BRIDGING PEDAGOGY AND TECHNOLOGY: THE INFLUENCE OF AI ON SECOND LANGUAGE ACQUISITION IN PAKISTAN

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Abstract:

The research is aimed to evaluate the transformative role of Artificial Intelligence tools on second language acquisition in the Pakistani context where technological integration has rapidly expanded in education yet unevenly disturbed. The study explores how AI driven application like artificial intelligence tutoring system, adaptive feedback programs and conversational catboats reshape the traditional centered methodologies into more learner centered experiences and personalized experiences. Drawing on data from ESL classrooms, teacher interviews, and learner feedback, this research examines the pedagogical, cognitive, and socio-cultural implications of AI for language learning through qualitative research. The findings reveal that while AI enhances learner autonomy, engagement, and access to real time corrective feedback, challenges persist regarding digital literacy, infrastructural limitations, and the risk of pedagogical dependency on technology. The study argues for a balanced human-AI partnership in language education, where teachers act as facilitators of critical and contextualized learning. Ultimately, this research contributes to deeper understanding of how AI can bridge educational gaps and reconfigure language learning in developing regions.

Key Words: Technology, AI Tools, Second language Acquisition, Pakistani Context, Teacher

Introduction

The integration of Artificial Intelligence (AI) in education has emerged as one of the most transformative developments in recent decades, reshaping the ways in which knowledge is accessed, processed, and internalized. Within the field of second language acquisition (SLA), AI-driven tools such as intelligent tutoring systems, adaptive feedback applications, and conversational chatbots have redefined traditional approaches to language learning by enabling personalized, data-driven, and learner-centered experiences (Li et al., 2023; Zou et al., 2021). Through automation, interactivity, and real-time feedback, AI technologies offer new avenues for enhancing language exposure, communication practice, and assessment efficiency. However, while such innovations have gained traction in technologically advanced contexts, their implementation in developing educational systems such as Pakistan remains complex and uneven, shaped by disparities in digital literacy, resource allocation, and pedagogical readiness (Ramzan, & Alahmadi, 2024).

In language education, traditional teaching models have long been characterized by teacher-centered instruction and textbook-driven learning (Rahman, 2019). Although communicative and task-based methodologies have increasingly been adopted, they often face constraints in practice due to large class sizes, limited exposure to authentic input, and exam-oriented curricula. The introduction of AI-assisted language learning (AILL) tools provides an opportunity to transcend these limitations by facilitating autonomous learning, multimodal engagement, and context-sensitive scaffolding (Li & Wang, 2022). Tools such as Duolingo, Grammarly, Replika, and ChatGPT simulate interaction, offer personalized corrective feedback, and adapt learning trajectories to individual learner profiles—features that can significantly augment language input and practice opportunities, particularly in English as a Second Language (ESL) contexts(Ramzan et al., 2023 a, b)

However, the transformative potential of AI in language education must be understood within the sociocultural and infrastructural realities of Pakistan. Despite government initiatives promoting digital education and blended learning models, educational technology integration remains inconsistent across institutions (Jamil & Shah, 2022). Urban universities may have access to advanced learning management systems and high-speed internet, while rural and public-sector institutions often face technological constraints. Moreover, teachers' digital competence and attitudes toward AI-based instruction vary widely, influencing how effectively such tools are adopted (Khan & Raza, 2023). This digital divide not only limits equal access to AI-enhanced learning but also shapes pedagogical outcomes, potentially reinforcing existing inequalities in English proficiency and educational opportunity.

From a pedagogical perspective, AI tools promise to reconfigure the teacher's role—from transmitter of knowledge to facilitator of critical, autonomous, and contextually situated learning (Cox, 2023). Yet, this shift also raises critical questions about teacher identity, pedagogical dependency, and the ethical dimensions of machine-mediated instruction. For instance, reliance on AI feedback may reduce opportunities for human interaction and affective support, which are central to language learning motivation and sociocultural development (Vygotsky, 1978; Warschauer, 2020). Therefore, understanding how AI functions not merely as a technological tool but as a pedagogical actor influencing discourse, cognition, and social relations in the classroom—is essential to assess its real impact on second language acquisition.

