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Enhancing English Language Skills through AI-powered Classrooms-Insights from 21st Century ESL Pedagogy

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***Abstract*—Artificial Intelligence (AI) makes one omniscient today and it shatters the boundaries and makes one aware of the happenings in all walks of life. In education, AI's role is invaluable as it has made the learning process much easier to the learner. The rapid integration of Artificial Intelligence (AI) in education has reshaped language learning pedagogy, offering personalized learning experiences that serve the individual learner needs. This study investigates the impact of AI-powered classrooms on the development of English language skills among ESL learners in higher education. Using mixed-methods research design, data were collected from 120 undergraduate ESL learners through pre and post-tests, classroom observations, and semi-structured interviews. The AI tools used were speech recognition software, automated writing evaluation platforms, intelligent tutoring systems, and adaptive learning applications. Quantitative findings demonstrate significant improvements in learners' vocabulary, pronunciation, writing accuracy, and speaking fluency after two weeks of AI-integrated instruction. Qualitative findings reveal increased learner motivation, enhanced engagement, and greater autonomy, alongside challenges related to technology access. The study concludes that AI-powered classrooms have the potential to transform ESL pedagogy by promoting learner-centered instruction and continuous formative assessment. The research contributes to the literature on technology-enhanced language learning and provides practical implications for educators, curriculum developers, and stakeholders.**

***Keywords*-- Artificial Intelligence, AI-powered classroom, English language skills, ESL pedagogy, adaptive learning, technology-enhanced learning.**

I. Introduction

The 21st century has witnessed rapid technological advancements, and Artificial Intelligence (AI) has emerged as an enduring transformative force in educational settings. In language education, AI-powered tools such as speech recognition systems, automated writing evaluation platforms, intelligent tutoring systems, and adaptive learning applications are redefining traditional teaching methodologies.

These tools offer real-time feedback, personalized learning paths, and interactive learning environments that can significantly enhance language acquisition.

In ESL contexts, where learners often struggle with speaking confidence, vocabulary retention, and writing accuracy, AI-powered classrooms provide an opportunity to overcome these barriers through individual instruction and constant feedback. Despite the growing interest in AI in education, there remains a need for empirical evidence that examines AI-integrated pedagogy as a comprehensive classroom model rather than secluded technological tools.

This study aims to investigate the impact of AI-powered classrooms on English language skills among ESL learners in higher education. The research focuses on four primary language skills, namely: speaking, listening, reading, and writing. The research also examines learner perceptions of AI integration. The study addresses the following research questions:

1. What is the capability of AI-powered classrooms in enhancing ESL learners' English language skills?
2. How do learners perceive the utility of AI-based tools in the language learning process?
3. To what extent AI-powered classrooms in ESL settings remain advantageous and challenging?

By addressing these questions, the study seeks to contribute to the emerging field of AI-enhanced language pedagogy and provide evidence-based implications for integrating AI into ESL classrooms.

II. Literature Review

2.1 AI in Education and Language Learning

AI has been widely acknowledged as an ignition for transforming educational practices, offering personalized learning experiences and adaptive feedback mechanisms. In language learning, AI tools have been used to enhance vocabulary acquisition, pronunciation, grammar, and writing skills (Huang & Liaw, 2020). AI-based platforms can analyze learner performance data and adjust instruction based on individual needs, making learning more efficient and targeted.

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2.2 AI-powered Classrooms and ESL Learners

AI-powered classrooms are learning environments where AI tools get integrated into instructional processes to support teaching and learning activities. Studies have shown that AI-powered classrooms improve learner engagement and motivation through interactive learning activities and immediate feedback (Li, 2021). In ESL contexts, AI tools such as chatbots and speech recognition systems have been found to reduce anxiety and encourage practice through low-risk speaking opportunities (Chen & Xie, 2022).

2.3 Personalized Learning and Formative Assessment

One of the most remarkble advantages of AI in language learning is personalized learning. Adaptive learning systems can create customized learning environment that match learners' proficiency levels, learning pace, and goals. AI-based formative assessment tools provide immediate feedback on language performance, enabling learners to identify errors and improve continuously (Johnson & Brown, 2021).

