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A METHODOLOGICAL FRAMEWORK FOR INTEGRATING AI TOOLS IN GAME-BASED EFL INSTRUCTION

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Atamuratova Mexribon Kamarbek qizi
Master's student, Department of Foreign Language and Literature,
Chirchik State Pedagogical University
Email: atamuratovamehribon677@gmail.com
Academic supervisor: **Mukhitdinova Munira Ravshanovna**

Abstract: *This study develops a theoretically grounded framework for integrating artificial intelligence (AI) tools into gamified English as a Foreign Language (EFL) instruction. While AI technologies and gamification are widely adopted, their integration often lacks alignment with core second language acquisition (SLA) mechanisms. This study addresses this gap by proposing a mechanism-based model that links AI functionalities—such as adaptive feedback, conversational agents, and speech recognition—with gamified learning structures to support vocabulary acquisition and speaking development. The framework conceptualizes learning as a recursive cycle involving input, noticing, cognitive processing, interaction, output, and feedback. The study contributes a structured pedagogical model that clarifies how technological affordances can support language learning processes and offers a context-sensitive perspective applicable to emerging EFL environments. The framework provides a foundation for future empirical validation and instructional design.*

Keywords*: Artificial intelligence, gamification, EFL, speaking skills, vocabulary acquisition, SLA, framework*

INTRODUCTION

The rapid integration of artificial intelligence (AI) and gamification has significantly transformed the landscape of English as a Foreign Language (EFL) education. AI-powered technologies, including conversational agents, speech recognition systems, and adaptive learning platforms, enable personalized instruction, immediate feedback, and continuous performance tracking. In parallel, gamification introduces structured engagement through goal-oriented tasks, reward systems, and interactive challenges, which aim to increase learner motivation and participation. Despite these advancements, existing implementations remain predominantly technology-driven rather than pedagogy-driven. AI tools are frequently introduced as isolated instructional add-ons, without being systematically aligned with underlying mechanisms of second language

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acquisition (SLA). Similarly, gamification is often reduced to surface-level engagement strategies that prioritize motivation over meaningful cognitive and linguistic development. This misalignment leads to a fundamental limitation: learners may actively participate in technology-enhanced environments, yet fail to achieve measurable gains in communicative competence, particularly in speaking and vocabulary use.

From a theoretical perspective, effective language acquisition requires the integration of several interdependent processes, including input processing, attention allocation, interaction, output production, and feedback-mediated refinement. However, current AI-supported and gamified learning environments rarely operationalize these processes in a coherent and systematic manner. As a result, the relationship between technological affordances and language development outcomes remains weakly defined. The central problem, therefore, is not the lack of technological innovation, but the absence of a mechanism-based methodological framework that explains: how AI tools mediate input processing, interaction, and feedback in language learning; how gamification structures cognitive engagement and communicative practice; how both can be systematically aligned with SLA processes to support speaking and vocabulary development. This gap is particularly evident in emerging EFL contexts, where access to digital tools is increasing, yet instructional practices remain largely teacher-centered and lack structured opportunities for communicative language use.

This study aims to develop a theoretically grounded and pedagogically coherent framework for integrating AI tools into gamified EFL instruction. The proposed framework focuses on explaining the underlying mechanisms through which AI and gamification can jointly facilitate vocabulary acquisition and speaking development, thereby bridging the gap between technological innovation and effective language learning.

LITERATURE REVIEW

The integration of artificial intelligence (AI) and gamification in English as a Foreign Language (EFL) education has expanded significantly; however, their pedagogical effectiveness remains inconsistent. While AI technologies enable adaptive learning, real-time feedback, and simulated interaction, and gamification increases learner engagement, both are often implemented without alignment with core mechanisms of second language acquisition (SLA). As a result, learning environments frequently produce high participation but limited development of communicative competence. SLA research demonstrates that language acquisition is a cognitively mediated and interaction-driven process involving input, noticing, interaction, output, and feedback (Gass & Selinker, 2008;

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Mitchell, et al., 2013). Although comprehensible input is a necessary condition for learning (Krashen, 1985), it does not guarantee acquisition unless learners actively process and attend to linguistic forms (Larsen-Freeman, 1997). Schmidt's Noticing Hypothesis emphasizes that conscious attention is essential for transforming input into intake (Schmidt, 1990), while Anderson's skill acquisition theory explains how repeated practice leads to automatization of language use (Anderson, 1982). Vocabulary development, in particular, requires multiple exposures and meaningful processing to support long-term retention (Nation, 2001). Interaction plays a central role in this process. According to Long, negotiation of meaning during interaction promotes comprehension and facilitates feedback, while Swain highlights that output enables learners to identify gaps in their knowledge and refine their linguistic system (Long, 1996).

