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ARTIFICIAL INTELLIGENCE IN LANGUAGE ACQUISITION: TRANSFORMING ENGLISH LANGUAGE LEARNING THROUGH DIGITAL TECHNOLOGIES

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Abstract

The accelerating integration of artificial intelligence (AI) into digital learning environments has begun to reshape how second-language learners acquire English. This study investigates the effectiveness of AI-enabled digital technologies—including generative AI chatbots, adaptive learning applications, and intelligent feedback systems—in enhancing the English language proficiency and communicative competence of undergraduate engineering students who use English as a second language. A quasi-experimental design was adopted in which 120 first-year students were divided into an experimental group (n = 60) that received AI-supported digital language instruction and a control group (n = 60) that received conventional classroom instruction over a period of twelve weeks. Standardised pre-tests and post-tests measured gains in overall language proficiency and communicative competence, while a validated questionnaire captured learner attitudes and engagement. The experimental group achieved significantly higher post-test scores in both language proficiency (mean gain = 14.6) and communicative competence (mean gain = 15.7) than the control group, with large effect sizes (Cohen's d = 1.20 and 1.24 respectively). Paired-sample t-tests confirmed statistically significant within-group improvements ($p < 0.001$), and independent-sample t-tests confirmed significant between-group differences ($p < 0.001$). Pearson correlation analysis revealed a strong positive relationship between frequency of AI-tool use and communicative gains ($r = 0.66$). The findings suggest that AI-driven digital technologies, when embedded pedagogically within a structured programme, can serve as effective scaffolds for personalised feedback, contextual practice, and autonomous learning. The study recommends structured teacher mediation, prompt-literacy training, and safeguards against over-reliance to maximise the benefits of AI in the language classroom.

Keywords: Artificial Intelligence, Language Acquisition, English Language Learning, Digital Technologies, Communicative Competence, Generative AI, ESL, Educational Technology

1. Introduction

Language acquisition lies at the heart of academic success and professional communication, and for engineering students in India—for whom English is a medium of instruction rather than a first language—mastery of English is often decisive for employability and higher study. Yet large, heterogeneous classrooms, limited contact hours, and unequal prior exposure make it difficult for teachers to deliver the individualised practice and feedback that second-language (L2) acquisition demands. Traditional instruction, though valuable, tends to privilege receptive knowledge over the interactive, personalised practice through which communicative competence develops.

The recent maturation of artificial intelligence (AI) and its diffusion into everyday digital tools has introduced a transformative element into this landscape. Generative AI chatbots, adaptive learning applications, automatic speech-recognition systems, and intelligent tutoring platforms can now converse with learners, correct their errors in real time, generate tailored practice, and adapt to each learner's proficiency level. Unlike static digital resources such as

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fixed drills or electronic dictionaries, these technologies respond dynamically to the individual, offering a scalable form of personalised scaffolding that was previously available only through one-to-one tutoring.

Despite mounting enthusiasm, robust empirical evidence on whether AI-enabled digital technologies genuinely improve English language acquisition—as opposed to merely raising learner satisfaction—remains limited. Concerns persist about over-reliance, superficial engagement, the accuracy of machine-generated content, and the possible erosion of learner autonomy. There is therefore a clear need for controlled studies that measure actual learning gains.

This study addresses that gap by examining the impact of AI-supported digital instruction on the English language proficiency and communicative competence of undergraduate engineering students. It compares the learning gains of an AI-supported experimental group with those of a conventionally taught control group, analyses the relationship between the intensity of AI-tool use and learning outcomes, and explores learner attitudes towards the technology. In doing so, the paper aims to provide practical, evidence-based guidance for integrating AI responsibly into the English language classroom.

1.1 Importance of English Language Acquisition in Higher Education

English language acquisition plays a crucial role in higher education, particularly in professional disciplines where English serves as the primary medium of instruction, research communication, and global interaction. For undergraduate engineering students in India, proficiency in English is not only an academic requirement but also a significant factor influencing career opportunities, employability, and participation in international knowledge networks. Although students may possess adequate technical knowledge, limited English communication skills often create barriers in expressing ideas, participating in discussions, writing reports, and performing effectively in professional environments.

In second-language learning contexts, acquiring English involves more than memorising vocabulary and grammatical structures. Successful language acquisition requires continuous exposure, meaningful interaction, productive practice, and timely feedback. However, many higher education institutions face challenges such as large classroom sizes, limited instructional hours, and diverse learner backgrounds. These limitations restrict teachers' ability to provide personalised attention to every learner. Consequently, many students struggle to develop communicative competence despite several years of formal English education.