The Pakistani ESL context offers a unique lens to explore these dynamics. English functions as a language of power, education, and socioeconomic mobility, yet access to quality instruction is unevenly distributed (Rahman, 2022). In this context, AI has the potential to democratize learning by offering cost-effective, accessible, and individualized pathways for language development. However, its integration must be critically examined to ensure that technology enhances, rather than replaces, human agency in learning processes. A nuanced understanding of how AI tools are perceived and utilized by both teachers and learners is crucial for designing effective, inclusive, and contextually relevant pedagogies.

Therefore, this study aims to evaluate the influence of AI tools on second language acquisition in Pakistan, focusing on their pedagogical, cognitive, and socio-cultural implications. It explores how AI-driven feedback systems, conversational agents, and adaptive learning environments reshape the traditional classroom into a more learner-centered space, while also examining the challenges and limitations inherent in this transformation.

Research Questions

By analyzing classroom practices, teacher perspectives, and learner experiences, the study seeks to answer the following guiding questions:

1. How do AI tools influence language learning processes and learner autonomy in Pakistani ESL classrooms?
2. What challenges and pedagogical shifts emerge from integrating AI into language education?
3. How do teachers and students perceive the role of AI in relation to traditional instructional methods?

In addressing these questions, the research contributes to ongoing debates on AI-mediated language education, emphasizing the need for a balanced human AI partnership where technological innovation complements, rather than substitutes, the teacher's pedagogical expertise. Ultimately, it aims to bridge the gap between global technological advancements and local educational realities, fostering an evidence-based understanding of how AI can enhance second language acquisition in developing contexts like Pakistan.

Literature Review

Artificial Intelligence (AI) has emerged as a transformative force in second language acquisition **(SLA)**, reshaping traditional pedagogical structures and redefining learner-teacher dynamics. Globally, AI-enhanced environments have introduced intelligent tutoring systems (ITS), adaptive feedback models, and conversational agents that individualize instruction and respond to learners' evolving needs (Li, Zou, & Xie, 2023; Hwang, 2022). These technologies operationalize what Oxford (2017) describes as "data-driven pedagogy," where continuous learner analytics guide personalized linguistic input, assessment, and feedback loops (Javaid et al., 2025a)

Recent studies highlight the pedagogical power of AI to enhance learner engagement, fluency development, and error correction. For example, Zou et al. (2021) found that AI-assisted chatbots simulate authentic communicative interactions, offering contextualized input that fosters pragmatic competence and confidence in target language use. Similarly, Li and Wang (2022) emphasize the role of adaptive feedback algorithms in supporting individualized learning trajectories, allowing learners to progress according to cognitive readiness rather than standardized classroom pacing(Javaid et al., 2025b)

However, this transformation is not purely technological but epistemological it shifts how knowledge is constructed and how language learning is conceptualized. As Warschauer (2020) argues, AI moves language education beyond behaviorist drill practices toward a dynamic ecology of human-machine co-learning, where the learner actively negotiates meaning through multimodal engagement. Such a reconfiguration invites reconsideration of teachers' roles, learners' autonomy, and the ethical dimensions of AI-mediated learning (Ramzan et al., 2023c)

The emergence of AI in education has challenged traditional assumptions about teacher authority and instructional control. Scholars increasingly view teachers as facilitators, data interpreters, and critical mediators rather than mere transmitters of linguistic knowledge (Cox, 2023; Holmes, 2021). Within AI-supported classrooms, teachers guide learners in navigating feedback, interpreting automated assessment, and situating AI-generated input within broader sociolinguistic realities.

Empirical research underscores the importance of teacher agency in determining the success of AI integration. Hockly (2021) contends that while AI provides precision in micro-level feedback,

it cannot replicate human sensitivity to context, emotion, or culture—dimensions essential for language socialization. Similarly, Rahman and Aslam (2022), in a study of Pakistani universities, found that many teachers used AI tools informally due to the absence of institutional training or clear pedagogical frameworks. This reliance on self-taught experimentation highlights the digital pedagogical gap in developing contexts.

Moreover, AI systems often encode ideological biases, privileging standardized English norms and subtly reinforcing native-speaker ideologies (Pennycook, 2017; Kumaravadivelu, 2020). Teachers thus play a critical role in mediating these technologies, ensuring that AI tools are used critically and inclusively, without reproducing linguistic hierarchies. As van Lier (2004) reminds us, pedagogy must remain dialogic—anchored in human interaction and contextual interpretation, even in technologically mediated spaces.