Communicative Language Teaching (CLT) and Task-Based Language Teaching (TBLT) attempt to operationalize these principles (Richards, 2014), yet they often lack sufficient structure for individualized feedback and sustained engagement, especially in large or resource-limited contexts (Harmer, 2015). This issue is particularly evident in EFL environments such as Uzbekistan, where teacher-centered instruction limits opportunities for spontaneous speaking and productive vocabulary use (Abdullaeva, 2022; Rakhmatullaeva, 2021). Gamification has been widely adopted to address motivational challenges. While it increases participation and persistence (Sailer, 2020), its impact on learning outcomes remains inconsistent. Research indicates that gamified environments often prioritize engagement over cognitive processing, resulting in superficial learning (Zainuddin, 2020). Learners may complete tasks without engaging in meaningful interaction or output, leading to what can be described as "high engagement but low acquisition" (Gee, 2003). AI introduces additional opportunities for language learning. It supports adaptive input, personalized feedback, and simulated communication. For example, chatbots allow learners to engage in low-anxiety speaking practice, increasing confidence and participation (Belda-Medina, 2022). However, AI integration remains pedagogically fragmented. Tools are often used as isolated applications rather than components of a coherent instructional system (Kapp, 2020).

A critical synthesis reveals fragmentation across three domains. SLA theory explains learning mechanisms but is rarely integrated into digital environments. Gamification enhances engagement but lacks cognitive depth. AI provides adaptivity but lacks pedagogical coherence. Consequently, there is no unified framework that systematically connects these elements. To address this gap, this study proposes a mechanism-based framework that integrates AI and

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gamification within SLA processes. The framework conceptualizes learning as a recursive cycle:

Input → Noticing → Interaction → Output → Feedback → Automatization

Within this model, AI functions as a system of adaptive regulation, controlling input complexity, feedback precision, and progression (Li, 2021). Gamification functions as a system of engagement regulation, structuring repetition, attention, and communicative effort (Sailer, 2020). Together, they form a dual-regulation mechanism that supports both cognitive processing and sustained participation. The key contribution of this framework lies in its shift from tool-centered implementation to process-oriented instructional design. In contexts with limited speaking practice and feedback opportunities, this approach offers a structured pathway for improving communicative competence.

Methodology

This study employed a qualitative conceptual synthesis design to develop a theoretically grounded framework for integrating artificial intelligence (AI) tools into gamified EFL instruction. Rather than measuring instructional outcomes empirically, the study aimed to explain the pedagogical and cognitive mechanisms through which AI-supported and gamified environments facilitate speaking and vocabulary development. Accordingly, the research was positioned as a framework-building study based on theory integration and structured literature synthesis. The analysis drew on peer-reviewed studies from three major academic databases: Scopus, Web of Science, and ERIC. These sources were selected for their comprehensive coverage of applied linguistics, educational technology, and language pedagogy. The search focused primarily on publications from 2020 to 2025 to capture recent developments in AI-enhanced and gamified learning, while foundational SLA studies were included to establish theoretical grounding. Studies were selected based on the following criteria: relevance to EFL contexts; focus on AI, gamification, or both; and contribution to speaking development, vocabulary acquisition, interaction, or feedback processes. Irrelevant or duplicate studies were excluded. The selected literature was analyzed through a three-stage thematic process. First, studies were coded for recurring SLA-related constructs, including input, noticing, interaction, output, feedback, and engagement. Second, patterns were identified linking technological affordances with learning processes, distinguishing between superficial and pedagogically meaningful uses of AI and gamification. Third, these patterns were abstracted into a process-oriented framework aligned with core SLA stages.

The resulting model represents a synthesis of recurring theoretical and empirical insights, ensuring coherence, relevance, and conceptual rigor.

Proposed framework: Mechanism-based AI–gamification model

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Multi-layer dynamic architecture. The proposed framework conceptualizes AI-supported gamified EFL instruction as a dynamic, mechanism-driven learning system in which language development emerges from the continuous interaction between cognitive processes, technological affordances, and pedagogical design. Unlike linear instructional models that assume a fixed progression from input to output, this framework adopts a recursive, feedback-sensitive structure. Learning evolves through iterative cycles of processing, interaction, and feedback, where performance at later stages—particularly output and feedback—recalibrates earlier stages by adjusting input complexity, task demands, and interactional conditions. The model is grounded in the cognitive-interactionist perspective of second language acquisition (SLA), which views learning as the outcome of interconnected processes including input processing, noticing, interaction, and output (Mitchell, 2013). However, rather than treating these as abstract constructs, the framework operationalizes them within a technology-mediated environment. Artificial intelligence and gamification are positioned not as supplementary tools but as regulatory systems with distinct yet complementary roles. AI governs adaptivity and diagnostic precision, including input personalization and feedback calibration (Holmes, 2022), while gamification regulates engagement dynamics such as repetition, attention, and communicative persistence (Sailer, 2020). Together, they form a dual-regulation mechanism that aligns cognitive activation with sustained learner involvement.

