

An Empirical Study of the Grammatical Competence of Professional Students and the Impact of AI-Assisted and Interactive Mobile Technologies in Enriching Language Competency

M. Papi Naidu*

Department of English (BS&H), Aditya Institute of Technology and Management,
Tekkali-532201, Srikakulam, Andhra Pradesh, India

*Corresponding author: mpapinaidu@gmail.com

Abstract

This study explores the grammatical competence of third-year B.Tech mechanical engineering students and evaluates the role of AI-assisted and interactive mobile technologies in enhancing their language skills. Despite their English-medium education, many students display significant gaps in grammar, which affects their performance in competitive exams and campus recruitment processes. Two grammar tests—pre- and post-intervention—were conducted with a group of 64 students to measure their progress. Between the tests, AI tools and mobile learning platforms such as ChatGPT, Duolingo, and Memrise were introduced to enhance engagement and improve language competency. The results reveal a notable improvement in student performance among those who actively used the technologies, with the highest-scoring group increasing from 8 to 10 students. However, participation declined in the second test, highlighting the need for continuous motivation and engagement strategies. Survey data and observations indicate that gamified learning and real-time feedback provided by the mobile apps fostered higher engagement and boosted students' confidence. Despite these improvements, challenges in sustaining participation persist, indicating that integrating AI tools into regular coursework could be crucial for long-term success. This study demonstrates the potential of AI-powered tools and mobile technologies to bridge grammar learning gaps and prepare students for academic and professional challenges. It recommends incorporating interactive tools into classroom teaching, offering incentives for active participation, and tracking progress through data analytics to provide personalized feedback. These strategies are essential to equip students with the communication skills necessary for career growth and global competence.

Keywords

Grammatical competence, AI tools, interactive mobile learning, data interpretation, communication skills

Introduction

In an increasingly globalized world, proficiency in English is essential for academic success and professional growth. For engineering students, effective communication skills—especially in English—play a vital role in campus recruitment, competitive exams, and career advancement. However, despite being educated in English-medium schools, many professional students demonstrate poor grammatical competence, which hinders their ability to express ideas clearly and confidently. This lack of proficiency not only affects their academic performance but also limits opportunities in job interviews, recruitment drives, and real-world professional settings. Grammatical knowledge forms the core of communicative competence, and mastery over grammar is crucial for both written and spoken communication. Traditional grammar teaching methods often fail to engage students, leading to reluctance to learn. Students may perceive grammar lessons as monotonous or irrelevant to real-life situations, contributing to low motivation and participation. While grammar is frequently overlooked in favor of broader language skills, it remains a critical component of communication. As observed in campus recruitment processes, employers emphasize the importance of correct grammar usage when interacting with international clients or colleagues. Hence, addressing these learning gaps is necessary to better prepare students for professional environments.

With recent advancements in Artificial Intelligence (AI) and interactive mobile technologies, new opportunities have emerged to personalize and gamify language learning. AI tools such as ChatGPT and mobile platforms like Duolingo and Memrise offer real-time feedback, personalized practice, and interactive learning experiences. These tools have the potential to enhance student engagement by presenting grammar concepts through gamified activities, quizzes, and conversations. Moreover, mobile technologies facilitate self-paced learning, allowing students to practice grammar at their convenience, both inside and outside the classroom. This study seeks to investigate the impact of AI-assisted tools and interactive mobile technologies on students' grammatical competence. Through a two-phase testing process—conducted before and after the introduction of these technologies—the research evaluates how these tools influence learning outcomes and engagement. Additionally, this study aims to identify the challenges students face in adopting these technologies and explore strategies to integrate AI tools into everyday learning practices effectively.

The significance of this research lies in its focus on addressing learning barriers and utilizing AI tools to provide personalized grammar instruction. While previous studies have explored various teaching techniques, this research emphasizes the innovative use of technology to improve students' grammatical competence. The findings will offer insights into the effectiveness of AI-based tools in bridging language learning gaps and highlight strategies for sustained student engagement. The outcomes are expected to contribute to educational practices by proposing a technology-enhanced learning model that promotes grammatical proficiency and communication skills, equipping students with the competencies required for global opportunities.

In summary, this research explores how AI and mobile technologies can transform grammar learning from a static and tedious experience into a dynamic, engaging, and effective process. It aims to establish a framework for integrating AI tools into language learning to empower students, ensuring they are better prepared for both academic success and professional competence.

