantitative findings revealed strong endorsement for actionable teacher support dashboards (80.8% agreement), visual pronunciation feedback (78.8%), and private AI speaking practice for anxiety reduction (75.0%; M = 2.98/4.00). However, experts expressed reservations regarding automated prompts for language elaboration (53.8% agreement), fixed 14-meeting schedules (57.7%), and automated grading weights (57.7%). Qualitative analysis highlighted that acceptance remains conditional upon accent fairness, data privacy, and active teacher oversight. Implications: Theoretically, the study advances AI-assisted language learning by establishing a human-centered collaborative model that prioritizes teacher-AI shared regulation over technological substitution. Pedagogically and practically, the findings imply that institutions and EdTech developers should deploy AI primarily for scalable, low-stakes rehearsal and actionable lesson planning, while preserving teacher authority over social communication, pragmatic competence, and high-stakes assessment.

I. INTRODUCTION

The rapid advancement of artificial intelligence (AI) is reshaping contemporary educational practice, enabling instructional environments to respond more directly, dynamically, and adaptively to individual learning needs (Wang, 2025). Recent breakthroughs in generative AI, natural language processing (NLP), automatic speech recognition

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(ASR), machine learning, and conversational agents allow educational systems to personalize learning pathways, deliver instant diagnostic feedback, and dynamically adapt scaffolding (Yu & Guo, 2023). Unlike conventional digital learning applications that deliver static content or fixed drills, AI-powered applications interact dynamically with learners, analyze behavioral data, and tailor recommendations to specific performance profiles (Mananay, 2024). These technical capabilities make AI a promising partner in language education, expanding instructional responsiveness beyond traditional classroom constraints.

Among the four core language skills, speaking remains particularly challenging for English as a Foreign Language (EFL) learners because it requires the simultaneous, real-time coordination of pronunciation, grammatical accuracy, lexical selection, fluency, and interactional competence. Many EFL learners struggle to express ideas confidently due to limited exposure to authentic target-language environments, inadequate opportunities for oral communication, and pervasive foreign language classroom anxiety (Abdelrady et al., 2026; Ali et al., 2025; Sharma, 2024). These affective and situational barriers reinforce one another: restricted practice diminishes learner confidence, while speaking anxiety discourages active classroom participation. Conventional classroom conditions often exacerbate this deficit, as large class sizes, limited instructional hours, and unequal student participation restrict opportunities for sustained oral rehearsal and targeted, individualized feedback (Ngoka et al., 2026; Sharma, 2024). Addressing these systemic challenges requires an instructional environment that expands opportunities for oral practice while providing regular, personalized guidance beyond classroom boundaries.

Blended learning has emerged as an effective instructional model for overcoming these constraints by systematically combining face-to-face classroom instruction with online learning modalities (Wu et al., 2025). This approach enables learners to engage in communicative classroom interactions while utilizing digital resources for autonomous practice (Buacokrung et al., 2025; Zuhri et al., 2026). In EFL contexts, blended learning provides structural flexibility, fosters learner autonomy, and extends language exposure beyond scheduled class sessions (Cao et al., 2024; Johnson & Marsh, 2014; Zuhri et al., 2026).

However, despite widespread adoption, many blended learning models remain technology-supported rather than intelligence-driven. Online components frequently serve as static repositories for course materials or assignment submission portals, without adaptively tailoring instruction to individual learners' characteristics. Consequently, standardized blended learning environments often fail to accommodate variations in learners' speaking proficiency, learning pace, or specific communicative difficulties (Buacokrung et al., 2025; El-Sabagh, 2021; Liu et al., 2026).

Artificial intelligence can transform blended learning from a static dual-mode format into an adaptive, intelligence-driven ecosystem for EFL speaking development (Qureshi et al., 2026; Sivasankar, 2026). AI tools address specific instructional needs: speech recognition systems evaluate pronunciation and prosody; conversational chatbots provide low-stakes dialogue practice; generative AI produces contextualized prompts and role-play scenarios; and intelligent feedback engines deliver real-time corrective recommendations (Chen et al., 2025; Wald & Seiwald, 2026). Learning analytics track individual progress, enabling students and teachers to pinpoint specific oral difficulties (Al-husban, 2025; Ding & Yusof, 2025; Qiao & Zhao, 2023).

Crucially, AI technologies must be integrated into EFL speaking instruction as a complement to, rather than a substitute for, human educators. Speaking is inherently social, cultural, and interpersonal, involving the negotiation of contextual meaning, pragmatic judgment, emotional engagement, and spontaneous interaction (Ding & Yusof, 2025; Zhang, 2025). Although AI systems efficiently support pronunciation drills, vocabulary expansion, and automated feedback, they cannot replicate a teacher's pedagogical expertise, empathy, encouragement, or adaptive classroom facilitation (Ghamrawi et al., 2023; Hu & Qiu, 2026; Zhang, 2025). Effective speaking instruction depends on teachers' ability to scaffold complex tasks, facilitate collaborative group work, offer nuanced corrective feedback, build learner self-efficacy, and foster psychological safety (AbuSahyon et al., 2023; Huang & Kakham, 2026).