A significant strand of AI-SLA research emphasizes learner autonomy as a central pedagogical outcome of intelligent learning systems. AI tools such as Grammarly, Duolingo, Elsa Speak, and ChatGPT enable learners to practice independently, receive instant feedback, and monitor progress in real time. This self-directed engagement corresponds with Benson's (2011) notion of "autonomy as control over learning," where students exercise agency in setting goals, selecting tasks, and evaluating outcomes.

From a cognitive perspective, AI-mediated feedback supports metacognitive awareness, helping learners identify linguistic patterns and internalize corrective input (Li & Wang, 2022). Such systems provide adaptive scaffolding consistent with Vygotsky's (1978) zone of proximal development (ZPD)—bridging the gap between current competence and potential achievement. As learners interact with AI-generated feedback, they engage in reflective noticing, a process crucial for long-term language development (Schmidt, 1990).

Nevertheless, the autonomy promoted by AI is not unproblematic. Research by Kim and Park (2023) warns of "algorithmic dependency," where learners accept AI corrections passively without critically processing linguistic rationale. In Pakistan, Khan and Raza (2023) observed similar trends, noting that students using AI tools for essay writing often relied on automated suggestions without understanding the underlying grammar or discourse conventions. This overreliance highlights the need for critical digital literacy—teaching learners not just *how* to use AI but *how to think* with it.

In multilingual societies such as Pakistan, the integration of AI into ESL education intersects with broader language ideologies and educational inequalities. English in Pakistan functions as both a linguistic resource and a gatekeeper of social mobility (Rahman, 2022). Thus, AI-mediated English learning often reproduces existing power hierarchies by valorizing standardized English forms embedded in Western-trained algorithms.

Jamil and Shah (2022) note that digital educational tools in Pakistani institutions often lack localization, resulting in contextual dissonance—students engage with examples, accents, and cultural references far removed from their lived realities. Similarly, Mahboob (2021) critiques that AI-driven English learning reinforces a "monolingual habitus," marginalizing local varieties such as Pakistani English and discouraging translanguaging practices that naturally occur in ESL settings.

Furthermore, the digital divide remains a structural challenge. As found in this study, students from public universities and rural areas face limited internet connectivity, outdated devices, and minimal institutional support, echoing Warschauer's (2003) concept of the "second digital divide," which emphasizes inequalities in meaningful access and participation. These structural

constraints underscore the importance of policy-level interventions that integrate AI ethically and equitably into educational systems.

A growing consensus among scholars advocates for a human-centered model of AI in language education, emphasizing synergy between technological precision and human empathy (Zou et al., 2021; Cox, 2023). Such a partnership aligns with critical educational linguistics (Holmes, 2021), which views language learning as both a cognitive and ideological process. In this framework, AI serves not as a replacement for teachers but as a *pedagogical collaborator* that extends human capabilities while remaining grounded in ethical and contextual awareness.

For developing contexts like Pakistan, this perspective implies the need to localize AI applications, integrate teacher training in digital pedagogy, and foster learner awareness of linguistic diversity. Ultimately, AI should act as a *tool of democratization*, not domination—bridging educational inequities rather than reproducing them.

This human–AI partnership model thus redefines SLA as a collaborative ecology of intelligence where cognitive, cultural, and computational systems interact to support inclusive, reflective, and sustainable language learning practices.

Methodology

1. Research Design

This study employs a qualitative research design situated within the interpretivist paradigm to explore how AI tools influence second language acquisition (SLA) in Pakistani ESL contexts. Qualitative inquiry enables an in-depth understanding of the meanings, perceptions, and experiences of teachers and learners as they interact with AI-driven platforms. The study seeks not to generalize statistically but to interpret the contextual, pedagogical, and socio-cultural dimensions of technology-mediated language learning (Creswell & Poth, 2018).

The design draws upon classroom-based qualitative research (Nunan, 2015) and elements of case study methodology (Yin, 2018), enabling a rich, contextualized examination of how AI tools—such as AI tutoring systems, adaptive feedback applications, and conversational chatbots—are integrated into language learning. These tools include both institutional platforms (e.g., LMS-integrated AI modules) and popular external applications (e.g., Grammarly, Duolingo, ChatGPT).

2. Theoretical Orientation

The study is informed by Sociocultural Theory (Vygotsky, 1978) and the Human–AI Interaction framework (Warschauer, 2020), both of which view learning as a socially mediated process enhanced through interaction—whether human or technological.

