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# ARTIFICIAL INTELLIGENCE-POWERED VOCABULARY ACQUISITION: PERCEPTIONS AND PERFORMANCE OF UNIVERSITY STUDENTS IN PAKISTAN

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## Abstract
*This study explores how artificial intelligence (AI) tools influence English vocabulary acquisition among university students in Pakistan, with particular attention to learners' perceptions and experiences. Framed within a qualitative research design, the investigation employed semi-structured interviews and focus group discussions with undergraduate students across three universities. Participants had prior exposure to AI-powered platforms such as ChatGPT, Grammarly, and vocabulary learning applications, which provided an authentic context for examining their engagement with digital language tools. Findings reveal that students perceive AI as both a facilitator of autonomous learning and a motivator for expanding their lexical repertoire. Participants highlighted the immediate feedback, personalized suggestions, and interactive nature of AI applications as key factors enhancing their vocabulary retention and usage. However, concerns were expressed regarding overreliance on AI, potential inaccuracies in automated outputs, and limited critical thinking when vocabulary learning is fully outsourced to technology. Interestingly, students reported that AI tools encouraged them to engage more actively in self-directed learning, while also reshaping classroom interactions where teachers increasingly acted as facilitators rather than sole knowledge providers. The study concludes that AI holds significant promise for enhancing vocabulary acquisition in higher education settings, provided it is integrated thoughtfully alongside traditional pedagogical approaches. By foregrounding learners' voices, this research underscores the need for context-sensitive strategies that balance technological innovation with critical literacy skills. These findings contribute to growing scholarship on educational technology in developing countries, particularly within the English as a Foreign Language (EFL) context.*

***Keywords:*** *Artificial Intelligence, Vocabulary Acquisition, EFL, University Students*

## Introduction

In the digital age, language learning is being reshaped by the integration of advanced technologies, most notably artificial intelligence (AI). Over the last decade, the global adoption of AI tools has transformed education by providing learners with immediate feedback, adaptive content, and personalized learning pathways (Li & Ni, 2021). Within the domain of English as a Foreign Language (EFL), vocabulary acquisition has remained a central concern because lexical competence forms the foundation of communicative proficiency (Nation, 2013). Traditional approaches to vocabulary instruction—such as rote memorization, dictionary use, and teacher-led

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drills—have often been criticized for being monotonous and limited in their capacity to sustain learners' motivation (Schmitt, 2010). Against this backdrop, AI-powered tools such as Grammarly, ChatGPT, and Quizlet have emerged as innovative platforms offering dynamic, learner-centered opportunities for vocabulary development.

For university students in Pakistan, English proficiency represents more than academic success; it is also a gateway to professional advancement and international engagement. English is not only the medium of instruction in most higher education institutions but also a prerequisite for employment in both domestic and global markets (Mahboob, 2017). Despite its importance, many Pakistani undergraduates struggle with inadequate vocabulary knowledge, a challenge that hampers their reading comprehension, writing skills, and overall communicative competence (Manan, David, & Dumanig, 2016). This persistent gap suggests that conventional teaching methods may be insufficient in meeting the lexical needs of EFL learners in Pakistan. Consequently, there is a pressing need to explore how AI-powered tools can supplement or transform vocabulary acquisition practices in higher education.

AI tools provide learners with interactive features such as instant error correction, semantic suggestions, and contextualized examples that traditional classrooms often cannot offer (Godwin-Jones, 2020). For instance, Grammarly assists students by identifying lexical and grammatical inaccuracies while simultaneously suggesting alternative vocabulary items. ChatGPT and similar conversational agents expose learners to authentic, context-rich interactions that mirror real-life communication. Such tools not only enhance lexical knowledge but also foster autonomous learning, enabling students to take greater control of their progress (Zou & Xie, 2019). This autonomy is particularly significant in Pakistani universities, where large class sizes and limited teacher-student interaction often restrict personalized vocabulary instruction (Shamim & Rashid, 2019).