Human–AI collaboration offers a human-centered approach to integrating AI into education

(Buseyne et al., 2026; Kim, 2024). Rather than delegating instruction entirely to teachers or software, this framework establishes a functional division of labor: AI assumes computational, analytical, and repetitive tasks (e.g., speech recognition, low-stakes rehearsal, predictive progress analytics), while teachers focus on the social, emotional, pedagogical, and pragmatic dimensions of learning (Ifenthaler et al., 2024; Nguyen, 2025). In EFL speaking, AI provides continuous oral practice and immediate diagnostic feedback outside class, enabling teachers to guide authentic classroom communication, critical thinking, and socio-cultural competence (Hu & Qiu, 2026; Li, 2025).

Although research on artificial intelligence in language education is expanding rapidly, existing studies predominantly examine individual tools, such as standalone chatbots, speech recognition tutors, or automated scoring systems, in isolation (Idul et al., 2026; Khodi et al., 2026). Furthermore, research on blended learning has focused primarily on general implementation outcomes rather than on constructing instructional architectures that systematically integrate multiple AI capabilities within a coherent pedagogical framework (Ali et al., 2025; Kurniawan et al., 2025; Shaya et al., 2026). Consequently, educators and instructional designers lack a structured, empirically validated model detailing how teachers, learners, AI technologies, and blended learning activities should collaborate.

To address this gap in the literature, this study pursues three integrated research objectives. First, the study aims to design a comprehensive Human–AI Collaborative Blended Learning Framework. Second, it seeks to quantitatively evaluate expert endorsement and feasibility ratings across nine core framework components, specifically assessing actionable teacher support dashboards, visual pronunciation feedback, private rehearsal for anxiety reduction, chatbot prompts for language elaboration, schedule feasibility, and automated assessment distribution. Third, the study investigates qualitative expert feedback to identify essential pedagogical, ethical, and practical implementation conditions, including actionable dashboard summaries, accent fairness, pragmatic competence, schedule flexibility, student AI literacy, and small-scale pilot testing, to ensure the human-centered, ethical deployment of AI in EFL speaking instruction. The proposed framework is expected to generate multi-dimensional pedagogical, practical, and theoretical outcomes.

II. METHODS

Research Design

This study employs a two-phase mixed-methods conceptual design research approach to propose and evaluate a Human–AI Collaborative Blended Learning Framework for the development of EFL speaking. Conceptual design research is appropriate when the primary objective is to synthesize theoretical, empirical, and technological literature into an integrated instructional architecture that guides educational practice. To ensure that the proposed framework is both theoretically sound and practical, the research workflow was executed in two sequential phases:

- Phase 1: Conceptual Framework Synthesis: A systematic literature review was conducted across computer-assisted language learning (CALL), communicative language teaching (CLT), blended learning, learning analytics, and human–AI shared regulation. This phase identified essential pedagogical, technological, and analytical components and organized them into a 7-layer framework.
- Phase 2: Mixed-Methods Expert Validation: To evaluate the feasibility, pedagogical coherence, and potential implementation barriers of the framework, an expert validation survey was conducted with specialists in language education, applied linguistics, and educational technology.

Expert Evaluation Sample and Selection Criteria

The expert evaluation sample comprised N = 52 specialists in language teaching, applied linguistics, and educational technology. Participants were selected through purposive sampling based on three criteria: holding a postgraduate degree in a relevant field, demonstrating expertise in EFL curriculum design or educational technology, and having professional experience in higher education or language teaching.

Table 1 details the demographic and professional distribution of the expert panel (N = 52), demonstrating a high level of academic qualifications and balanced disciplinary coverage. In terms of academic attainment, the majority

Table 1. Demographic and Professional Profile of the Expert Panel

Characteristic	Category	Respondents (n)	Percentage (%)
Academic Degree	PhD	21	40.4%
	Master's	30	57.7%
	Other	1	1.9%
Primary Expertise	Language teaching / EFL curriculum design	29	55.8%
	Applied linguistics / second language acquisition	17	32.7%
	Educational technology / AI in education	6	11.5%
Professional Experience	Less than 5 years	24	46.2%
	5–10 years	13	25.0%
	10–15 years	11	21.2%
	More than 16 years	4	7.7%

of respondents held postgraduate degrees, with 57.7% holding a Master's degree (n = 30) and 40.4% holding a PhD (n = 21), with 1.9% holding other advanced professional qualifications (n = 1). Disciplinary expertise was predominantly centered in Language Teaching and EFL Curriculum Design (55.8%, n = 29), followed by Applied Linguistics and Second Language Acquisition (32.7%, n = 17), and Educational Technology or AI in Education (11.5%, n = 6). Regarding professional teaching and research experience, 46.2% of experts had less than 5 years of experience (n = 24), 25.0% possessed 5–10 years (n = 13), 21.2% reported 10–15 years (n = 11), and 7.7% had over 16 years of active service (n = 4). Furthermore, when completing domain-specific evaluation sections, respondents sorted themselves into three functional specialist tracks: 28 language teachers and syllabus leads, 20 applied linguists and second-language acquisition experts, and 4 educational technology/AI specialists—a functional distribution that closely matched their reported primary academic credentials.