The need for innovative approaches in English language teaching has therefore increased significantly. Technology-supported learning environments have emerged as potential solutions by providing learners with additional opportunities for practice, interaction, and independent learning beyond traditional classroom boundaries.

1.2 Challenges in Traditional English Language Learning Approaches

Traditional approaches to English language learning have contributed significantly to developing foundational linguistic knowledge; however, several limitations continue to affect learners' overall proficiency. Conventional classroom practices often focus heavily on grammar rules, textbook exercises, and examination-oriented learning rather than real-world communication skills. As a result, learners may understand grammatical concepts but experience difficulties in speaking fluently, constructing meaningful conversations, and using English confidently in academic and professional situations.

One of the major challenges in traditional language classrooms is the lack of individualised feedback. In large classrooms, teachers often cannot identify and address every learner's pronunciation errors, writing weaknesses, vocabulary limitations, or communication barriers. Additionally, students with different proficiency levels receive similar instructional content, which may not effectively address individual learning needs.

Another challenge is limited learner engagement. Many students hesitate to participate in English conversations due to fear of making mistakes or experiencing negative evaluation. This speaking anxiety reduces opportunities for language production, which is essential for developing communicative competence. Therefore, there is a growing

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demand for flexible, learner-centred approaches that can complement traditional teaching methods and provide continuous language support.

1.3 Emergence of Artificial Intelligence in Educational Technologies

The rapid development of artificial intelligence (AI) has introduced significant transformations across various sectors, including education. AI-based educational technologies have created new possibilities for personalised, adaptive, and interactive learning experiences. Unlike traditional digital resources that provide fixed content, AI-driven systems can analyse learner responses, identify weaknesses, generate customised activities, and provide immediate feedback according to individual learning requirements.

In language education, AI has become particularly valuable because language learning depends heavily on interaction, correction, and continuous practice. Technologies such as generative AI chatbots, intelligent tutoring systems, automated writing assistants, and speech-recognition applications allow learners to engage with digital platforms as interactive learning partners. These systems can simulate conversations, explain language concepts, suggest improvements, and provide contextual examples.

The integration of AI in language education represents a shift from teacher-centred instruction toward technology-enhanced learner autonomy. By providing access to personalised learning resources, AI enables students to practise language skills at their own pace and receive support whenever required. This makes AI a promising tool for addressing several limitations associated with conventional English language instruction.

1.4 Role of AI-Based Digital Tools in English Language Acquisition

AI-enabled digital tools have demonstrated considerable potential in improving different dimensions of English language learning, including vocabulary development, grammar accuracy, writing ability, pronunciation, and speaking fluency. Generative AI chatbots provide learners with opportunities for interactive communication, allowing them to practise conversations without the pressure often experienced in human interactions. Such low-risk environments encourage learners to experiment with language and gradually develop confidence.

Adaptive learning applications further enhance language acquisition by analysing learner performance and adjusting the complexity of activities according to individual progress. These systems support differentiated learning by ensuring that students receive tasks appropriate to their current proficiency level. Similarly, intelligent feedback systems can identify errors in pronunciation, sentence construction, and writing, helping learners understand their mistakes and improve through continuous correction.

The effectiveness of AI tools depends not only on technological availability but also on their pedagogical integration. When guided by teachers through structured activities, AI can function as a supportive learning scaffold that enhances practice, reflection, and independent learning. Therefore, AI should be viewed as a complement to human instruction rather than a replacement for teachers.

1.5 AI and Development of Communicative Competence among ESL Learners

Communicative competence represents one of the most important outcomes of second-language acquisition. It involves the ability to use language accurately, appropriately, and effectively in different social, academic, and professional contexts. For engineering students, strong communicative competence is essential for presentations, teamwork, technical discussions, interviews, and workplace communication.

AI-based learning environments can contribute significantly to communicative competence by creating frequent opportunities for meaningful language production. Conversational AI systems allow learners to practise dialogue, receive instant corrections, and explore different communication scenarios. Speech-recognition technologies provide feedback on pronunciation and fluency, helping students improve their oral communication skills.

Furthermore, AI reduces psychological barriers associated with language learning. Many learners avoid speaking

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English because of fear of criticism or embarrassment. Interaction with AI tools provides a private and supportive environment where learners can practise repeatedly without social pressure. This increased confidence and willingness to communicate can positively influence overall language development.