The significance of this study lies in its attempt to situate vocabulary acquisition within the evolving intersection of language pedagogy and AI-driven technology. By focusing on Pakistani university students, the research acknowledges a context where linguistic challenges are compounded by structural limitations in higher education. Moreover, investigating students' perceptions of AI use is critical because technology acceptance is often mediated by cultural attitudes, institutional support, and individual learner readiness (Teo, 2011). Understanding how learners in Pakistan perceive AI-powered vocabulary learning tools can therefore inform policy makers, educators, and curriculum designers about the potential benefits and challenges of integrating such technologies into EFL instruction.

While global scholarship increasingly documents the role of AI in language learning (Fryer & Carpenter, 2006; Kukulska-Hulme, 2020), research specific to developing countries remains limited. In Pakistan, studies have primarily addressed broader issues of English language teaching, such as curriculum design, teacher training, and socio-political influences (Mahboob, 2017; Shamim, 2008). Little is known about the micro-level processes by which learners engage with AI applications for vocabulary acquisition and the implications for pedagogical practices. This gap

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highlights the problem at the heart of the current study: the absence of empirical, context-specific research examining the intersection of AI technology and vocabulary learning among Pakistani undergraduates.

The problem is further compounded by concerns that AI, while promising, may create new challenges. Overreliance on AI feedback could reduce learners' critical thinking, encourage superficial memorization, or even lead to the uncritical adoption of incorrect lexical suggestions when algorithms make errors (Zawacki-Richter et al., 2019). Additionally, disparities in access to digital resources across urban and rural universities may widen the gap between privileged and disadvantaged students. Thus, while AI-powered tools have the potential to enhance vocabulary learning, their effectiveness cannot be assumed without careful investigation of learners' experiences and perceptions within the Pakistani higher education system.

This study addresses these issues by exploring how Pakistani university students perceive and experience AI-powered vocabulary acquisition. By employing a qualitative research design, the study seeks to foreground learners' voices and provide nuanced insights into both the opportunities and constraints associated with AI tools. Such an inquiry is significant for multiple stakeholders: for students, it identifies ways to optimize self-directed learning; for teachers, it offers strategies for integrating technology into instruction; and for policy makers, it provides evidence-based guidance for developing digital learning initiatives. In sum, the study situates itself within the urgent need to rethink vocabulary pedagogy in Pakistan through the lens of technological innovation while remaining attentive to learners' contextual realities.

**Research Questions**

Q1. How do Pakistani university students perceive the role of AI-powered tools in enhancing their English vocabulary acquisition?

Q2. What experiences do students report regarding the use of AI applications (e.g., ChatGPT, Grammarly, Quizlet) for vocabulary learning in academic and self-directed contexts?

Q3. What challenges and limitations do students identify when relying on AI tools for vocabulary development in higher education settings?

**Literature Review**

**The Centrality of Vocabulary in EFL Learning**

Vocabulary acquisition has long been recognized as a cornerstone of language proficiency in English as a Foreign Language (EFL) contexts. According to Nation (2013), lexical knowledge is essential for reading comprehension, writing fluency, and oral communication. Without an adequate vocabulary, learners cannot progress beyond rudimentary language use, regardless of their grammatical competence. Schmitt (2010) further emphasizes that vocabulary is not only cumulative but also incremental, requiring continuous exposure and practice in multiple contexts. This makes vocabulary learning both a critical and challenging aspect of EFL instruction, especially in contexts such as Pakistan, where exposure to authentic English usage is limited outside classrooms (Dumanig et al., 2016).

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Traditional approaches to vocabulary instruction in Pakistan have relied heavily on rote memorization, word lists, and dictionary work. While these methods can aid short-term recall, they are often criticized for failing to promote long-term retention or contextualized use of vocabulary (Shamim, 2008). These limitations create a strong rationale for exploring innovative, technology-enhanced approaches, particularly those offered by artificial intelligence (AI).