Research Objectives

1. To assess the grammatical competence of third-year B.Tech students.
2. To introduce AI tools and interactive mobile technologies for language learning.
3. To measure the impact of these interventions on students' performance.
4. To analyze student feedback on using mobile-based learning tools.

Literature Review

The importance of grammatical competence as a core component of language learning has been extensively discussed in the field of applied linguistics. Researchers highlight that grammar forms the structure and rules that enable effective communication, facilitating both verbal and written expression (Ur, 2009). Without a solid grasp of grammar, students struggle to express ideas coherently, especially in professional and academic contexts. Despite its relevance, grammar is often perceived as challenging to learn, which necessitates innovative teaching methods to maintain student engagement and improve learning outcomes.

Theoretical Framework on Grammar Learning

Ur (2009) defines grammar as the set of rules governing the combination of words to convey specific meanings. These rules also guide speakers in organizing their thoughts, expressing intentions, and structuring communication through questions, requests, and statements. Additionally, grammar helps convey complex relationships, such as tense, agreement, and plurality, which are critical for professional communication.

Hui (2013) highlights the significance of individual learning differences in grammar acquisition, proposing that learners benefit most from personalized and adaptive learning. Traditional teaching methods, which emphasize rote memorization, often fail to meet these individual needs. Hui advocates for blended approaches that integrate both explicit grammatical instruction and opportunities for implicit learning through contextual usage. This framework aligns with AI-based tools like ChatGPT, which offer personalized feedback and real-time interaction tailored to each learner's abilities.

Contextual and Communicative Approaches to Grammar

Weatherford (1997) and Willoughby (1993) recommend contextualized grammar instruction, where grammar is taught within meaningful language activities rather than isolated drills. They argue that students engage more effectively when grammar learning is embedded within real-life situations. Such contextualized instruction mirrors the gamified approach adopted by platforms like Duolingo and Memrise, which offer interactive, real-world scenarios to make grammar more relevant and engaging for learners. These tools allow students to practice grammar in realistic contexts, bridging the gap between theoretical knowledge and practical application.

Challenges in Grammar Learning for Professional Students

Professional students, especially in engineering programs, often demonstrate low motivation to learn grammar due to its perceived irrelevance to their technical fields. However, employers in multinational corporations (MNCs) have consistently emphasized the need for strong communication skills, including grammatical accuracy, to negotiate with clients and collaborate effectively with colleagues. Despite this demand, many students continue to struggle with writing reports, emails, and participating in interviews due to gaps in grammatical competence.

Research by Shrivastava and Mahajan (2021) suggests that social networking platforms and AI-based tools can help students overcome these barriers by making language learning more accessible and engaging. Similarly, Ma (2021) argues that immersive technologies like virtual reality (VR) and augmented reality (AR) provide opportunities for students to learn grammar in simulated environments, improving their learning outcomes through real-time interaction.

AI and Mobile Technologies in Grammar Learning

Recent advancements in Artificial Intelligence (AI) and interactive mobile technologies have transformed the language learning landscape. AI-powered chatbots and mobile apps, such as ChatGPT, Duolingo, and Rosetta Stone, offer real-time assistance and personalized feedback to learners. These platforms leverage AI algorithms to analyze learner behavior and adapt content based on individual progress, ensuring that each student receives targeted support. AI also enables speech recognition and translation, allowing students to practice spoken grammar in real-world conversations.

According to Sun et al. (2021), mobile learning tools help reduce the anxiety associated with grammar learning by offering non-judgmental environments where students can practice without fear of criticism. ChatGPT facilitates conversational practice by providing immediate corrections and suggestions, while apps like Mondly and Babbel employ gamification to motivate learners through rewards and progress tracking. These tools encourage self-paced learning, which is particularly beneficial for professional students balancing academic and personal commitments.

Impact of AI and Mobile Learning on Engagement and Performance

Divekar et al. (2021) observed that AI-based tools enhance student engagement by making learning interactive and relevant. They found that students who use such tools demonstrate significant improvement in grammatical accuracy, vocabulary usage, and sentence construction. In their study, AI-enabled platforms were particularly effective in bridging learning gaps among students with varied proficiency levels, ensuring that each learner progressed according to their capabilities.