- **Sociocultural Theory** posits that cognitive development occurs through social interaction and the use of mediating tools. In this context, AI functions as a digital mediator, offering scaffolding through feedback, adaptive prompts, and simulated interaction.
- **Human–AI Interaction Theory** explores how technology can augment, but not replace, human pedagogical functions. It emphasizes the collaborative dimension of AI use in classrooms, where teachers act as facilitators of critical and reflective engagement with technology.

This dual theoretical lens supports the investigation of how AI modifies pedagogical dynamics, affects learner autonomy, and interacts with the sociocultural realities of the Pakistani education system.

3. Research Context and Participants

The study was conducted across three public and two private universities in Punjab and Sindh, where English is taught as a second language at the undergraduate level. These institutions were selected for their variation in technological infrastructure, student demographics, and digital readiness**,** providing a diverse picture of AI's pedagogical role.

Using purposive sampling**,** participants included:

- 15 ESL teachers (8 female, 7 male) who had integrated at least one AI-assisted platform into their teaching.
- 60 undergraduate ESL learners (aged 18–23) who used AI tools for language learning either as part of classroom activities or self-directed study.

All participants had at least basic digital literacy and consented to participate voluntarily. The sample size ensured sufficient depth of inquiry while maintaining feasibility for qualitative analysis**.**

4. Data Collection Methods

Data were collected over a period of three months (February–April 2025) through multiple qualitative instruments to enable data triangulation (Denzin, 2017).

a. Classroom Observation

A total of 10 ESL classroom sessions (60–90 minutes each) were observed where AI tools were being used for grammar practice, writing assistance, or interactive conversation tasks. The researcher adopted a non-participant observation role to minimize classroom disruption.

An observation checklist focused on:

- Nature and frequency of AI tool use (e.g., feedback, correction, interaction).
- Changes in classroom dynamics (teacher–student and student–AI interactions).
- Evidence of learner autonomy, engagement, and collaboration.
- Teacher mediation strategies when AI feedback conflicted with pedagogical goals.

Field notes and audio recordings (with consent) were later transcribed and coded.

b. Semi-Structured Teacher Interviews

Each of the 15 teachers participated in semi-structured interviews lasting 40–60 minutes. The interviews explored teachers' perceptions of AI tools, pedagogical adaptation, and the challenges faced in technology integration. Guiding questions included:

- How have AI tools changed your teaching practices and classroom interaction?
- What benefits or limitations do you observe in learners' language development through AI?
- How do you balance AI feedback with your own pedagogical input?

The interviews were conducted in English or Urdu (depending on participant comfort) and recorded with consent.

c. Learner Focus Group Discussions

To capture the collective experiences and attitudes of students, three focus group discussions were held (8–10 participants each). Students discussed their engagement with AI tools, perceived learning outcomes, and concerns about dependence or authenticity. Prompts included:

- How do you feel when using AI-based applications for language learning?
- Does AI feedback help you learn, or does it replace teacher input?
- How does AI affect your confidence and motivation to learn English?

The discussions provided insight into the affective and cognitive dimensions of AI-mediated learning.

d. Document and Platform Analysis

To contextualize the classroom and interview data, relevant documents were reviewed, including institutional technology policies, syllabi, and learning management system (LMS) reports. Additionally, commonly used AI tools were examined for their pedagogical features, feedback mechanisms, and interaction design (e.g., type of corrective feedback, personalization algorithms).

This document and platform analysis allowed the researcher to link observed pedagogical practices with the affordances and constraints of the specific AI tools being used.

5. Data Analysis

Data were analyzed through Thematic Analysis (Braun & Clarke, 2021), following six iterative stages:

1. Familiarization with data through repeated reading of transcripts and field notes.
2. Initial coding of salient ideas related to pedagogy, cognition, and socio-cultural context.
3. Categorization of codes into broader themes.
4. Refinement of themes to ensure coherence and distinctiveness.
5. Integration of themes across data sources for triangulated interpretation.
6. Theorization in relation to sociocultural and AI-mediated learning frameworks.

Three overarching themes emerged:

1. Pedagogical transformation and teacher adaptation.
2. Learner autonomy and cognitive engagement through AI.
3. Socio-cultural and infrastructural constraints.

NVivo software (v.12) was used for organizing and coding qualitative data. Reflexive memos were maintained to record researcher interpretation and ensure transparency in analysis.