**Artificial Intelligence in Language Learning**

Artificial intelligence has become one of the most transformative forces in education. Li and Ni (2021) describe AI as offering adaptive learning, personalized instruction, and immediate feedback—characteristics that address the shortcomings of traditional one-size-fits-all teaching methods. Within language learning, AI tools provide affordances such as speech recognition, natural language processing, and machine learning algorithms that can tailor learning experiences to individual needs (Godwin-Jones, 2020).

Tools like Grammarly, Duolingo, and ChatGPT illustrate how AI supports vocabulary acquisition by identifying learners' weaknesses, offering corrective feedback, and exposing them to context-based language use. Zou and Xie (2019) argue that AI-powered applications enhance motivation by making learning interactive and autonomous. Similarly, Fryer and Carpenter (2006) highlight the role of conversational bots in simulating authentic communication environments, where vocabulary is learned in meaningful contexts rather than isolation.

For EFL learners in developing countries, AI offers a scalable solution to issues of limited teacher availability, large class sizes, and inadequate instructional resources. This is particularly relevant in Pakistan, where structural challenges often hinder effective vocabulary instruction (Shamim & Rashid, 2019).

**Vocabulary Acquisition through AI Tools**

Research has consistently shown that AI technologies can accelerate vocabulary acquisition by providing contextual learning opportunities and continuous reinforcement. Nation (2013) asserts that words learned through repeated contextual encounters are more likely to be retained and actively used. AI tools operationalize this principle by offering learners personalized, repeated exposure to target vocabulary.

For instance, Quizlet employs machine learning to adapt flashcard repetition to individual learner performance, ensuring optimal retention. Grammarly identifies not only errors but also suggests more precise lexical choices, thereby enhancing learners' productive vocabulary. ChatGPT, as a conversational agent, provides context-rich interactions, simulating real-life dialogues in which learners acquire vocabulary organically (Godwin-Jones, 2020).

Despite these benefits, concerns remain regarding overreliance on AI. Zawacki-Richter et al. (2019) caution that learners may adopt AI suggestions uncritically, potentially perpetuating inaccuracies or hindering deeper cognitive processing. Therefore, AI must be integrated thoughtfully into broader pedagogical frameworks.

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**Students' Perceptions of AI in Language Learning**

Understanding learners' perceptions is vital because attitudes toward technology often determine its acceptance and effectiveness. The Technology Acceptance Model (TAM) suggests that perceived usefulness and perceived ease of use strongly predict learners' willingness to adopt new technologies (Teo, 2011).

Studies across diverse contexts have found that students generally perceive AI tools as helpful for improving vocabulary and language proficiency. Zou and Xie (2019) report that learners appreciated the autonomy and immediate feedback provided by AI systems. Kukulska-Hulme (2020) notes that mobile-assisted and AI-supported learning tools are valued for their flexibility and portability, which align with contemporary learners' digital lifestyles.

In Pakistan, however, perceptions may be shaped by socio-cultural and infrastructural factors. For example, Mahboob (2017) highlights that unequal access to technology and digital literacy gaps remain significant barriers in higher education. Students from urban universities may find AI tools accessible and motivating, while those from rural institutions may struggle due to poor internet connectivity and limited exposure. Hence, perceptions of AI are not uniform but shaped by contextual realities.

**The Role of Autonomous Learning**

One of the most celebrated advantages of AI-powered vocabulary acquisition is its promotion of autonomous learning. Benson (2013) defines autonomy as the capacity of learners to take control of their own learning, which includes setting goals, selecting resources, and monitoring progress. According to Shah et al. (2025), AI applications align with this principle by offering personalized pathways and immediate feedback, enabling students to identify and address their own weaknesses.

For Pakistani learners, who often study in teacher-centered classrooms, AI introduces a paradigm shift toward learner-centered practices. Shamim and Rashid (2019) observe that large class sizes in Pakistan limit teachers' ability to provide individualized vocabulary instruction. AI tools can fill this gap by offering tailored support, allowing students to practice independently outside classroom hours.