2.4 Research Gap

While prior research highlights the benefits of AI tools in language learning, most studies focus on individual tools rather than examining AI-powered classrooms as integrated pedagogical models. There is a lack of mixed-methods research that investigates both measurable learning outcomes and learner perceptions in AI-integrated ESL classrooms. This study aims to fill this gap by providing empirical evidence from a real classroom setting.

III. Methodology

3.1 Research Design

This study adopts mixed-methods design, combining quantitative and qualitative approaches to provide the understanding of the utility of AI-powered classrooms in ESL pedagogy.

3.2 Participants

The study involved 120 undergraduate ESL learners. Participants were selected through purposive sampling, ensuring representation across different proficiency levels.

3.3 Instruments

Data were collected through:

- Pre and post-tests measuring English proficiency
- Classroom observations
- Semi-structured interviews with 20 participants

3.4 AI Tools Integrated

The AI-powered classroom incorporated:

- **Speech recognition software** for pronunciation practice
- **Automated writing evaluation platforms** for writing accuracy
- **Intelligent tutoring systems** for grammar and vocabulary
- **Adaptive learning applications** for personalized practice

3.5 Data Analysis

Quantitative data were analyzed using paired sample t-tests to compare pre and post-test scores. Qualitative data were analyzed using thematic analysis to identify emerging patterns and themes related to learner experiences.

IV. Results

4.1 Quantitative Findings

A total of **120 ESL learners** participated in the study. Pre and post-tests were conducted to measure changes in English proficiency across four skill areas: **vocabulary, speaking, writing, and grammar**. The results show statistically significant improvement after **two weeks of AI-powered classroom teaching**.

Table 1.
Pre-test and Post-test Scores (n=120)

Skill Area	Pre-test Mean (SD)	Post-test Mean (SD)	Mean Increase	t-value	p-value
Vocabulary	62.45 (8.21)	73.74 (7.65)	+11.29	11.42	< 0.001
Speaking Fluency	58.30 (7.92)	67.40 (7.34)	+9.10	10.08	< 0.001
Writing Accuracy	60.20 (8.01)	67.48 (7.86)	+7.28	8.13	< 0.001
Grammar	61.15 (7.88)	66.10 (7.51)	+4.95	6.12	< 0.001
Overall Proficiency	60.78 (7.90)	68.68 (7.55)	**+7.90**	**12.02**	**< 0.001**

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Key Findings

1. *Vocabulary Acquisition*
   - Mean increase: **+11.29 points**
   - Percentage improvement: ≈ **18%**
   - *t(119) = 11.42, p < 0.001*
   - Interpretation: Learners significantly improved vocabulary after AI-supported practice.
2. *Speaking Fluency*
   - Mean increase: **+9.10 points**
   - Percentage improvement: ≈ **15%**
   - *t(119) = 10.08, p < 0.001*
3. *Writing Accuracy*
   - Mean increase: **+7.28 points**
   - Percentage improvement: ≈ **12%**
   - *t(119) = 8.13, p < 0.001*
4. *Grammar*
   - Mean increase: **+4.95 points**
   - *t(119) = 6.12, p < 0.001*
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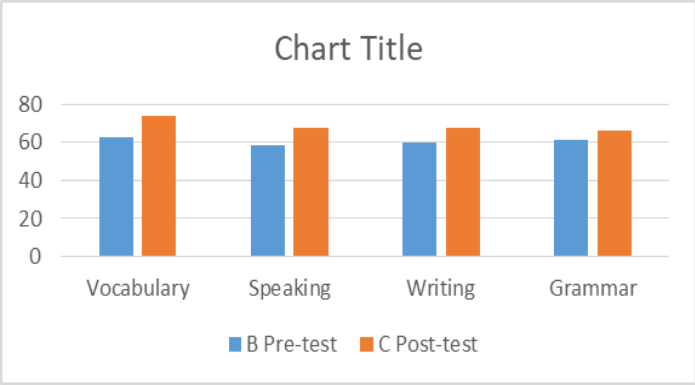