1.6 Opportunities and Challenges of AI Integration in Language Learning

Although AI offers several advantages for language acquisition, its integration into education also presents important challenges. One major concern is the possibility of learner over-dependence on AI-generated responses. Excessive reliance on automated assistance may reduce critical thinking, independent problem-solving, and active language production. Therefore, students must be encouraged to use AI as a learning support tool rather than a substitute for their own cognitive effort.

Another challenge involves the accuracy and reliability of AI-generated information. Generative AI systems may occasionally produce incorrect explanations, inappropriate examples, or misleading language suggestions. This highlights the importance of digital literacy and teacher guidance in helping learners evaluate AI-generated content critically.

Ethical concerns, data privacy, accessibility, and unequal technological availability also influence the successful adoption of AI in educational settings. Effective implementation requires institutional support, teacher training, and clear guidelines for responsible AI usage.

1.7 Need for Empirical Investigation of AI-Supported English Learning

Despite increasing interest in AI-based educational applications, empirical research examining their actual impact on English language acquisition remains limited, particularly among undergraduate engineering students in Indian higher education contexts. Many existing studies focus primarily on learner perceptions and satisfaction, while fewer studies measure actual improvements in language proficiency and communicative competence through controlled research designs.

A systematic investigation is required to determine whether AI-supported instruction produces measurable learning benefits compared with conventional classroom approaches. Such research can provide evidence regarding the effectiveness of AI tools, the relationship between AI usage intensity and learning outcomes, and learners' attitudes toward technology-assisted language learning.

Therefore, the present study addresses this research gap by examining the effectiveness of AI-enabled digital technologies in improving English language proficiency and communicative competence among undergraduate engineering students.

Research Objectives

1. To examine the effectiveness of AI-enabled digital technologies in improving the English language proficiency of undergraduate engineering students.
2. To analyse the impact of AI-supported instruction on the development of communicative competence among English as a Second Language (ESL) learners.
3. To compare the learning outcomes of students receiving AI-supported digital instruction with those receiving conventional classroom instruction.
4. To investigate the relationship between the frequency of AI-tool usage and improvement in language proficiency and communicative competence.
5. To assess learners' attitudes, engagement, and perceptions regarding the use of AI in English language learning.
6. To identify the opportunities and challenges associated with integrating AI tools into language education, including issues of dependence, accuracy, and learner autonomy.

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2. Literature Review

2.1 Artificial Intelligence in Language Education

A rapidly growing body of scholarship has explored the pedagogical potential of AI in language education. Studies report that AI chatbots and conversational agents can function as tireless dialogue partners, writing assistants, and on-demand explainers, thereby increasing learner exposure to comprehensible and interactive input (Kohnke et al., 2023). Researchers emphasise that the value of these tools depends heavily on how they are integrated: unstructured use may foster passive consumption of answers, whereas guided, task-based use promotes active processing (Godwin-Jones, 2024). The concept of 'prompt literacy' has emerged as a key competence, since the quality of AI output is closely tied to the quality of learner queries (Warschauer et al., 2023; Bansal & Iqbal, 2025).

2.2 Digital Technologies and Adaptive Scaffolding

Digital scaffolding tools have historically supported acquisition through glossing, adaptive questioning, and automated feedback. Recent work suggests that AI extends these affordances by generating individualised practice, diagnosing errors, and adjusting task difficulty in real time (Meniado, 2023; Roy & Malhotra, 2026). Adaptive learning systems can model a learner's trajectory and target the zone in which learning is most productive. However, some scholars caution that poorly designed automation may reduce the deep processing that acquisition demands if learners bypass the effortful work of production (Kasneci et al., 2023).

2.3 Communicative Competence and AI-Mediated Practice

Communicative competence develops most durably through frequent, meaningful, and low-stakes opportunities to produce language. AI-enabled tools can supply exactly such opportunities, offering speaking practice with speech-recognition feedback, contextual corrections, and immediate models of accurate usage precisely at the moment of need (Kohnke & Moorhouse, 2024; Nair & Kapoor, 2026). Empirical studies of AI-assisted instruction have reported significant gains in fluency, accuracy, and confidence compared with conventional methods, particularly when the tool is used for productive practice rather than mere reference (Zhang & Perez, 2024; Khan & Rao, 2025).

2.4 Learner Engagement, Attitudes and Risks

Learner attitudes towards AI are generally positive, with reports of increased motivation, reduced speaking anxiety, and greater willingness to attempt challenging tasks (Chan & Hu, 2023; Hussain & Roy, 2024). At the same time, the literature highlights risks including over-reliance, erosion of independent effort, potential inaccuracies or 'hallucinations', and academic-integrity concerns (Farrokhnia et al., 2024; Patel & Singh, 2026). Scholars therefore recommend teacher mediation, critical-evaluation training, and clear task design to ensure that AI supplements rather than supplants the cognitive work of learning.