**Challenges of AI Integration in Pakistani Higher Education**

Despite its promise, AI integration into vocabulary instruction in Pakistan faces multiple challenges. Zawacki-Richter et al. (2019) highlight concerns regarding ethical use, data privacy, and the accuracy of AI outputs. For example, automated suggestions may occasionally provide incorrect lexical items, leading to confusion rather than learning.

Infrastructure is another major barrier. According to Shamim (2008), many Pakistani universities struggle with inadequate digital facilities, unreliable internet access, and limited teacher training in technology use. These systemic constraints hinder the widespread adoption of AI-based learning solutions.

Furthermore, there are cultural considerations. Learners in Pakistan are accustomed to traditional teacher-centered models, and shifting to autonomous, technology-driven approaches may create

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resistance (Mahboob, 2017). Without adequate orientation and institutional support, students may fail to harness the full potential of AI tools.

**Problem Statement in Context**

The reviewed literature highlights a paradox: while AI tools hold immense potential for enhancing vocabulary acquisition, particularly by promoting autonomy and contextualized learning, their implementation in Pakistan remains underexplored. The absence of empirical research on Pakistani learners' perceptions and experiences constitutes a significant gap. Existing studies have documented AI's benefits globally (Godwin-Jones, 2020; Zou & Xie, 2019), but contextual realities in Pakistan—such as digital divides, educational inequities, and cultural attitudes—necessitate local investigation.

This study, therefore, addresses the critical problem of understanding how Pakistani university students perceive and experience AI-powered vocabulary acquisition, with the aim of informing future pedagogical strategies that balance innovation with contextual sensitivity.

**Conceptual Framework**

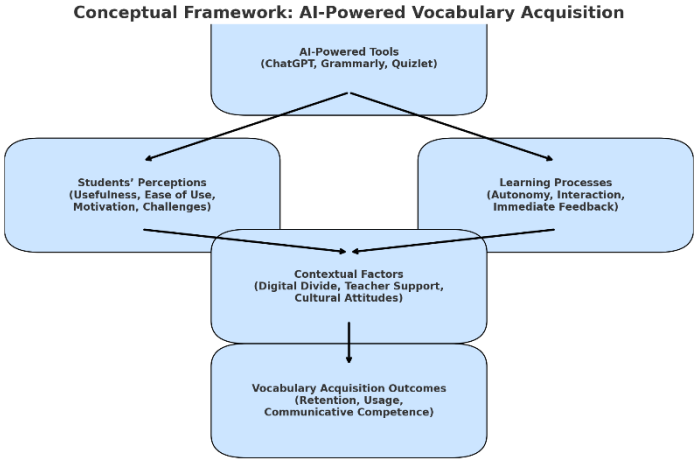


*Figure 1: Conceptual Framework for AI-Powered Vocabulary Acquisition*

The conceptual framework (Figure 1) demonstrates the multi-dimensional pathways through which artificial intelligence (AI) tools impact vocabulary acquisition in the Pakistani higher education context, positioning AI-powered tools such as ChatGPT, Grammarly, and Quizlet at the top as central technological drivers that directly influence two key domains: students' perceptions and learning processes. Students' perceptions—covering perceived usefulness, ease of use, motivation, and recognition of challenges—are critical because they shape learners' acceptance and sustained engagement with technology (Teo, 2011), while learning processes—autonomy, interactive engagement, and immediate feedback—reflect the pedagogical affordances of AI that enhance active vocabulary acquisition (Zou & Xie, 2019). Both perceptions and learning processes intersect with contextual factors, including the digital divide, institutional support, and cultural attitudes toward technology, which mediate how AI tools are used in practice; these contextual realities are especially salient in Pakistan, where disparities in access to technology and teacher

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readiness can either facilitate or hinder AI integration (Mahboob, 2017; Shamim & Rashid, 2019). At the base of the framework, these interconnected elements converge to shape vocabulary acquisition outcomes—improved retention, greater active usage of vocabulary, and enhanced communicative competence—core indicators of successful EFL learning (Nation, 2013; Shah et al., 2025). Overall, the framework underscores a dynamic relationship between technology, learners, and context, emphasizing that AI's impact on vocabulary learning is not linear but mediated by perceptions and contextual realities; this holistic model guides the present study's qualitative exploration of how Pakistani undergraduates experience AI-powered vocabulary acquisition.