Data Collection

Data were collected through an online expert validation questionnaire administered over a ten-day period from 7 to 16 October 2026. The survey instrument comprised two main sections:

- Quantitative Evaluation Items: Nine items evaluating core components of the proposed model—including teacher dashboards, visual pitch feedback, private AI practice, chatbot prompts, schedule feasibility, and automated assessment weights. Items were rated on a 4-point Likert scale: 1 = Disagree, 2 = Needs Work, 3 = Agree, and 4 = Strongly Agree. A 4-point scale was deliberately selected to eliminate neutral midpoint bias and encourage definitive expert judgment.
- Qualitative Open-Ended Prompts: Qualitative prompts solicited detailed expert commentary regarding pedagogical integration, dashboard features, accent fairness, pragmatic competence, schedule flexibility, AI literacy, and implementation conditions. Participants were anonymized as P01-P52 in submission order.

Data Analysis

The collected quantitative and qualitative data were processed using an integrated mixed-methods analysis framework:

- Quantitative Analysis: Descriptive statistics, including mean scores (M), standard deviations (SD), and overall agreement percentages (combining "Agree" and "Strongly Agree" responses), were calculated across all nine evaluation items using automated statistical software.
- Qualitative Analysis: Open-ended textual comments were analyzed using qualitative thematic synthesis. Textual excerpts were systematically coded and grouped into key implementation themes, with a focus on conditional acceptance factors, accent fairness, teacher oversight, and privacy concerns.
- Integration: Quantitative ratings and qualitative commentary were triangulated to refine the 7-layer framework, identify lower-scoring items requiring adjustment, and establish actionable design principles.

Ethics Approval and Participant Consent

This study was conducted in strict accordance with established institutional ethical guidelines for research involving human participants. Prior to completing the online validation survey (7–16

October 2026), all expert respondents (N = 52) were provided with a digital Informed Consent Statement detailing the study's research objectives, voluntary nature of participation, and rights regarding data withdrawal. Participants explicitly granted informed consent before accessing the questionnaire items. To safeguard privacy and confidentiality, all survey responses were fully anonymized and assigned alphanumeric participant identifiers (P01 to P52). No personally identifiable information (PII), institutional affiliations, or digital contact details were linked to individual survey ratings or qualitative excerpts. Collected data were stored in password-protected, encrypted cloud storage accessible exclusively to the primary research team and processed strictly for academic synthesis.

III. RESULTS AND ANALYSIS

Conceptual Framework Architecture

The proposed framework integrates artificial intelligence, blended learning principles, and learner-centered pedagogy into a unified, 7-layer instructional architecture. Rather than replacing human educators, the framework establishes a functional division of labor where AI handles scalable computational and analytical tasks (such as speech recognition, acoustic feedback, and practice logs), while human teachers remain responsible for authentic social communication, pragmatic competence, emotional encouragement, and pedagogical judgment.

Figure 1 illustrates the proposed Human–AI Collaborative Blended Learning Framework for EFL Speaking Development, which establishes an integrated, learner-centered instructional architecture connecting technological capabilities with human pedagogy. At its structural foundation, Stakeholder Participation and System Governance defines the operational roles, data protection standards, and ethical boundaries for learners, educators, educational technology developers, and university administrators. This foundational layer ensures that data privacy, voice recording security, and accent-inclusive system governance are established prior to instructional deployment. Building directly on this governance foundation, Learner Profile Analysis evaluates each student's baseline diagnostic competencies, specific communicative needs, and affective states, most notably, foreign-language classroom anxiety. By capturing diagnostic oral proficiency, personal communication goals, and affective apprehension before instruction begins, the framework ensures that subsequent speaking activities are dynamically tailored to individual learners' characteristics rather than providing a standardized, one-size-fits-all learning path.

At the heart of the framework lies the Human–AI Collaboration Engine, which operationalizes a functional division of labor between artificial intelligence and human educators. Rather than positioning technology as an autonomous replacement for teachers, this layer delegates high-volume computational and analytical tasks,