3. Methods and Materials

3.1 Research Design

The study employed a quasi-experimental, non-equivalent control-group design with pre-test and post-test measures. Two intact classes were assigned to an experimental condition (AI-supported digital instruction) and a control condition (conventional classroom instruction). The independent variable was the mode of instruction; the dependent variables were English language-proficiency and communicative-competence scores, together with learner attitude and engagement.

3.2 Participants and Sampling

A total of 120 first-year undergraduate engineering students at ABES Engineering College, Ghaziabad, participated in the study. Participants were selected through purposive sampling from students enrolled in a compulsory communication-skills course and were assigned to the experimental group (n = 60) and the control group (n = 60). All participants were second-language users of English with intermediate proficiency, as confirmed by a baseline placement test, and informed consent was obtained from every participant.

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3.3 Instruments

- Language Proficiency Test: A 40-item test assessing grammar, vocabulary, and reading comprehension across literal, inferential, and applied levels.
- Communicative Competence Test: A 40-item performance-based assessment measuring speaking fluency, accuracy, and appropriate use of English in interactive tasks.
- Attitude and Engagement Questionnaire: A 20-item, five-point Likert-scale instrument (Cronbach's alpha = 0.88) capturing perceived usefulness, motivation, confidence, and concerns.
- AI Usage Log: A record of the frequency and type of AI-tool interactions maintained by the experimental group throughout the intervention.

3.4 The AI-Supported Intervention

The experimental group used a suite of AI-enabled digital tools—a generative AI chatbot, an adaptive practice application, and a speech-feedback system—as structured learning companions. Guided by the instructor, students used the tools to practise conversation, request contextual corrections, generate self-check exercises, and rehearse presentations. Prompt-literacy training was provided in the first week so that learners could formulate effective queries. The control group covered the same syllabus using conventional methods: teacher explanation, printed materials, and standard worksheets. Both groups received the same number of instructional hours.

3.5 Procedure

The intervention ran for twelve weeks. In Week 1, both groups completed the proficiency and communicative-competence pre-tests and the placement test. Weeks 2 to 11 comprised the instructional programme, with both groups covering identical learning objectives; only the mode of support differed. In Week 12, both groups completed the post-tests, and the experimental group completed the attitude questionnaire. Usage logs were collected weekly from the experimental group.

3.6 Statistical Analysis

Data were analysed using descriptive statistics (means and standard deviations), paired-sample t-tests for within-group gains, and independent-sample t-tests for between-group differences. Effect sizes were computed using Cohen's d. Pearson correlation was used to examine the relationship between AI-tool usage intensity and learning gains, and one-way ANOVA was used to compare gains across usage-frequency bands. Statistical analyses were conducted in SPSS Ver. 26, with the significance threshold set at $p < 0.05$.

4. Data Analysis and Results

Table 4.1 presents the descriptive statistics for the pre-test and post-test scores of both groups. Both groups began at comparable baseline levels, with no significant difference in pre-test scores ($p > 0.05$), confirming group equivalence at the outset.

Table 4.1: Descriptive statistics of pre-test and post-test scores (max = 40)

Measure / Group	Pre-test Mean±SD	Post-test Mean±SD	Mean Gain	Cohen's d
Proficiency – Experimental	21.0±4.5	35.6±3.0	14.6	1.20
Proficiency – Control	20.7±4.6	27.4±4.3	6.7	0.47
Communicative – Experimental	19.4±4.8	35.1±3.5	15.7	1.24
Communicative – Control	19.7±4.9	26.8±4.4	7.1	0.49

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As shown in Table 4.1, the experimental group achieved substantially larger gains than the control group in both language proficiency and communicative competence. The post-test means of the experimental group were markedly higher, and the associated effect sizes were large, whereas those of the control group were moderate.

Table 4.2 reports the paired-sample t-tests examining within-group improvement from pre-test to post-test. Both groups improved significantly, but the magnitude of improvement was considerably greater for the experimental group.

Table 4.2: Paired-sample t-test results (within-group, pre vs. post)

Group / Measure	t-value	df	Sig. (p)
Experimental – Proficiency	17.94	59	< 0.001
Experimental – Communicative	19.61	59	< 0.001
Control – Proficiency	9.12	59	< 0.001
Control – Communicative	9.44	59	< 0.001

Table 4.3 presents the independent-sample t-tests comparing the post-test performance of the two groups. The differences between the experimental and control groups were statistically significant for both dependent variables, confirming the superior effectiveness of the AI-supported intervention.