## Research Methodology

### Research Design

This study adopts a qualitative research design to explore how university students in Pakistan perceive and experience the use of artificial intelligence (AI) tools for vocabulary acquisition. A qualitative approach is particularly appropriate for this study because it seeks to capture learners' subjective experiences, attitudes, and contextual realities rather than to quantify outcomes (Creswell & Poth, 2018). The design is interpretivist in orientation, focusing on how meaning is constructed by learners in their engagement with AI-powered platforms such as ChatGPT, Grammarly, and Quizlet.

### Research Setting and Participants

The research was conducted in three public and private universities in Pakistan where English serves as the medium of instruction in higher education. Participants were selected using purposive sampling, which allowed the inclusion of undergraduate students with prior experience using AI applications for academic or personal learning. A total of 30 students (10 from each university) participated in the study. Efforts were made to ensure diversity in terms of gender, academic discipline, and socio-economic background to capture a wide range of perceptions and experiences.

### Data Collection Methods

Two primary data collection methods were employed:

1. **Semi-Structured Interviews**
   Individual interviews were conducted with 15 students to elicit in-depth accounts of their experiences with AI-powered vocabulary tools. The semi-structured format provided flexibility to probe into emerging themes while ensuring consistency across participants (Kvale & Brinkmann, 2015).
2. **Focus Group Discussions (FGDs)**
   Two focus group discussions, each comprising 7–8 participants, were organized to explore collective perspectives and stimulate interaction among learners. This method was particularly useful for understanding how shared experiences and peer discussions shaped attitudes toward AI tools in language learning.

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Both methods were guided by open-ended questions derived from the research questions, covering areas such as perceived usefulness of AI, challenges in adoption, and perceived influence on vocabulary development. Interviews and FGDs were conducted in English and Urdu, depending on participants' preference, and were audio-recorded with consent.

**Data Analysis**

Data were analyzed using thematic analysis as outlined by Braun and Clarke (2006). Transcripts were coded inductively to identify recurring patterns and themes. Initial coding was followed by categorization into broader thematic domains, including *perceptions of AI usefulness*, *autonomy in learning*, *challenges and limitations*, and *vocabulary outcomes*. NVivo software was employed to organize and manage the data, ensuring systematic analysis. Thematic analysis was chosen because of its flexibility and its capacity to capture both manifest and latent meanings in qualitative data.

**Trustworthiness of the Study**

To ensure credibility, member checking was conducted, allowing participants to review and confirm the accuracy of transcriptions and interpretations. Triangulation was achieved by comparing findings from interviews and FGDs, which strengthened the validity of emerging themes. Peer debriefing with academic colleagues was also used to enhance confirmability. Dependability was maintained through an audit trail documenting decisions made during data collection and analysis (Lincoln & Guba, 1985).

**Ethical Considerations**

Ethical approval was obtained from the participating universities. Informed consent was collected from all participants, who were assured of their right to withdraw at any stage. Anonymity and confidentiality were maintained by assigning pseudonyms to participants and securely storing all audio recordings and transcripts. Given the sensitivity of digital learning in developing contexts, participants were informed about the purpose of the study and the voluntary nature of their involvement.

**Limitations**

The qualitative design, while rich in insights, limits the generalizability of findings to the broader population of Pakistani students. The study also focused on students from three universities, which may not fully capture experiences across different regions or institutions. Nevertheless, the findings provide valuable context-specific insights into how AI-powered tools influence vocabulary acquisition in higher education settings.