Input layer: AI-regulated exposure system. The input layer functions as an adaptive exposure system in which AI dynamically controls the selection, sequencing, and presentation of linguistic input. Unlike static instructional materials, input is continuously calibrated based on learner proficiency, prior knowledge, and performance data. This aligns with the principle of optimal input, ensuring that learners are exposed to language slightly beyond their current competence, consistent with the concept of the zone of proximal development (Vygotsky, 1978). A key feature of this layer is multimodal input, integrating textual, auditory, and visual elements to support comprehension and retention (Kukulska-Hulme, 2020). This reduces cognitive strain by distributing processing across channels while increasing semantic richness. In addition, the framework incorporates adaptive lexical recycling, where vocabulary is reintroduced across varied contexts using spaced repetition principles (Qodirova, 2022). This promotes long-term retention and supports transfer to productive use. AI enhances input salience by highlighting relevant linguistic features and adjusting density based on learner needs. This directly supports noticing processes, increasing the likelihood that learners attend to and process language forms.

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Cognitive load is also regulated through continuous monitoring, ensuring that input remains challenging but manageable (Li, 2021). As a result, the input layer functions as an intelligent system that optimizes exposure conditions for effective learning.

Noticing and cognitive processing layer: Gamified attention regulation. The second layer transforms input into intake through attentional and cognitive processes. It distinguishes between noticing—conscious attention to linguistic forms—and processing, which involves encoding and organizing these forms into memory. Both processes are essential: noticing without processing leads to superficial awareness, while processing without attention is unlikely to occur. Gamification serves as the primary mechanism for regulating attention. Through elements such as challenges, prompts, and time constraints, gamified tasks increase the salience and urgency of linguistic input, directing learner focus (Kapp, 2012). Unlike passive exposure, these tasks embed language within meaningful and goal-oriented activities, enhancing cognitive engagement. Gamification also structures repetition through varied task conditions, promoting contextualized retrieval rather than mechanical practice. This aligns with skill acquisition theory, where repeated, meaningful use facilitates the transition from declarative to procedural knowledge (Anderson, 1982). Deeper processing is achieved when learners engage in problem-solving and interpretation, leading to stronger retention. Cognitive load is carefully managed at this stage. Task design minimizes extraneous load while maintaining sufficient complexity to promote learning. This ensures that learners operate within an optimal processing zone, avoiding both overload and disengagement (Li, 2021). Overall, this layer strengthens the cognitive foundation necessary for effective interaction and output.

Interaction layer: AI–gamified meaning negotiation. The interaction layer represents the transition from individual processing to communicative use. It operationalizes key principles of communicative and task-based language teaching by embedding language use in meaningful interaction. Interaction is treated as a mechanism for restructuring interlanguage through negotiation of meaning, including clarification, reformulation, and feedback uptake (Gass, 2008). AI and gamification jointly regulate this process. AI-based conversational agents provide adaptive interactional scaffolding, enabling learners to engage in responsive dialogue that adjusts to their proficiency level. These systems sustain interactional flow, reduce communication breakdowns, and create low-anxiety environments for experimentation (Belda-Medina, 2022). Gamification intensifies interaction by embedding communication within structured challenges. Tasks require learners to use language actively to achieve goals, introducing communicative pressure that increases

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engagement and participation (Zainuddin, 2020). This transforms interaction from optional activity into a necessary condition for task completion. Importantly, this layer supports pushed production, where learners must clarify meaning and extend responses. Interaction thus serves as a bridge between cognitive processing and output, preparing learners for more complex language use. By increasing both quantity and quality of interaction, the framework addresses a major limitation of traditional EFL classrooms.

Output layer: Pushed production system. The output layer focuses on transforming internalized knowledge into active communicative performance. Learners engage in tasks such as role plays and scenario-based dialogues that require real-time language production under communicative constraints. This stage operationalizes the Output Hypothesis, where production enables learners to identify gaps in their knowledge and refine their linguistic system (Kapp, 2012). Output is conceptualized as a multi-dimensional performance system involving fluency, accuracy, lexical range, and interactional responsiveness (Zawacki-Richter, 2019). AI supports production by providing dynamic scaffolding, including prompts and reformulations that help learners maintain communication even with limited resources (Huang, 2023). These supports adjust in real time, ensuring that tasks remain challenging yet achievable. Output also generates performance data that feeds into subsequent stages, making it both a learning activity and a diagnostic mechanism. This data-driven aspect enables continuous adaptation and improvement.