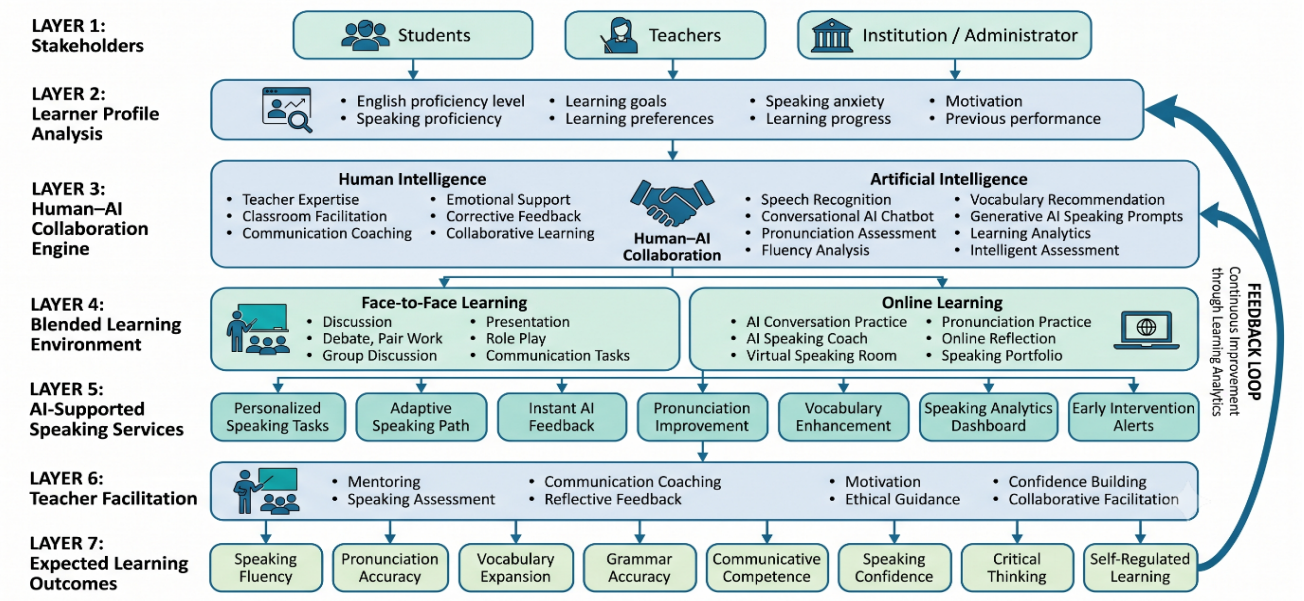


Figure 1. Human–AI Collaborative Blended Learning Framework for EFL Speaking Development

such as acoustic pitch tracking, automated speech transcription, vocabulary recommendations, and practice log generation, to AI systems. Concurrently, human teachers retain responsibility for guiding social communication, fostering psychological safety, guiding scaffolded pair and group work, and facilitating pragmatic skills such as politeness, conflict resolution, and persuasive discourse. This division of labor directly informs the Blended Learning Environment, which bridges autonomous online practice and face-to-face classroom interaction. In this blended space, pre-class online rehearsal enables students to complete private voice drills and conversational chatbot interactions on their personal devices, which then directly prepare them for communicative, interactive classroom tasks such as role-plays, debates, and collaborative problem-solving.

Supporting these blended activities, Adaptive AI Speaking Services deliver real-time technological assistance directly to learners outside scheduled class hours, offering visual pitch and intonation graphs, automated speech recognition tuned to local accents, and conversational chatbots for low-stakes practice. The data generated from these autonomous practice sessions feed into Teacher Facilitation and Actionable Dashboards, which synthesize student practice logs into concise, one-page pre-class summaries. These dashboards highlight recurring pronunciation or grammatical difficulties and alert teachers to students experiencing high anxiety, thereby enabling educators to plan targeted classroom interventions without being overwhelmed by raw audio data. Finally, the framework culminates in a Continuous Learning Analytics and Feedback Mechanism, establishing an iterative, closed-loop process that links learning outcomes back to learner profile analysis. Performance data from both AI practice logs and teacher evaluations continually update the learner profile, allowing instructional recommendations, practice frequency, and task difficulty to adapt dynamically over time while ensuring that final assessment decisions remain firmly under human pedagogical authority.

Quantitative Findings

The quantitative analysis evaluated responses from 52 expert participants (N = 52) who rated nine core components of the proposed AI-supported blended learning framework for EFL speaking instruction12. Data were collected over a ten-day period from 7 to 16 October 20263. Responses were measured on a 4-point Likert scale—where 1 = Disagree, 2 = Needs Work, 3 = Agree, and 4 = Strongly Agree—deliberately omitting a neutral midpoint to encourage definitive expert judgment12. Overall agreement percentages were calculated by combining "Agree" (rating 3) and "Strongly Agree" (rating 4) responses12. Mean endorsement scores across the nine items ranged from M = 2.58 to M = 2.98, indicating an overall favorable reception of the framework alongside specific reservations regarding scheduling, grading weights, and automated elaboration prompts.

The quantitative analysis included responses from 52 participants who evaluated nine components of the proposed AI-supported blended learning model for speaking instruction. Responses were measured on a four-point scale, ranging from 1 (Disagree) to 4 (Strongly Agree), with 2 representing "Needs Work" and 3 representing "Agree." Mean scores ranged from 2.58 to 2.98, indicating generally favorable evaluations alongside reservations about several components. All participants completed the nine items, and agreement percentages were calculated by combining "Agree" and "Strongly Agree" responses.

Using AI practice summaries to help teachers plan classroom activities received the

Table 2. Expert Evaluation and Endorsement Ratings Across Proposed Framework Components

Component evaluated	Mean / 4	SD	Agreement
AI handles basic drills outside class; teachers focus on classroom conversation	2.77	0.70	73.1%
Connecting a mobile voice app, university learning platform, and teacher dashboard	2.71	0.70	65.4%
Combining speech recognition and AI chatbots for speaking practice	2.88	0.76	73.1%
Visual pitch graphs for pronunciation and intonation feedback	2.92	0.76	78.8%
Chatbot prompts encouraging longer sentences and better vocabulary	2.58	0.80	53.8%
Private AI practice reducing speaking anxiety	2.98	0.75	75.0%
AI practice summaries helping teachers plan classroom activities	2.92	0.74	80.8%
Feasibility of a 14-meeting semester plan	2.60	0.77	57.7%
Fairness of 30% AI practice records and 70% teacher grading	2.65	0.74	57.7%

highest proportion of agreement, at 80.8% (n = 42; M = 2.92, SD = 0.74). Visual pitch graphs for identifying and correcting pronunciation and intonation errors also received substantial support, with 78.8% agreement (n = 41; M = 2.92, SD = 0.76). Private AI practice as a means of reducing speaking anxiety obtained the highest mean score (M = 2.98, SD = 0.75), with 75.0% of respondents agreeing or strongly agreeing (n = 39). These results indicate that respondents evaluated teacher support, visual pronunciation feedback, and private speaking rehearsal particularly positively. Assigning basic pronunciation and vocabulary drills to AI outside the classroom so that teachers could focus on classroom conversation received 73.1% agreement (n = 38; M = 2.77, SD = 0.70). Combining speech recognition and AI chatbots to support speaking development received the same agreement percentage (73.1%, n = 38), but a higher mean score (M = 2.88, SD = 0.76). The practical integration of a mobile voice application with the university learning platform and a teacher dashboard received comparatively lower support, with 65.4% agreement (n = 34; M = 2.71, SD = 0.70). For this item, 30.8% selected "Needs Work" (n = 16), while 3.8% disagreed (n = 2).