**Research Findings**

The analysis of interview and focus group data revealed four major themes regarding university students' perceptions and experiences of AI-powered vocabulary acquisition in Pakistan: (1) perceptions of AI usefulness, (2) AI and learner autonomy, (3) challenges and limitations, and (4) vocabulary acquisition outcomes. These themes capture the nuanced ways students engaged with AI tools, highlighting both opportunities and constraints in their academic context.

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**Perceptions of AI Usefulness**

Most participants viewed AI-powered tools as highly beneficial in supporting vocabulary development. Applications such as Grammarly and ChatGPT were praised for providing instant feedback and contextualized word suggestions, which participants felt were missing in traditional classroom instruction. Students noted that AI tools reduced their dependence on teachers for vocabulary explanations and allowed them to explore new words independently. For example, one student remarked:

*"When I use Grammarly, it doesn't just correct my words, it gives me better vocabulary options. I feel like my writing becomes richer instantly."*

This perception aligns with the Technology Acceptance Model (Teo, 2011), where perceived usefulness directly shapes learner adoption. The interactive and adaptive nature of AI made students feel that their learning was more personalized and efficient. Focus group discussions further revealed that students believed AI increased their motivation, as they could immediately see progress in their vocabulary use.

**AI and Learner Autonomy**

A significant finding was the role of AI in fostering autonomous learning practices. Many students reported that they used AI tools outside classroom hours to practice vocabulary in ways that suited their individual learning styles. ChatGPT, in particular, was seen as an "always available partner" for practicing word usage in sentences or dialogues.

Several participants expressed that AI reduced their anxiety in experimenting with new words. They could test vocabulary without fear of judgment, which encouraged them to take more risks in language use. As one student explained:

*"I feel more confident trying new words with ChatGPT because it doesn't judge me. Later, I use those words in class discussions."*

This theme reflects Benson's (2013) notion of learner autonomy, where technology becomes a facilitator for self-directed and reflective learning. Students emphasized that AI tools allowed them to set personal goals, track progress, and monitor their vocabulary development over time.

**Challenges and Limitations**

Despite the positive perceptions, participants also identified several challenges in relying on AI for vocabulary learning. A recurring concern was overreliance on automated feedback, which sometimes led to passive acceptance of AI suggestions without critical evaluation. For example, some students noted that they occasionally adopted incorrect or awkward vocabulary provided by AI without verifying its appropriateness.

Another key limitation was infrastructural inequality. Students from rural or resource-constrained backgrounds reported limited access to high-speed internet and personal devices, which hindered consistent engagement with AI applications. A participant from a rural university expressed:

*"We know these tools are useful, but many times the internet is too weak to use them properly. It makes us feel left out compared to students in big cities."*

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Additionally, participants highlighted linguistic and cultural mismatches in AI tools. They noted that certain vocabulary suggestions did not align with Pakistani academic or cultural contexts, making them less practical for everyday use. Teachers' limited training in integrating AI into classrooms was also mentioned, with students observing that while some instructors encouraged AI use, others discouraged it due to fears of academic dishonesty or plagiarism.

**Vocabulary Acquisition Outcomes**

Students consistently reported improvements in vocabulary retention, active usage, and communicative competence as outcomes of AI-assisted learning. Many participants noted that the repetition and contextual reinforcement provided by AI tools made words easier to remember. Quizlet's adaptive flashcard system was cited as particularly helpful for memorization, while Grammarly and ChatGPT were valued for promoting active use of words in writing and dialogue. Participants also shared that AI tools enhanced their academic writing, enabling them to employ more precise and sophisticated vocabulary. One student described:

*"Before using AI tools, my essays were very simple. Now I can use advanced words and my professors notice the difference."*

Moreover, students highlighted that these tools improved their communicative confidence. Practicing with conversational bots enabled them to use vocabulary in simulated real-life contexts, which reduced hesitation in classroom discussions and oral presentations.