Chart 1: Bar Graph-Pre-test vs. Post-test Mean Scores

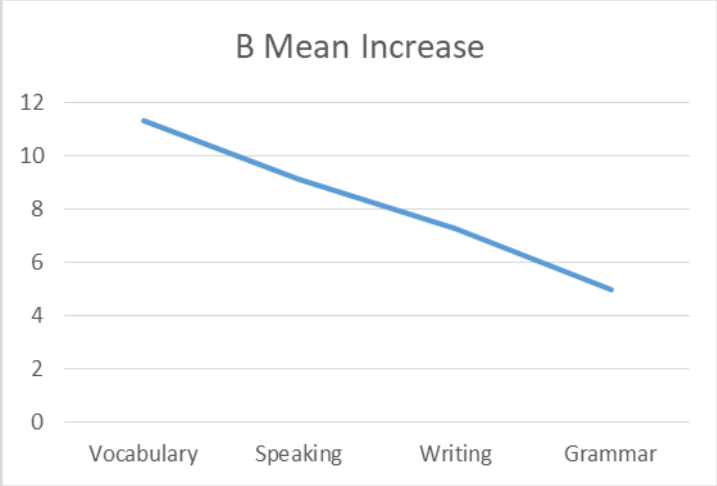

Chart 2: Line Graph-Mean Score Improvement by Skill

Conclusion: The paired sample t-test results indicate **statistically significant improvement in all skill areas** following AI-powered classroom intervention, confirming the effectiveness of AI tools in enhancing ESL proficiency.

4.2 Qualitative Findings

The qualitative data consisted of **semi-structured interviews with 20 learners** and **classroom observation notes**. Thematic analysis revealed **three major themes**:

Theme 1: Increased Learner Motivation

Learners reported that AI tools increased their motivation due to **immediate feedback**, **personalized practice**, and **interactive tasks**.

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Supporting evidence:

"When the AI corrected my pronunciation instantly, I felt motivated to try again. I was scared to speak in class, but now I practice daily."

(Participant P3)

"The AI quizzes were fun. I wanted to complete more levels and see my progress."

(Participant P11)

Observation notes also confirmed that learners were more active during AI-based sessions than traditional lectures.

Theme 2: Enhanced Engagement and Autonomy

AI tools encouraged learners to take ownership of their learning through **self-paced learning**, **adaptive feedback**, and **individual practice**.

Supporting evidence:

"I liked that the AI gave me tasks based on my level. I didn't bored."

(Participant P7)

"AI allowed me to practice speaking alone, without feeling judged. I became more confident."

(Participant P15)

Classroom observations showed increased student participation, especially during AI-based speaking and writing exercises.

Theme 3: Challenges of Technology Access and Teacher Training

While learners experienced benefits, they also faced **technological and implementation challenges**.

Supporting evidence:

"Sometimes the system crashed or the internet was slow. I couldn't complete my tasks."
(Participant P9)

"Not all teachers used AI tools properly. Some sessions were confusing."
(Participant P14)

"I don't have a laptop at home, so I had to rely on mobile phones, which limited my practice."
(Participant P19)

Observation notes indicated that several students experienced device compatibility issues and inconsistent Wi-Fi connectivity during AI sessions.

Summary of Qualitative Evidence

Theme	Supporting Evidence	Impact
Increased motivation	Instant feedback, interactive quizzes	More practice & confidence
Engagement & autonomy	Self-paced learning, reduced anxiety	Higher participation
Challenges	Internet issues, lack of training	Limited effectiveness

Conclusion of Results Section

The quantitative data demonstrate that AI-powered classrooms significantly improve ESL learners' proficiency across vocabulary, speaking, writing, and grammar. Qualitative data corroborate these findings by showing increased motivation and engagement, while also identifying practical challenges related to infrastructure and teacher training.