Evaluations were more divided regarding course duration and assessment. The feasibility of the proposed 14-meeting semester plan received 57.7% agreement (n = 30; M = 2.60, SD = 0.77), while 34.6% selected "Needs Work" (n = 18) and 7.7% disagreed (n = 4). The proposed assessment arrangement, combining 30% AI practice records with 70% teacher grading, also received 57.7% agreement (n = 30; M = 2.65, SD = 0.74). However, 38.5% considered this arrangement in need of improvement (n = 20), and 3.8% disagreed (n = 2). These distributions identify scheduling and grading as components requiring further refinement. Chatbot prompts intended to encourage longer, more detailed sentences and better vocabulary received the lowest mean score (M = 2.58, SD = 0.80) and the lowest agreement percentage, at 53.8% (n = 28). A further 38.5% selected "Needs Work" (n = 20), while 7.7% disagreed (n = 4). Across the nine items, the findings show stronger endorsement of AI for supporting teachers, pronunciation feedback, and private practice than for promoting language elaboration or determining course and assessment arrangements. These results describe respondents' evaluations of the proposed model and do not constitute evidence of measured improvements in students' speaking proficiency.

The quantitative result shows AI-supported blended speaking instruction should prioritize teacher guidance, purposeful independent practice, and clear connections between learning outside and inside the classroom. AI practice summaries should help teachers identify recurring difficulties and select appropriate classroom activities, while visual pronunciation feedback and private rehearsal should prepare students for meaningful interaction with peers. Implementation should include accessible tools, manageable tasks, and opportunities for teachers to review automated feedback. The course schedule should remain flexible enough to accommodate differences in students' proficiency and progress, and assessment should distinguish between participation in practice and demonstrated speaking competence. Chatbot activities should promote accurate, appropriate, and coherent communication rather than simply longer responses or more complex vocabulary. These implications support piloting the model before wider adoption, with evaluation focused on speaking development, classroom participation, teacher workload, and assessment fairness.

Across the nine evaluation items, the quantitative findings demonstrate significantly stronger expert endorsement for deploying AI as a supportive tool for teachers, a provider of visual pronunciation feedback, and a private rehearsal mechanism than for using AI to promote language elaboration or enforce fixed course schedules and grading ratios. These statistical patterns imply that AI-supported blended speaking instruction should prioritize actionable teacher dashboards, flexible mastery-based pacing, and a clear distinction between formative practice participation and high-stakes summative evaluation.

Qualitative Thematic Synthesis: Expert Perspectives and Implementation Conditions

Qualitative analysis of open-ended responses from the expert panel (anonymized as P01 to P52) revealed a consensus toward conditional acceptance of integrating AI into EFL speaking instruction. While experts recognized clear opportunities for flexible oral rehearsal, diagnostic visual feedback, and enriched classroom interaction, their endorsement remained strictly contingent upon establishing explicit pedagogical connections,

ensuring accent fairness, maintaining student data privacy, and preserving human teacher oversight. Rather than viewing AI as a standalone instructional solution, experts framed technology as a supportive rehearsal mechanism that requires active teacher facilitation to translate digital practice into genuine communicative competence.

Bridging Independent AI Practice and In-Class Communicative Application

Experts emphasized that independent AI practice achieves pedagogical value only when directly connected to subsequent classroom interaction, rather than functioning as isolated digital homework. Highlighting the necessity of continuous learning design, P02 stated: "*Make sure what students practice with AI outside the class is checked and used inside the class*". Supporting this perspective, P21 recommended that out-of-class tasks should remain "*short, accessible, and linked to classroom activities*". Experts noted that pronunciation drills, vocabulary rehearsal, and conversational chatbot simulations gain purpose when students actively apply rehearsed structures in follow-up classroom discussions, role-plays, and collaborative tasks.

Regarding course structure and pacing, expert acceptance of fixed timelines was visibly conditional. P39 advocated for instructional adaptivity, arguing that "*we should remain flexible and adjust the pace according to students' progress and needs*". Conversely, P23 expressed concern regarding standard course duration, noting that "*14 meetings are not enough for reaching a B1 level*". These qualitative insights highlight the necessity of adopting a flexible, mastery-based course progression rather than enforcing rigid calendar schedules.

Private AI Rehearsal, Confidence Building, and Classroom Transfer

Experts widely acknowledged that private AI interaction offers a low-stakes, non-threatening environment for initial oral practice. P34 observed that automated tools allow learners to "*practise at their own pace, make mistakes without embarrassment*". This low-anxiety setting encourages students to experiment with unfamiliar language structures without fear of peer judgment or immediate social evaluation.