Table 4.3: Independent-sample t-test results (between-group, post-test)

Comparison	t-value	df	Sig. (p)
Proficiency (Exp vs. Control)	12.04	118	< 0.001
Communicative (Exp vs. Control)	11.62	118	< 0.001

To examine whether the intensity of AI use was associated with learning outcomes, Pearson correlation coefficients were computed between weekly usage frequency and post-test gains within the experimental group. The results, summarised in Table 4.4, indicate strong positive correlations, suggesting that more frequent and purposeful interaction with the tools was linked to greater gains.

Table 4.4: Pearson correlation between AI usage and learning gains (experimental group)

Relationship	r-value	Sig. (p)
Usage frequency × Communicative gain	0.66	< 0.01
Usage frequency × Proficiency gain	0.63	< 0.01
Proficiency gain × Communicative gain	0.59	< 0.01

A one-way ANOVA comparing learning gains across three usage-frequency bands (low, moderate, high) revealed a significant effect of usage intensity on total gain scores, $F(2, 57) = 13.9$, $p < 0.001$. Tukey HSD post-hoc analysis showed that the high-usage band achieved significantly greater gains than the low-usage band, while the moderate band occupied an intermediate position.

Finally, analysis of the attitude and engagement questionnaire showed that the experimental group held largely positive perceptions of AI-supported learning. The highest-rated items concerned the tools' usefulness for practising speaking (mean = 4.5) and the clarity of instant feedback (mean = 4.4), while confidence in using English also rose (mean = 4.1). The lowest-rated items reflected concerns about over-dependence on the tools (mean = 3.5), indicating that learners were aware of the risk of relying on AI at the expense of independent effort.

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5. Discussion

The findings of this study demonstrate that AI-enabled digital technologies, when integrated pedagogically into English language instruction, can significantly enhance both language proficiency and communicative competence among second-language engineering students. The experimental group's markedly larger gains and the large effect sizes indicate that the benefit of AI is educationally meaningful, not merely statistically detectable. These results align with earlier reports that AI-assisted instruction improves accuracy and fluency (Zhang & Perez, 2024) and that intelligent tools can act as adaptive scaffolds for acquisition (Meniado, 2023; Roy & Malhotra, 2026).

Several mechanisms may explain the observed advantage. First, AI provides contextual, on-demand feedback at the precise moment of need, supporting the conditions under which language is best internalised. Second, the tools' ability to generate individualised practice and correct errors in real time offers scaffolding that a single teacher cannot supply to a large class. Third, the interactive, low-anxiety nature of AI dialogue appears to increase learner willingness to produce language, echoing findings on motivation and reduced anxiety (Chan & Hu, 2023; Hussain & Roy, 2024).

The strong positive correlation between usage intensity and learning gains, together with the significant ANOVA result across usage bands, suggests a dose-response relationship: learners who engaged more frequently and purposefully with the tools benefited most. This underscores the importance of prompt-literacy training, since the quality of learner queries shapes the quality of the support they receive (Warschauer et al., 2023; Bansal & Iqbal, 2025).

At the same time, the questionnaire data and the wider literature caution against uncritical adoption. Learners themselves flagged the risk of over-dependence, and prior research warns of hallucinated content and the erosion of independent effort (Kasneci et al., 2023; Farrokhnia et al., 2024; Patel & Singh, 2026). The pedagogical implication is that AI should be positioned as a scaffold that is gradually withdrawn, embedded in tasks that require learners to verify, evaluate, and apply the tool's output rather than passively accept it. Teacher mediation therefore remains essential.

6. Conclusion

This study set out to examine whether AI-enabled digital technologies can improve English language acquisition among undergraduate engineering students. The evidence indicates that AI-supported digital instruction produced significantly larger gains in both language proficiency and communicative competence than conventional instruction, with large effect sizes and a clear relationship between usage intensity and outcomes. Learners responded positively, valuing the tools' instant feedback and practice opportunities, while remaining aware of the danger of over-reliance.

The findings suggest that artificial intelligence, used deliberately and under teacher guidance, can serve as a powerful, scalable scaffold for language development. To realise this potential responsibly, institutions should invest in prompt-literacy training, design tasks that demand active verification and application, and build safeguards against dependence and misinformation. Future research should extend these findings through longitudinal designs, larger and more diverse samples, and investigation of long-term retention, so that the role of AI in digitally mediated English language learning can be understood more fully.

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