Feedback and adaptation layer: AI-driven recalibration. The feedback layer transforms performance into learning through systematic analysis and adjustment. Unlike traditional models focused on error correction, this framework integrates multiple forms of feedback. Immediate feedback targets surface-level issues such as pronunciation and grammar, allowing real-time adjustments (Chaudhry, 2022). Delayed feedback provides deeper insights into recurring patterns, including lexical gaps and interactional weaknesses (Zawacki-Richter, et al., 2019). A critical mechanism is feedback uptake, where learners modify their output in response to feedback, leading to language development. AI aggregates performance data across tasks, enabling longitudinal analysis of learner progress. This supports adaptive recalibration, where input, tasks, and interaction are adjusted based on performance (Huang, 2023). The result is a closed-loop system in which each stage informs and reshapes the next.

Automatization layer: Procedural fluency development. The final layer represents the transition from controlled to automatic language use. Through repeated cycles of practice, learners develop procedural fluency characterized by rapid retrieval, reduced hesitation, and improved accuracy. This

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process aligns with skill acquisition theory, where repeated meaningful use leads to automatization (Gass, 2008). Retrieval-based practice plays a central role, strengthening memory and enabling efficient language use (Nation, 2001). As automatization increases, cognitive load decreases, allowing learners to focus on meaning rather than form (Abdullaeva, 2022). Importantly, this stage is not final; it initiates new cycles at higher levels of complexity, ensuring continuous development.

Core learning mechanism: Recursive SLA cycle. The framework operates through a recursive cycle:

Input → Noticing → Processing → Interaction → Output → Feedback → Automatization

This cycle is adaptive rather than linear. Feedback continuously reshapes earlier stages, ensuring alignment between learner performance and instructional design. AI regulates precision through personalization and feedback, while gamification sustains engagement through repetition and challenge.

Key Contribution. The framework advances existing research by integrating SLA theory, AI, and gamification into a unified model. It shifts from tool-centered design to mechanism-based instruction, clarifying how technology supports language learning processes. By distinguishing between adaptive regulation (AI) and engagement regulation (gamification), the model explains why technology alone does not guarantee learning outcomes. Its recursive structure reflects language learning as a dynamic system, providing a more realistic and actionable framework for EFL instruction.

Discussion

The findings of this conceptual synthesis indicate that the effectiveness of artificial intelligence (AI) and gamification in EFL instruction depends not on their technological novelty, but on the extent to which they are systematically aligned with core mechanisms of second language acquisition (SLA). Rather than functioning as isolated innovations, AI tools and gamified structures are most effective when embedded within a recursive system that activates noticing, interaction, output, feedback uptake, and procedural fluency. This shift from tool-centered implementation to mechanism-oriented design provides a more coherent foundation for technology-enhanced language learning. From a theoretical perspective, the framework extends cognitive-interactionist models of language acquisition by specifying how digital affordances mediate the transition from exposure to performance. Noticing is enhanced through salience management, interaction is structured through scaffolded and feedback-rich exchanges, and output is operationalized as performance under communicative constraints. In this sense, the framework does not merely transfer SLA concepts into digital contexts but redefines their functioning within an adaptive learning

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system. A key contribution of the model lies in its differentiation between adaptive regulation and engagement regulation. AI governs precision by controlling input complexity, feedback accuracy, and progression pathways, while gamification governs intensity by sustaining attention, repetition, and communicative effort. This distinction addresses a persistent limitation in the literature: high engagement does not necessarily lead to acquisition, and high adaptivity does not guarantee sustained practice. Effective learning emerges from the interaction of both systems rather than from either one independently.

These dynamics are particularly significant for speaking development. In many EFL contexts, learners possess receptive knowledge but lack opportunities for repeated, low-risk, feedback-supported oral production. By combining AI-mediated interaction with gamified task constraints, the framework creates conditions for pushed output, interactional repair, and repeated lexical retrieval. These processes are critical for developing fluency and activating vocabulary in real-time communication. Importantly, speaking is conceptualized not as the frequency of participation but as the cumulative outcome of retrieval under pressure, feedback uptake, and iterative recalibration.