However, experts cautioned against assuming that reduced anxiety during private AI practice automatically transfers to live, spontaneous human communication. P21 explicitly warned: "*However, this may not automatically lead to greater classroom participation*". Emphasizing a more skeptical view, P22 expressed concern regarding student engagement, remarking: "*I don't think so. It may make students be lazy*". Together, these perspectives indicate that while private AI rehearsal creates a supportive foundation, teachers must actively scaffold the transition from autonomous digital practice to interactive peer communication.

Actionable Teacher Support Dashboards and Workload Optimization

Comments on the teacher dashboard emphasized the critical need for concise, actionable data to directly inform pre-class lesson planning. Experts warned against overwhelming educators with voluminous raw audio files or exhaustive performance logs. P21 suggested: "*A short class summary would be more useful than detailed logs for every student*". Reinforcing this design principle, P31 stressed: "*It should include only information I can act on before class*".

Expanding on dashboard functionality, P43 proposed an instructional recommendation feature: "*The dashboard should highlight the three most important areas to focus on during the next lesson and suggest suitable classroom activities*". These insights demonstrate that the educational utility of learning analytics depends on selective data synthesis that highlights recurring class-wide errors and identifies high-anxiety students needing targeted coaching.

Evaluative Boundaries of Automated Metrics vs. Human Pragmatic Competence

Experts clearly delineated the boundary between automated speech processing and genuine communicative competence. While automated metrics evaluate suprasegmental features, vocabulary range, and speech rate, experts prioritized intelligible connected speech over artificial phonetic perfection. P09 recommended targeting "*word and sentence stress, rhythm, and connected speech*", while P18 emphasized "*connected speech, intonation for discourse, and word stress, rather than perfect individual sounds*".

Regarding automated linguistic metrics, P03 acknowledged that "*automatic metrics can be*

useful indicators of language growth". However, P09 cautioned against over-relying on surface features: "*Longer sentences do not always mean better grammar, and more words do not necessarily indicate richer vocabulary.*" Furthermore, experts affirmed that essential interpersonal dimensions of speaking remain uniquely human domains. P03 asserted: "*A human teacher brings real interpersonal consequences, cultural knowledge, contextual judgment, and genuine social interaction*". P15 cataloged core pragmatic competencies that require human guidance, including "*politeness, empathy, appropriate tone, turn-taking, conflict resolution, and persuasive debate*".

Accent Fairness, Algorithmic Bias, and Assessment Trust

The risk of algorithmic bias against non-native regional accents emerged as a central concern regarding automated evaluation. To ensure fairness in assessment, P50 advocated for localized model training: "*Integration of local accents in the data training*". Proposing a practical verification step, P31 urged institutions to "*compare the AI's scores with what teachers hear in class*".

A key tension surfaced regarding target pronunciation benchmarks. While P49 recommended setting a standard native reference model ("*Set the standard pronunciation model and calculate each student's deviation score*"), other experts prioritized intelligibility and regional variation over native-normative compliance. Addressing assessment accountability and student agency, P21 insisted: "*Students should be able to question incorrect feedback, and teachers should make the final assessment decisions*"

Responsible Engagement, Student AI Literacy, and Data Privacy

Experts highlighted the need to foster responsible student engagement and to establish robust data privacy protections. To prevent superficial task completion or academic dishonesty, P47 advised: "*Put some limits or control on using AI for students so that they cannot just copy and paste their homework*". Addressing digital literacy, P50 recommended integrating explicit instruction: "*Introduce students to AI Literacy Course, more specifically modules related to prompt engineering and AI hallucination*".

Regarding data governance, experts demanded transparent consent and secure storage of recordings. P49 asserted that systems should "*only allow saving personal information and other files with the user's consent*". P31 added that "*students should also know where their voice recordings go and who can hear them*". These comments confirm that informed consent, voice encryption, and transparent data policies are essential prerequisites for ethical implementation.

Technical Accessibility, Institutional Infrastructure, and Pilot Testing

Finally, experts cautioned against assuming uniform technological access or digital self-efficacy among all learners. P34 stressed: "*We should not assume that all students have equal access to technology or feel equally comfortable using AI tools*". Differences in hardware quality, internet connectivity, or digital literacy must not be conflated with variations in student motivation or language aptitude.

To mitigate implementation risks, experts recommended incremental deployment backed by university leadership. P21 advised: "*Start with a small pilot before using the system for graded assessment*". Concurrently, P52 underscored institutional prerequisites: "*Full support of the university is required, especially for the infrastructure*". These insights support a phased rollout strategy that validates system reliability, user access, and teacher workload before high-stakes institutional adoption.

The qualitative synthesis demonstrates that expert endorsement of the Human–AI Collaborative Blended Learning Framework remains strictly contingent on pedagogical alignment, trust, and human agency. While specialists recognize that low-stakes AI practice offers a non-threatening space to reduce speaking anxiety and support independent oral rehearsal, they emphasize that out-of-class digital practice gains true educational value only when directly linked to interactive, face-to-face classroom communication. Furthermore, experts underscored that ethical implementation requires accent-inclusive speech recognition to ensure fairness in evaluation, transparent controls over voice data privacy, explicit instruction in student AI literacy, and small-scale pilot testing before high-stakes adoption. Ultimately, these qualitative insights affirm that while artificial intelligence serves as a scalable tool for oral rehearsal

and pre-class diagnostic planning, the human educator remains indispensable for guiding social interaction, cultivating pragmatic competence, and exercising final assessment authority.