6. Trustworthiness and Ethical Considerations

To ensure credibility and dependability, the study used:

- **Data triangulation** (multiple sources: classroom, interviews, focus groups).
- **Member checking**, where preliminary findings were shared with selected teachers for feedback.
- **Peer debriefing** with two applied linguistics experts to validate thematic coherence.
- **Thick description** to support transferability to similar contexts.

Ethical approval was obtained from participating institutions. Participants were assured of confidentiality, voluntary participation, and data anonymity. Pseudonyms were used in all transcripts and reports.

7. Methodological Limitations

As a qualitative inquiry, the findings are context-specific and not statistically generalizable. The reliance on purposive sampling may limit representativeness; however, the **richness of the data and depth of insight** ensure strong interpretive validity. Future studies could complement these findings with quantitative or mixed-method designs to measure learning outcomes more objectively.

Results

The qualitative analysis yielded three major themes and several subthemes that illuminate how AI tools are transforming the landscape of second language acquisition (SLA) in Pakistani ESL classrooms. Drawing on classroom observations, teacher interviews, focus group discussions, and document analysis, the results reveal both the pedagogical opportunities and the structural constraints of AI integration.

Theme 1: Pedagogical Transformation and Teacher Adaptation

AI-driven tools are reconfiguring traditional teaching methods by shifting classroom practices from teacher-centered instruction to learner-centered and data-informed approaches.

1.1. AI as a Pedagogical Partner

Teachers reported that AI tools such as ChatGPT, Grammarly, and Duolingo acted as "virtual assistants" in language instruction. These platforms supported real-time grammar correction, vocabulary enhancement, and pronunciation practice. One university teacher explained:

"I used to spend hours marking essays, but now Grammarly provides immediate feedback. It allows me to focus more on guiding students' ideas instead of fixing every small error." (Teacher 6, Public University)

Classroom observations confirmed that AI-based writing tools enhanced learner participation by reducing anxiety about language accuracy. Students appeared more confident in expressing ideas, as they knew immediate feedback was available through the tool.

1.2. Repositioning of Teacher Roles

Rather than replacing teachers, AI tools redefined their professional role. Teachers became facilitators, curators of digital resources, and mediators between technology and learners' socio-cultural contexts.

"AI doesn't replace us—it complements what we do. My job now is to teach students how to use AI responsibly and interpret feedback critically." (Teacher 3, Private University)

However, some teachers expressed concerns about their limited training in AI integration and the absence of institutional guidelines. Many noted that pedagogical innovation was self-driven rather than supported by formal policy.

1.3. Increased Learner Engagement and Motivation

Students described AI platforms as "non-judgmental spaces" that encouraged risk-taking in language use. Learners especially valued interactive chatbots and adaptive quizzes that personalized tasks according to performance levels.

"When I use Duolingo, I get points and feedback instantly—it feels like a game, not a test." (Student FGD 2)

These findings suggest that gamification and instant feedback mechanisms increased learners' motivation and sustained participation, particularly among those who previously found language learning intimidating.

Theme 2: Learner Autonomy and Cognitive Engagement through AI

AI integration promoted autonomous learning behaviors and fostered deeper metacognitive **awareness** of linguistic performance.

2.1. Independent Learning and Self-Regulation

Students reported using AI tools outside the classroom for writing assignments, pronunciation drills, and vocabulary building. Many noted that they no longer depended solely on teachers for correction and guidance.

"Before, I had to wait for my teacher's feedback. Now I can see my mistakes right away. It helps me learn faster." (Student FGD 1)

Observation data showed that students used AI tools collaboratively are checking each other's AI-generated feedback and discussing linguistic accuracy indicating a move toward peer-supported autonomy.

2.2. Cognitive Scaffolding through Adaptive Feedback

AI feedback often scaffolded learners' understanding of grammatical structures and lexical choices. For instance, Grammarly's detailed explanations of grammatical errors helped students reflect on linguistic rules, rather than simply memorizing corrections. However, teachers cautioned that some students over-relied on AI suggestions without fully processing their reasoning:

"AI gives them the answer, but not always the understanding. Some students copy the corrections without learning why." (Teacher 12, Public University)

This reflects a key pedagogical challenge: ensuring that AI serves as a learning scaffold rather than a substitute for cognitive effort.