Similarly, Fleming (2003) highlights that asynchronous internet-based instruction—where students can engage with content at their own pace—improves academic performance in grammar. This aligns with the concept of spaced repetition used by apps like Memrise, which reinforce grammar rules over time to ensure retention. Wu and Wang (2021) further emphasize that flipped classroom models powered by AI tools help students internalize grammar concepts before class, freeing up class time for interactive discussions and practice.

The existing literature underscores the need for innovative teaching methods to address the challenges associated with grammar learning, particularly for professional students. AI-assisted tools and interactive mobile technologies offer promising solutions by personalizing learning experiences and fostering engagement through gamified content and real-time feedback. While traditional teaching methods still play a role, integrating AI-powered platforms can significantly enhance grammatical competence and communication skills, preparing students for competitive exams, interviews, and professional careers.

This study builds on these insights by evaluating the impact of AI-assisted tools on the grammatical competence of engineering students, focusing on how these technologies influence student motivation, participation, and performance. The findings will contribute to the growing body of research on technology-enhanced language learning and provide practical recommendations for educators to integrate AI tools into their teaching practices effectively.

This literature review provides a comprehensive overview of the theoretical and empirical studies relevant to your research topic. It emphasizes the role of AI and mobile technologies in grammar learning while addressing the challenges faced by professional students.

Research Methodology

The study employed a mixed-method approach that included quantitative and qualitative data collection. The following steps were taken:

1. Sample Size: 64 third-year B.Tech Mechanical Engineering students.
2. Tests: Two grammar tests—pre- and post-intervention—to measure competence.
3. Intervention: AI-based platforms like Duolingo, ChatGPT, and Memrise were introduced between the tests.
4. Survey and Observations: Feedback was collected through surveys and classroom observations to understand students' experiences with the tools.
5. Statistical Analysis: Test scores were analyzed to evaluate the impact of mobile technologies on student performance.

Data Collection

Test 1: Baseline Assessment (Conducted before intervention)

Participants: 31 out of 64 students

Performance Summary:

8 students scored between 16-20 marks

12 students scored between 11-15 marks

7 students scored between 6-10 marks

4 students scored below 5 marks

Insights from Test 1

Participation Rate: Only 31 students out of 64 participated, indicating a lack of motivation or confidence.

Performance: 50% of participants scored below 10 marks, reflecting significant gaps in grammar competency.

Student Feedback: Many students expressed discomfort with grammar exercises, viewing them as challenging or irrelevant to professional success.

Intervention with AI and Mobile Tools

Between the two tests, students were introduced to the following AI-powered platforms:

1. ChatGPT: Provided grammar correction and conversational practice.
2. Duolingo: Offered gamified grammar exercises with real-time feedback.
3. Memrise: Enabled personalized vocabulary practice using visual recognition and chatbots.
4. Mondly: Simulated real-world conversations through VR environments.

Test 2: Post-Intervention Assessment

Participants: 21 out of 64 students

Performance Summary:

- 10 students scored between 16-20 marks
- 4 students scored between 11-15 marks
- 2 students scored between 6-10 marks
- 5 students scored below 5 marks

Insights from Test 2

Performance Improvement: Despite fewer participants, 10 students achieved the highest score range, compared to 8 in Test 1.

Participation Decline: The number of participants dropped from 31 to 21, reflecting ongoing reluctance among some students.

Feedback: Students who used the mobile tools reported greater confidence in grammar usage and expressed interest in continuing with AI-based learning.

Data Interpretation and Analysis

Comparison of Test Results

This section provides a detailed interpretation and analysis of the data collected through tests, surveys, and observations during the study. The purpose of the analysis is to evaluate the effectiveness of AI-based tools and interactive mobile technologies in improving the grammatical competence of third-year B.Tech students.

Overview of Data Collection

The study involved two phases of testing:

Test 1 (Pre-intervention): Conducted at the beginning of the semester to assess students' baseline grammatical competence.

Test 2 (Post-intervention): Conducted after introducing AI tools and mobile technologies to determine improvement.

Participants:

64 students enrolled in the mechanical engineering program were invited to participate in both tests.

Test 1: 31 students participated.

Test 2: 21 students participated.

AI tools such as ChatGPT, Duolingo, Memrise, and Mondly were introduced to foster engagement, motivation, and real-time learning between the tests. Surveys and feedback were collected to understand students' experiences with these tools.