IV. DISCUSSION

The present study proposed a Human–AI Collaborative Blended Learning Framework for EFL speaking development by integrating artificial intelligence technologies, blended learning principles, and learner-centered pedagogy into a unified instructional design. Unlike previous studies that primarily investigate the effectiveness of individual AI applications (Fathi et al., 2024) or blended learning practices (Shi et al., 2023), this study advances a comprehensive instructional framework that positions artificial intelligence and human teachers as complementary partners in the development of speaking competence.

The framework demonstrates that effective AI integration cannot be achieved by merely adding digital tools or automating instructional tasks. Rather, it requires a pedagogically coherent learning environment in which intelligent technologies expand opportunities for practice, feedback, personalization, and assessment, while teachers retain responsibility for interpretation, interaction, motivation, and instructional judgment. This division of roles is essential because AI can process learner data and deliver scalable support, but it cannot independently reproduce the social, emotional, cultural, and pedagogical dimensions of authentic communication. Accordingly, the framework establishes human–AI collaboration, not technological substitution, as the central condition for meaningful and sustainable EFL speaking development. In doing so, it contributes to current discussions on AI-assisted language learning by offering a theoretically grounded and practically applicable model for integrating intelligent technologies with teacher expertise, learner agency, and authentic communicative practice.

One of the principal findings is that human–AI collaboration is not merely beneficial but foundational to effective speaking development. The proposed framework recognizes that artificial intelligence and teachers possess distinct yet complementary strengths that cannot be fully substituted for one another. AI technologies can efficiently perform computational tasks such as speech recognition, pronunciation analysis, conversational simulation, grammar detection, vocabulary recommendation, intelligent assessment, and learning analytics (Batdı & Jibril, 2024; Yeşilyurt, 2023). By automating these functions, AI enables learners to receive immediate feedback, engage in sustained and repeated speaking practice, and follow adaptive learning pathways tailored to their proficiency levels (Ding & Yusof, 2025; Torkhani, 2025). This scalability is especially valuable in EFL contexts, where limited instructional time, large class sizes, and unequal access to speaking opportunities often restrict individualized practice. However, increased technological efficiency does not, by itself, guarantee meaningful communicative development.

Speaking is inherently social, contextual, and interpersonal; it extends beyond linguistic accuracy to include the negotiation of meaning, confidence, pragmatic judgment, intercultural awareness, and responsiveness to others. Teachers, therefore, remain indispensable for facilitating authentic communication, encouraging interaction, fostering learner confidence, promoting intercultural awareness, and addressing learners' emotional and motivational needs (Kostka & Toncelli, 2023; Nallamuthu. & S.N.S, 2025; Rosmayanti, 2026). They must also interpret AI-generated feedback, determine its pedagogical relevance, and adapt instruction when automated evaluations fail to capture the complexity of learners' communicative performance. Accordingly, the framework rejects both teacher-centered resistance to technology and technology-centered substitution of teachers. It argues instead that optimal speaking development emerges from a deliberate division of labor: AI expands the scale, immediacy, and personalization of practice, whereas teachers provide the pedagogical judgment, relational support, and authentic interaction required to transform technological assistance into meaningful language learning. Human–AI collaboration is therefore not an optional enhancement within the framework but the central condition for effective, equitable, and sustainable EFL speaking development.

Another important contribution of the framework is its emphasis on personalized speaking instruction. Traditional EFL classrooms frequently provide identical learning activities for all students despite considerable differences in

language proficiency, confidence, learning pace, and communication needs. Such standardized instruction often limits opportunities for individualized support, particularly in large classes where teachers cannot continuously monitor every learner's speaking performance. The proposed framework addresses this limitation through learner profile analysis and adaptive AI technologies that generate personalized speaking tasks, pronunciation exercises, vocabulary recommendations, and individualized feedback based on learners' performance. Continuous learning analytics further allow instructional recommendations to evolve as learners progress. This personalized approach not only accommodates learner diversity but also promotes learner autonomy by encouraging students to monitor their own development and engage in self-directed speaking practice outside formal classroom settings.

The integration of blended learning within the framework further strengthens opportunities for speaking development. Classroom instruction provides authentic communicative experiences through discussions, presentations, debates, and collaborative learning activities, where learners negotiate meaning and interact directly with peers and teachers. Online learning complements these activities by extending speaking practice through AI-supported conversational agents, virtual speaking environments, pronunciation practice, and asynchronous reflective tasks. Rather than viewing online and face-to-face instruction as separate learning environments, the proposed framework conceptualizes them as complementary instructional spaces that reinforce one another. This integration allows learners to receive continuous opportunities for speaking practice while maintaining meaningful teacher guidance and collaborative interaction throughout the learning process.

The findings also highlight the growing educational value of conversational artificial intelligence and speech recognition technologies for language learning. Recent advances in natural language processing and generative AI have significantly improved the capacity of intelligent systems to simulate authentic conversations, generate contextualized speaking activities, and provide immediate corrective feedback. Within the proposed framework, these technologies create low-anxiety learning environments in which learners can repeatedly practice speaking without fear of negative evaluation. Such opportunities are particularly valuable for learners who have limited access to authentic English-speaking communities or who experience communication apprehension during classroom interaction. Nevertheless, the framework acknowledges that AI-generated conversations cannot fully replicate the complexity of authentic human communication, particularly regarding cultural interpretation, emotional expression, pragmatic competence, and spontaneous social interaction. Consequently, conversational AI is conceptualized as supplementary speaking practice rather than a substitute for authentic communicative experiences facilitated by teachers.