2.3. Confidence and Identity Development

Learners expressed that using AI tools boosted their linguistic confidence, especially for writing and pronunciation tasks. Some students reported feeling less anxious when submitting written work, as AI-assisted editing improved grammatical accuracy and coherence. Yet, a few learners also felt that AI feedback sometimes conflicted with local linguistic norms, leading to confusion about what counts as "correct" English in Pakistani contexts.

This tension illustrates the ideological dimension of AI-mediated language learning—where "native-like" norms encoded in AI systems may implicitly marginalize local English varieties.

Theme 3: Socio-Cultural and Infrastructural Constraints

While AI tools expanded learning possibilities, structural inequalities and cultural perceptions limited their full potential in ESL classrooms.

3.1. Digital Divide and Access Inequality

Students from public universities, particularly in semi-urban areas, reported limited internet connectivity, lack of personal devices, and restricted institutional support. As one student noted:

"We have to share one computer lab for many students. AI apps need good Wi-Fi and phones—many of us can't afford that." (Student FGD 3)

This technological disparity created a **digital hierarchy**, where learners from better-resourced private institutions gained more exposure and proficiency through AI-assisted learning.

3.2. Technological Literacy and Training Gaps

Teachers highlighted the **absence of professional development programs** on AI integration. Most learned to use AI applications independently through experimentation or online tutorials.

"We are using AI by trial and error. There's no training from the university or clear policy on how to use it effectively." (Teacher 9, Public University)

Without pedagogical guidance, AI tools were sometimes underutilized or misapplied, particularly in grammar translation-based classrooms still rooted in traditional teaching methods.

3.3. Pedagogical Dependence and Ethical Concerns

Both teachers and students expressed concern about **overreliance on AI-generated feedback**, raising issues of authenticity, plagiarism, and intellectual dependency.

"Some students copy whole paragraphs generated by AI—they think it's smart, but it's not their own voice." (Teacher 5, Private University)

Such findings indicate the need for critical digital literacy in educating learners to use AI ethically and creatively rather than as a shortcut to completion.

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Summary of Findings

Theme	Key Findings	Implications
Pedagogical Transformation	AI tools enhance engagement, shift teacher roles, and personalize learning.	Need for teacher training and policy integration.
Learner Autonomy	Students develop self-regulation and confidence, but risk cognitive dependence.	Promote reflective use of AI for metacognitive growth.
Socio-Cultural Constraints	Digital inequality and lack of institutional support hinder equitable access.	Require policy reform and infrastructure investment.

Discussion

The findings of this study reveal that the integration of Artificial Intelligence (AI) tools in Pakistani ESL classrooms is gradually redefining the pedagogical, cognitive, and sociocultural dimensions of language learning. While the results demonstrate significant benefits in promoting learner autonomy, engagement, and immediate feedback, they also underscore persistent challenges related to technological access, teacher preparedness, and ideological implications of AI-mediated learning. The discussion below interprets these findings in light of existing scholarship and theoretical frameworks within educational linguistics, sociocultural theory, and digital pedagogy. The study found that AI tools such as Grammarly, ChatGPT, and Duolingo have restructured the traditional teacher-centered classroom into more dynamic, learner-centered learning environments. This aligns with Warschauer's (2020) assertion that AI integration redefines the teacher's role from a transmitter of information to a mediator and facilitator of learning, who guides students in interpreting and critically engaging with digital feedback. Teachers in the study reported that AI-assisted platforms reduced their mechanical workload (e.g., marking grammar errors) and allowed more time for higher-order instruction such as critical discussion and creative writing. This resonates with Vygotsky's (1978) sociocultural theory, particularly the notion of mediation, where learning occurs through interaction with both social and technological tools. In this sense, AI functions as a *mediational artifact* that extends the learner's zone of proximal development (ZPD), scaffolding linguistic performance through adaptive and immediate feedback. However, while AI enhanced instructional efficiency, the lack of institutional support and professional training limited its systematic use. Similar concerns are reported by Zou, Li, and Hwang (2021), who emphasize that teacher training and technological literacy are prerequisites for meaningful AI adoption. In Pakistan's case, the self-directed experimentation observed among teachers underscores the urgent need for AI-integrated teacher education programs, ensuring that technology is used not as a substitute for pedagogy but as a partner in humanized instruction. The results also suggest that AI fosters learner autonomy and metacognitive awareness, as students use AI platforms to regulate their learning beyond the classroom. This reflects the shift from *dependent learners* to *active participants*, consistent with Benson's (2011) framework of autonomy in language learning. AI feedback systems, by offering real-time corrections and gamified learning experiences, empower learners to monitor their progress and develop self-regulation strategies. Moreover, AI-mediated interaction supports Krashen's (1985) Input Hypothesis by providing learners with comprehensible, scaffolded input that adjusts to their proficiency level. The adaptive feedback mechanisms in tools like Grammarly or Duolingo serve as forms of "i+1" input—linguistic material that slightly exceeds