Performance Data from Test 1 and Test 2

Score Range	Test 1 Participants (n=31)	Test2 Participants (n=21)
16-20 marks	8 students (25.8%)	10 students (47.6%)
11-15 marks	12 students (38.7%)	4 students (19.0%)
6-10 marks	7 students (22.6%)	2 students (9.5%)
0-5 marks	4 students (12.9%)	5 students (23.8%)

Interpretation of Test Results

Participation Trends

Decline in participation: Participation dropped from 31 students in Test 1 to 21 students in Test 2.

Reasons for Decline:

Some students reported discomfort with online tools, while others mentioned time constraints due to academic workload.

A subset of students appeared unmotivated to take the follow-up test, indicating the need for stronger engagement strategies.

Performance Improvement

High-Scoring Students (16-20 marks): Increased from 8 students in Test 1 to 10 students in Test 2, showing a 25% improvement in the top-performing group.

Moderate Scores (11-15 marks): The number of students scoring in this range decreased significantly from 12 to 4, indicating that some students either improved to higher scores or fell into lower categories.

Poor Performance (0-5 marks): Slightly more students (5) fell into this category in Test 2, highlighting persistent challenges in engaging some learners.

Survey Results: Student Feedback on AI and Mobile Tools

The survey collected qualitative feedback from students regarding their experiences with AI-based tools. Key findings include:

1. Engagement and Motivation

75% of students found Duolingo and Memrise helpful due to gamified content and progress tracking features.

Many students reported that real-time feedback from ChatGPT enhanced their confidence in grammar use.

2. Challenges with Mobile Learning

Some students expressed discomfort using mobile tools, citing interface difficulties and time management issues.

A few students mentioned that they found it difficult to balance mobile learning with their regular coursework.

3. Improved Competence

Around 60% of students using AI tools stated that they felt more comfortable with grammar and believed their communication skills improved.

Students specifically praised ChatGPT for providing personalized feedback and helping with sentence construction and vocabulary.

Comparison of Test 1 and Test 2 Results

Improvement in High Scores

In Test 1, 8 students scored between 16-20 marks (top score range).

In Test 2, 10 students reached this range, indicating that the AI tools positively influenced their performance.

Shift in Moderate Scores

The number of students scoring 11-15 marks dropped from 12 to 4.

This suggests polarization: some students improved significantly, moving to the top score range, while others experienced a decline in performance.

Persistent Low Performers

Despite the intervention, 5 students scored 0-5 marks in Test 2, indicating that AI tools alone were not sufficient to address their learning challenges. This points to the need for additional support through teacher guidance and structured intervention.

Key Findings and Insights

1. AI Tools Promote Engagement for Top Performers

Students who actively used platforms like ChatGPT and Duolingo showed significant improvement. These tools provided gamified learning experiences and real-time feedback, which motivated learners to practice consistently.

2. Challenges with Sustained Participation

The decline in participation between Test 1 and Test 2 highlights the need for continuous motivation and support. Some students struggled to balance mobile learning with their academic workload, suggesting that integrating these tools into classroom practices could improve adoption.

3. Polarization of Performance

While some students improved, others showed declining scores in Test 2, emphasizing that AI tools are not a one-size-fits-all solution. Some learners may require additional support from instructors to benefit fully from these technologies.

4. Feedback and Real-Time Assistance Enhance Learning

Students appreciated the personalized corrections provided by ChatGPT and the gamified elements in Duolingo, which made grammar learning enjoyable. These features are critical for addressing individual learning needs and fostering engagement.

Statistical Analysis and Trends

The improvement in high scores and the shift in participation are statistically significant indicators of the effectiveness of AI tools for motivated learners. However, the increase in low scores among

some students suggests the need for hybrid approaches that combine technology with traditional teaching methods.

Correlation between Engagement and Performance: Students who actively engaged with the tools showed better test results.

Impact of Gamification: Platforms like Duolingo and Memrise that incorporate gamified elements were more effective in motivating learners than non-interactive methods.

Implications for Future Learning Models

The findings suggest that AI-assisted tools and mobile learning platforms can complement traditional teaching methods but may not entirely replace them. To maximize the benefits: Instructors must integrate AI tools into the curriculum, using them as supplementary resources.

Reward-based systems can be introduced to maintain student participation throughout the learning process.