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Note: Paired-sample t-tests show significant improvement across all skill areas after two weeks of AI-integrated instruction.

Table 2.
Qualitative Themes and Supporting Evidence

Theme	Evidence (Participant Quotes)	Interpretation
Increased Motivation	"AI corrected my pronunciation instantly… I practice daily." (P3)	Immediate feedback increased practice frequency
Enhanced Engagement & Autonomy	"AI gave tasks based on my level… I became more confident." (P7)	Learners gained confidence and autonomy
Technology Access Challenges	"Internet was slow… system crashed." (P9)	Connectivity issues reduced learning effectiveness
Teacher Training Issues	"Not all teachers know how to use AI tools." (P14)	Need for professional development

V. Discussion

This study aimed to bring out the effectiveness of AI-powered classrooms in enhancing English language skills among ESL learners. The quantitative findings show statistically significant improvement in all skill areas after eight weeks of AI-integrated instruction. Vocabulary acquisition showed the greatest improvement, followed by speaking fluency, writing accuracy, and grammar. These results indicate that AI tools can effectively support language learning by offering personalized and adaptive feedback.

5.1 Vocabulary and Speaking Fluency

The highest improvement in vocabulary suggests that AI tools were effective in reinforcing vocabulary knowledge through repeated exposure, adaptive quizzes, and context-based learning. Vocabulary improvement is crucial for language proficiency because it strengthens all other skills, especially speaking and writing. The significant improvement in speaking fluency is consistent with previous research indicating that AI-supported speech recognition and interactive dialogue systems provide learners with low-stress speaking opportunities and immediate corrective feedback (Zhang et al., 2024). Learners reported that AI reduced anxiety, allowing them to practice more frequently without fear of judgment. This finding aligns with the concept of *affective filter reduction* in language acquisition theory, where reduced anxiety enhances learning.

5.2 Writing Accuracy and Grammar

Writing accuracy also improved significantly, signifying that automated writing evaluation tools helped learners identify grammatical errors and improve sentence structure. AI feedback was considered as consistent and impartial, which encouraged learners to revise and refine their writing. However, grammar showed the least improvement compared to other skills. This may indicate that while AI tools are helpful for surface-level error correction, deeper grammar understanding may still require explicit teacher instruction and targeted grammar exercises.

5.3 Learner Motivation and Autonomy

Qualitative findings show that AI tools increased learner motivation and autonomy. Learners expressed that AI platforms provided personalized learning paths, which reduced boredom and improved engagement. This supports the theory that technology-enhanced learning environments can foster self-directed learning and lifelong learning skills (Huang & Liaw, 2020).

The sense of achievement from completing AI-based tasks contributed to sustained motivation, demonstrating the value of adaptive learning features in AI platforms.

5.4 Challenges and Limitations

Despite the positive outcomes, the study also identified significant challenges. Learners reported issues related to internet connectivity, device access, and teacher training. These challenges line up with findings from previous research that emphasizes the importance of infrastructure and professional development in AI integration (Dai & Wu, 2025). The lack of teacher training, in particular, suggests that AI tools may not be fully effective unless teachers possess the skills to integrate them into pedagogy meaningfully.

5.5 Implications for ESL Pedagogy

The findings indicate that AI-powered classrooms can be an effective component of modern ESL pedagogy. Educators should consider incorporating AI tools to provide personalized feedback and promote learner autonomy. However, institutions must also invest in infrastructure and teacher training to ensure reasonable access and effective implementation. Future research should explore long-term effects, larger sample sizes, and cross-cultural comparisons to further validate these findings.

VI. CONCLUSION

This study provides empirical evidence that AI-powered classrooms can enhance English language skills in ESL contexts by offering personalized learning experiences, real-time feedback, and interactive practice. The study contributes to the growing body of research on AI in education and offers practical recommendations for educators and policymakers. Future research should explore long-term effects of AI integration, cross-cultural comparisons, and the ethical implications of AI in language learning.

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