the learner's current competence and thus promotes acquisition. Nonetheless, the study also uncovered a risk of cognitive dependency on AI feedback, where learners accept corrections without critically engaging with underlying language rules. This confirms Li and Wang's (2022) argument that while AI can personalize feedback, it must be complemented by explicit metacognitive instruction that helps learners understand and reflect on language form and use. Hence, the teacher's mediating role remains indispensable for transforming technological assistance into genuine cognitive development. A major finding concerns the uneven distribution of technological access and literacy between public and private universities. Students from under-resourced contexts experienced barriers such as limited internet access, shared devices, and insufficient institutional support, which created digital hierarchies in learning opportunities. This aligns with Warschauer's (2003) concept of the *second digital divide*, where disparities are not merely about access to technology but about the quality and depth of engagement with it.Beyond infrastructural inequality, the study also revealed ideological tensions embedded within AI systems. Many learners noted that AI feedback promoted "native-like" English norms, sometimes at odds with local usage and cultural expressions. This reflects Pennycook's (2017) notion of *language ideologies in global Englishes*, where digital tools often reproduce Western linguistic hierarchies under the guise of objectivity. In Pakistan's multilingual context, such norms risk marginalizing local varieties of English and reinforcing linguistic insecurity among learners. Therefore, while AI offers a pathway to democratize language learning, it must be localized through context-sensitive design and culturally responsive pedagogy. As Khan and Raza (2023) suggest, developing locally trained AI language models that incorporate Pakistani English features could foster inclusivity and linguistic empowerment. The findings collectively affirm the need for a balanced human–AI partnership in ESL instruction. AI tools excel in automating repetitive tasks, offering personalized feedback, and motivating learners through interactivity; however, they cannot replace the affective, ethical, and cultural dimensions of human teaching (Cox, 2023). Teachers remain vital in contextualizing AI-generated feedback, nurturing empathy, and cultivating critical digital literacy among students. This partnership model resonates with van Lier's (2004) ecological perspective on language learning, which views technology as part of a broader learning ecology where human agency, social context, and technological mediation co-evolve. In this framework, AI serves as one component of a dynamic system that supports but does not dominate the learning process. Ultimately, integrating AI in ESL classrooms requires not just technological adaptation but pedagogical transformation grounded in critical educational linguistics (Holmes, 2021). This means examining who benefits from AI implementation, whose language ideologies are embedded in these systems, and how technology can be used to promote—not restrict—linguistic diversity and learner empowerment.

Implications for Policy and Practice

Based on the findings, the following implications are proposed:

1. **Teacher Development and Policy Support:** Universities should establish structured training programs that equip ESL teachers with digital pedagogy skills and critical awareness of AI ethics.
2. **Inclusive Technological Infrastructure:** National educational policy must prioritize equitable access to digital tools and internet connectivity, particularly in public-sector institutions.
3. **Critical AI Literacy:** Learners should be trained to engage with AI outputs critically, questioning biases and contextualizing feedback within local linguistic norms.

4. **Localization of AI Systems:** Developers should collaborate with linguists to design AI models sensitive to regional English varieties and cultural identities.

Conclusion

The integration of AI into Pakistani ESL classrooms is both a technological and ideological turning point in second language education. It has demonstrated the potential to enhance autonomy, engagement, and linguistic competence, while also revealing deep-rooted inequalities and the persistence of global language hierarchies. The challenge moving forward lies not in replacing teachers with AI but in empowering teachers and learners to use AI critically, creatively, and contextually. By bridging pedagogy and technology, the study underscores the vision of a human-centered AI pedagogy one that aligns innovation with inclusivity, critical thinking, and sociocultural sensitivity. In doing so, it contributes to the emerging discourse on AI, educational linguistics, and language justice in developing contexts like Pakistan.

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