Blended learning models combining teacher guidance and AI-based platforms are likely to produce better outcomes.

The study confirms that AI-powered tools and mobile technologies positively impact grammatical competence, particularly for motivated learners. Gamified platforms such as Duolingo and personalized feedback tools like ChatGPT foster engagement and improve performance. However, the decline in participation and the persistence of low scores among some students underscore the importance of teacher involvement and structured interventions. Incorporating these tools into classroom practices and offering incentives for consistent use can ensure better outcomes.

The analysis demonstrates that AI-based learning solutions are most effective when combined with human support and motivation strategies. Future efforts should focus on building hybrid models that integrate technology with pedagogy, preparing students for competitive exams, professional communication, and career success.

Recommendations

1. **Integrate AI Tools into Curriculum:** Encourage the use of ChatGPT and Duolingo in classroom activities.
2. **Provide Incentives:** Offer certificates or rewards for students actively engaging with mobile learning platforms.

3. Monitor Progress: Use data analytics from these platforms to track individual performance and provide personalized feedback.
4. Facilitate Peer Learning: Organize group activities using interactive tools to foster collaborative learning.

References

1. Algeo, J., & Pyles, T. (2010). *The Origins and Development of the English Language* (6th ed.). Cengage Learning.
2. Allen, G. (2013). Roland Barthes. London & New York: Routledge/Taylor and Francis Group.
3. Asrifan, A., Zita, C. T., Vargheese, K., & Amir, M. (2020). The Effects of CALL (Computer-Assisted Language Learning) on Students' English Achievement and Attitude. *Journal of Advanced English Studies*, 3(2), 94–106. Retrieved from http://sastra.unifa.ac.id.
4. Baugh, A., & Cable, T. (2002). *A History of the English Language* (5th ed.). Pearson Education.
5. Divekar, R. R., et al. (2021). Foreign Language Acquisition via AI and Extended Reality: Design and Evaluation. *Computer-Assisted Language Learning*. doi:10.1080/09588221.2021.1879162.
6. Fleming, S. C. (2003). A Comparison of AI-Based Asynchronous Instruction and Traditional Teaching in Developmental Algebra. *ProQuest Dissertations & Theses Global*, 305300515.
7. He, H. (2013). "On FL Learners' Individual Differences in Grammar Learning and Grammatical Competence Training." *Theory and Practice in Language Studies*, 3(8), 1369–1374.
8. Larsen-Freeman, D. (2003). *Teaching Language: From Grammar to Gramming*. Boston, MA: Thomson-Heinle.
9. Li, P., Ning, Y., & Fang, H. (2021). AI-Assisted Translation and English Learning in a Multimedia Context. *International Journal of Electrical Engineering Education*. doi:10.1177/0020720920983528.
10. Ma, L. (2021). Immersive Teaching Methods for College English Using AI and VR Technology. *Mobile Information Systems*, 2021, 1–12. doi:10.1155/2021/2637439.
11. Muhammad, F., Susanto, D., Alimudin, A., & Rochman, Z. A. (2020). Development of an English Conversation Practice App with AI & Speech Recognition. *International Electronic Symposium (IES)*, 442–449. doi:10.1109/IES50839.2020.9231570.
12. Shrivastava, R., & Mahajan, P. (2021). Influence of Social Networking Sites on Scholarly Communication: A Study Using Literature in Artificial Intelligence. *Journal of Librarianship and Information Science*, 53(3), 522–529. doi:10.1177/0961000616678309.

13. Sun, Z., Anbarasan, M., & Kumar, D. P. (2021). Design of Online Intelligent English Teaching Platforms Using AI Techniques. *Computational Intelligence*, 37(3), 1166–1180. doi:10.1111/coin.12351.
14. Ur, P. (2009). *A Course in Language Teaching: Practice and Theory*. Cambridge University Press.
15. Weatherford, J. (1997). Contextualized Instruction of Grammar for Secondary-Level English Learners. *Educational Research Quarterly*, 20(2), 12–17.
16. Willoughby, D. (1993). Contextualized English Grammar Learning: A Study of Secondary Students. *Educational Insights*, 9(1), 41–50.
17. Wu, S., & Wang, F. (2021). AI-Based Flipped Classroom Model for Listening and Speaking Instruction in English Majors. *Mobile Information Systems*, 2021, 1–14. doi:10.1155/2021/4344244.