Applicability in the Uzbekistan context. The applicability of the framework in contexts such as Uzbekistan is conditional rather than universal. While the model addresses key instructional limitations—particularly restricted speaking opportunities and limited individualized feedback—its effectiveness depends on adaptation to local conditions. In many Uzbek classrooms, instruction remains teacher-centered, with emphasis on explanation and form-focused activities. In such environments, AI-mediated interaction can expand opportunities for speaking practice by providing low-anxiety environments, while gamified tasks can increase participation by embedding communication within goal-oriented challenges. However, large-scale implementation faces several constraints. Technological infrastructure varies significantly across institutions, affecting access to devices, internet connectivity, and platform reliability. As a result, full implementation of the framework may not be feasible in all contexts. A phased approach is therefore more realistic, beginning with partial integration of key components such as AI-supported speaking tasks and gamified repetition. Teacher preparedness represents another critical factor. The framework assumes the ability to select appropriate tools, design meaningful tasks, and interpret learning analytics. Without targeted professional development, there is a risk that AI and gamification will be applied superficially, resulting in high engagement but limited learning outcomes. This reinforces the argument that methodological integration is more important than technological availability. Learner variables also influence

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applicability. Differences in proficiency, digital literacy, and speaking anxiety affect how learners engage with AI-supported environments. Lower-level learners may benefit from structured scaffolding, while more advanced learners require complex interactional tasks. Although AI interaction can reduce anxiety, excessive reliance on artificial partners may limit exposure to authentic communicative variability.

Limitations and critical considerations. Several limitations should be acknowledged. First, the framework remains conceptual and has not yet been empirically validated. Its effectiveness may vary across contexts, proficiency levels, and instructional settings. Second, the balance between AI-driven adaptivity and gamified engagement is not inherently stable. Excessive gamification may shift focus toward reward-seeking behavior, while overly complex systems may reduce motivation. Third, AI-mediated interaction cannot fully replicate the pragmatic, sociocultural, and discourse-level richness of human communication. While it provides valuable practice opportunities, it should not replace human interaction but rather complement it. These limitations highlight the need for careful implementation and further empirical investigation.

Implications for practice. The framework offers several practical implications for EFL instruction. First, task design should prioritize communicative constraints that require active language use. Learners should be required to retrieve, reformulate, and sustain communication under time pressure rather than engage in passive recognition tasks. Second, tool selection should be function-driven rather than trend-driven. Different AI tools serve different purposes—input calibration, interaction, or feedback—and should be chosen accordingly. This prevents the ineffective use of multiple tools that do not contribute meaningfully to learning outcomes. Third, gamification should be used to structure repetition and persistence rather than simply increase motivation. Effective gamified systems encourage repeated engagement across varied contexts, supporting deeper cognitive processing. Fourth, assessment practices should shift toward performance-based indicators, including fluency, lexical retrieval, interactional responsiveness, and feedback uptake. This provides a more comprehensive measure of communicative competence. Finally, implementation should follow a phased approach. Initial integration may focus on AI-supported speaking tasks, followed by gamified repetition, and eventually more comprehensive systems. This allows adaptation to institutional conditions and supports gradual skill development among both teachers and learners.

CONCLUSION

This study developed a mechanism-based framework for integrating artificial intelligence and gamification into EFL instruction, with a focus on speaking

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development and vocabulary acquisition. The framework aligns technological affordances with core SLA processes, including input, noticing, interaction, output, feedback, and automatization. The primary contribution of the study lies in its shift from tool-centered perspectives to process-oriented instructional design. AI and gamification are conceptualized as regulatory systems within a recursive learning cycle, rather than as isolated innovations. AI governs adaptive precision through personalization and feedback, while gamification sustains engagement through structured repetition and communicative pressure. This dual-regulation model provides a more nuanced explanation of how technology can support language learning. The framework also reconceptualizes language learning as a dynamic and adaptive process. Rather than following a linear progression, learning emerges through iterative cycles of use, feedback, and adjustment. This perspective reflects contemporary views of language acquisition as a complex system. At the same time, the study acknowledges the need for empirical validation. Future research should examine how the framework operates in real instructional settings, particularly the interaction between AI-supported dialogue, gamified engagement, and measurable language outcomes. Experimental studies are needed to assess its impact on speaking fluency and vocabulary activation. In practical terms, the framework offers a flexible model that can be adapted to different contexts, including resource-limited environments. Its value lies in providing a clear structure for aligning technology with pedagogy. When applied effectively, it has the potential to expand speaking opportunities, improve feedback quality, and support sustained language development. Ultimately, the study demonstrates that the effectiveness of AI and gamification depends not on their presence, but on their alignment with learning mechanisms. Technology becomes pedagogically meaningful when it enables learners to notice, process, use, and refine language through structured and adaptive learning cycles.

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