The proposed framework further demonstrates the importance of learning analytics for evidence-based instructional decision-making. By continuously collecting and analyzing learner data, AI systems provide teachers with detailed information regarding learner participation, pronunciation accuracy, fluency development, vocabulary usage, and overall speaking performance. These insights enable teachers to identify learners requiring additional support and implement targeted interventions before learning difficulties become more significant. At the same time, learners gain access to visual progress dashboards that encourage reflection, goal setting, and self-regulated learning. The integration of learning analytics, therefore, transforms assessment from a periodic evaluation process into a continuous mechanism for supporting instructional improvement and personalized language development.

The proposed framework aligns closely with contemporary educational theories emphasizing learner-centered education, communicative language teaching, and human-centered artificial intelligence. From the perspective of communicative language teaching, speaking development occurs most effectively through meaningful communication rather than isolated language drills. Accordingly, the framework incorporates collaborative classroom activities and authentic interaction as central instructional elements while using AI to extend opportunities for individualized speaking practice. The framework also reflects principles of social constructivism by recognizing that language learning develops

through interaction, collaboration, and scaffolded support. Teachers facilitate these social learning processes, whereas AI provides individualized assistance that complements collaborative classroom experiences. Furthermore, the framework embodies the principles of human-centered AI by assigning AI technologies supportive rather than autonomous instructional roles, thereby ensuring that technological innovation remains aligned with educational values and human learning needs.

Future research should empirically evaluate the effectiveness of the proposed framework using design-based research, educational design research, or mixed-methods methodologies within diverse EFL contexts. Comparative studies may examine differences between Human–AI Collaborative Blended Learning and conventional blended learning in terms of speaking fluency, pronunciation accuracy, communicative competence, learner confidence, and self-regulated learning. Future investigations should also explore integrating emerging technologies such as multimodal AI, explainable AI, virtual and augmented reality, emotion recognition, and digital human avatars to further enhance speaking instruction. Additionally, ethical issues, including learner privacy, algorithmic bias, transparency, responsible AI governance, and equitable access to intelligent educational technologies, require continued investigation to ensure that future AI-supported language learning environments remain both educationally effective and socially responsible.

The proposed Human–AI Collaborative Blended Learning Framework demonstrates that the future of EFL speaking education should be based on collaboration rather than substitution. Artificial intelligence offers unprecedented opportunities for personalized learning, adaptive feedback, continuous assessment, and individualized speaking practice. Nevertheless, meaningful language learning continues to depend upon authentic human interaction, pedagogical expertise, emotional support, and collaborative communication. By integrating these complementary strengths into a unified instructional framework, the present study provides a theoretically grounded and pedagogically robust foundation for designing next-generation EFL speaking environments that support learners' communicative competence in an increasingly AI-enabled educational landscape.

V. CONCLUSION

This study developed a 7-layer Human–AI Collaborative Blended Learning Framework for EFL speaking instruction, establishing that effective language learning relies on a functional division of labor where artificial intelligence manages scalable speech recognition, practice analytics, and low-stakes conversational rehearsal, while human educators guide social interaction, pragmatic competence, emotional support, and instructional judgment. Expert evaluation confirmed that actionable teacher support dashboards, visual pronunciation feedback, and private rehearsal effectively reduce speaking anxiety and prepare students for classroom interaction, though experts emphasized that out-of-class digital practice must remain flexible, mastery-based, and directly linked to authentic communicative tasks. Theoretically, these findings advance computer-assisted language learning by establishing a human-centered, collaborative paradigm that prioritizes teacher-AI shared regulation over technological substitution. Pedagogically and practically, they imply that AI should be deployed for autonomous rehearsal and pre-class planning while human teachers retain exclusive authority over high-stakes summative evaluation, socio-cultural discourse, and pragmatic feedback. While the study is limited by its conceptual design and reliance on expert perception data, future research should empirically evaluate the framework through classroom pilot projects, design-based research, multimodal AI integration, and ethical socio-technical audits.

ETHICS STATEMENT

This study was conducted in accordance with institutional and international ethical standards and received formal review and approval from the Ethics Committee of Bukhara State University. The authors confirm that all research procedures strictly adhere to the ethical standards and publication guidelines of Jurnal Arbitrer. All participant information was fully anonymized and de-identified prior to data processing to ensure confidentiality..

CREDIT AUTHOR STATEMENT

Akhmedova Mehrinigor Bahodirovna was responsible for conceptualizing the research, conducting the research, writing the original draft, and arranging the formal analysis.

Karimjonova Shakhlo Ravshanjonovna was

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DECLARATION OF COMPETING INTERESTS

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

AI USE STATEMENT

During the preparation of this work, the authors used ChatGPT and Grammarly to improve the clarity and readability of the manuscript. All scientific content, coding of the learner data, analyses, interpretations, and conclusions were developed by the authors. The authors reviewed and edited all AI-assisted suggestion and take full responsibility for the content of the final manuscript.

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