However, some participants acknowledged that vocabulary gains were sometimes short-term if they relied solely on AI without additional practice or teacher reinforcement. This finding underscores the need for blended approaches that combine AI affordances with traditional pedagogy.

**Summary of Findings**

The findings illustrate a complex picture of AI-powered vocabulary acquisition among Pakistani university students. On one hand, AI was perceived as a valuable, motivating, and autonomy-enhancing resource that improved vocabulary retention and usage. On the other hand, structural barriers, overreliance risks, and contextual mismatches constrained its effectiveness. Importantly, the results highlight that the impact of AI is not linear but shaped by the interplay of perceptions, learning processes, and contextual realities, as outlined in the conceptual framework.

These insights suggest that while AI has considerable potential to transform vocabulary learning in Pakistan, its integration must be supported by equitable access, teacher guidance, and strategies that encourage critical engagement with technology rather than passive dependence.

**Discussion**

The purpose of this study was to explore Pakistani university students' perceptions and experiences of artificial intelligence (AI)-powered tools for vocabulary acquisition. Guided by a qualitative research design, the findings highlighted four interrelated themes: (1) perceptions of AI usefulness, (2) AI and learner autonomy, (3) challenges and limitations, and (4) vocabulary acquisition outcomes. These findings contribute to the growing body of scholarship on AI in education by situating learners' voices within a developing country context, thereby extending global

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discussions of technology-enhanced language learning into a context where digital divides and pedagogical traditions strongly shape outcomes.

**Perceptions of AI Usefulness**

Consistent with prior studies, participants overwhelmingly perceived AI-powered tools as useful in enhancing their vocabulary acquisition. Applications such as Grammarly and ChatGPT were valued for providing instant, personalized feedback that traditional classrooms often fail to deliver (Godwin-Jones, 2020). Students' emphasis on the motivational aspects of AI tools echoes Zou and Xie's (2019) findings that adaptive, interactive learning environments increase learner engagement.

This aligns with the Technology Acceptance Model (Teo, 2011), which posits that perceived usefulness and ease of use predict technology adoption. In this study, students repeatedly emphasized both dimensions, suggesting that positive perceptions directly influenced their willingness to integrate AI into their vocabulary learning practices. However, unlike findings in highly digitized contexts, Pakistani learners also foregrounded issues of accessibility and equity, illustrating how structural barriers shape perceptions in resource-constrained settings.

**AI and Learner Autonomy**

A notable finding of this study was the role of AI in fostering autonomous learning behaviors. Students used AI tools to practice vocabulary outside the classroom, track progress, and experiment with language in risk-free environments. This reflects Benson's (2013) conceptualization of autonomy, where learners assume greater responsibility for their language learning. Participants' accounts indicated that AI tools not only supplemented teacher instruction but also shifted the locus of control toward the learner.

These findings resonate with Kukulska-Hulme's (2020) work on mobile and AI-supported learning, which highlights the capacity of technology to extend learning beyond institutional boundaries. In Pakistan, where teacher-centered pedagogy and large class sizes restrict individualized feedback (Shamim & Rashid, 2019), AI tools offered students a sense of independence and personalization that they had not previously experienced. This suggests that AI integration could act as a catalyst for promoting more learner-centered approaches in traditionally teacher-dominated classrooms.

**Challenges and Limitations**

While the benefits of AI were widely acknowledged, participants also expressed concerns about overreliance on automated suggestions, infrastructural inequalities, and cultural mismatches. These challenges mirror Zawacki-Richter et al.'s (2019) caution that AI, if used uncritically, may undermine deeper cognitive engagement. The tendency of some students to adopt AI-generated vocabulary without evaluating its appropriateness indicates a need for critical digital literacy training alongside AI integration.

The issue of access emerged as particularly salient. Students from rural universities reported significant barriers, including unreliable internet connectivity and limited access to devices. This reflects Mahboob's (2017) observation that socio-economic disparities in Pakistan continue to

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limit equal opportunities in English language learning. Without deliberate policies to address infrastructural inequalities, AI risks reinforcing existing educational divides rather than mitigating them.

Teacher attitudes also played a role in shaping learners' engagement with AI. Some instructors encouraged AI use as a supplementary resource, while others discouraged it due to concerns about plagiarism and academic dishonesty. This finding highlights the importance of **institutional and pedagogical alignment** in integrating AI effectively into higher education.

**Vocabulary Acquisition Outcomes**

The study found that AI-powered tools enhanced vocabulary retention, active usage, and communicative competence, aligning with Nation's (2013) assertion that repeated, contextualized exposure promotes durable lexical knowledge. Students' testimonies that their academic writing had improved and that they felt more confident in oral communication echo Fryer and Carpenter's (2006) findings on the benefits of conversational bots for vocabulary practice.

However, some students acknowledged that vocabulary gains were sometimes short-lived without teacher reinforcement or additional practice. This supports Schmitt's (2010) critique of isolated vocabulary learning and underscores the importance of blended approaches that combine AI affordances with teacher guidance and classroom activities.

**Conclusion**

This study explored the perceptions and experiences of Pakistani university students regarding AI-powered tools for vocabulary acquisition. Findings revealed that AI is widely perceived as useful, motivating, and autonomy-enhancing, with clear benefits for vocabulary retention and communicative competence. However, challenges such as infrastructural inequality, overreliance on automated feedback, and limited teacher preparedness constrain its full potential.

The conceptual framework developed in this study emphasized the interconnected roles of AI tools, student perceptions, learning processes, and contextual factors in shaping vocabulary outcomes. The findings validate this model, showing that the impact of AI is not linear but mediated by learners' perceptions and by structural and cultural realities in the Pakistani context.

**Implications**

**Pedagogical Implications**

For educators, the findings suggest the need to adopt a blended learning approach that integrates AI tools with classroom instruction. Teachers should encourage critical evaluation of AI outputs, guiding students to reflect on appropriateness and context rather than passively adopting suggestions. Teacher training programs must also equip instructors with digital literacy skills to incorporate AI into pedagogy effectively.

**Policy Implications**

At the institutional and national levels, addressing infrastructural barriers is critical. Universities should invest in reliable internet access and digital resources to ensure equitable access for students across socio-economic backgrounds. Policymakers should also consider AI integration in national English curricula, aligning technological innovation with educational goals.

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**Theoretical Implications**

By situating the study within the Pakistani context, the research extends existing theories such as the Technology Acceptance Model (Teo, 2011) and learner autonomy frameworks (Benson, 2013). The findings suggest that these theories must account for contextual mediators such as infrastructure and cultural attitudes, particularly in developing countries where technological adoption is uneven.

**Limitations and Recommendations for Future Research**

While the study provides rich insights, its qualitative design and limited sample size restrict the generalizability of findings. Future research could adopt mixed-methods approaches, combining qualitative insights with quantitative measures of vocabulary gains to provide a more comprehensive assessment of AI's effectiveness. Comparative studies between urban and rural universities would also be valuable in examining how infrastructural disparities shape learners' experiences.

Additionally, longitudinal studies could explore whether AI-assisted vocabulary gains are sustained over time and how learners transition from AI-supported learning to independent application of vocabulary in academic and professional contexts.

**Final Reflection**

This study underscores that AI holds significant promise for transforming vocabulary acquisition in Pakistan's higher education system. Yet, its success depends not only on the sophistication of the tools themselves but also on students' perceptions, institutional support, and socio-cultural realities. As AI continues to evolve, its integration into EFL pedagogy must be approached thoughtfully, balancing innovation with equity and critical literacy. By foregrounding learners' voices, this study contributes to a deeper understanding of how technology can support, but not replace, the human dimensions of language learning.

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