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AI-Based Language Tools for Engineering Students: Rural Perspectives

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Abstract

In Industry 5.0, English proficiency is integral to global employability and collaboration, particularly for engineering graduates in rural India. Hence, this study analyzes the impact of artificial intelligence (AI) based language tools on improving students' spoken English fluency at Arifa Institute of Technology, Nagapattinam, Tamil Nadu. The study follows a quasi-experimental design with 90 students in two groups (Control and Experimental). Students in the experimental group engaged in 8-weeks of talking with three AI language tools (ChatGPT, ELSA Speak, Replika, and Duolingo) in their own time. The study's outcomes demonstrated a significant increase in fluency, pronunciation, and confidence, which endorses the usefulness of AI tools as an interactive and scaleable low-anxiety learning environment. The study recommends the integration of AI technologies into the language curriculum in rural settings, in particular rural developing contexts, with targeted teacher training and investment in digital infrastructure to equip graduates with communication skills in preparation for a knowledge-based economy.

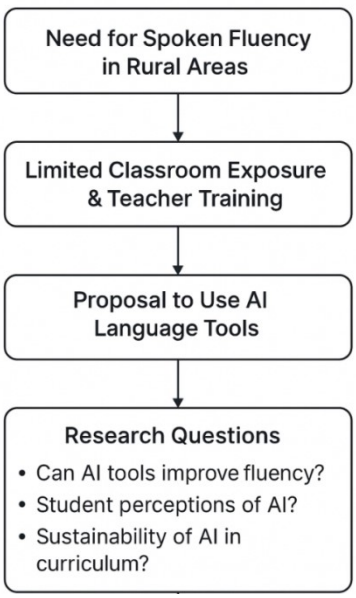
Keywords: spoken fluency, engineering education, rural colleges, chatgpt, elsa speak, pronunciation tools, industry 5.0, communicative competence, digital pedagogy, experimental study

Introduction

As countries, languages, and cultures merge into a global community and a global workforce, fluency in spoken English is increasingly considered a vital skill, particularly for engineering graduates who aim to network with industries abroad, attend international conferences and seminars, or work across international borders. In India, fluency in spoken English is also increasingly seen as an indicator of employability. Recruiters place equal emphasis on communicative English ability as they do on engineering knowledge (Steinhauer et al. 92-93). In addition to the potential importance of fluency in spoken English for employability, students at rural engineering colleges like those in Nagapattinam district of Tamil Nadu are struggling to meet fluency expectations. This is due to a variety of challenges, including: limited exposure or practice of English outside classroom contexts; very few English language teachers have had extensive training; and many English language teachers do not engage students in real spoken or interactive English in the classroom and therefore, emphasis is mostly on grammar and writing (Kumar and Murthy 118).

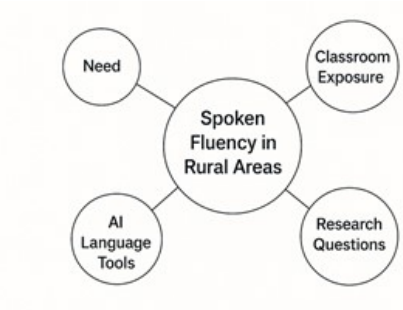
Rural schools espouse pedagogies that adhere to traditional school structures that are heavy on rote learning and text, leaving students with inadequate experiences of spontaneous speech, real-time feedback, and interaction with their peers. For scholars in Second Language Acquisition (SLA), this

misalignment has produced an observable “fluency gap” where students possess knowledge but do not demonstrate fluent communication skills. This is a case for Freire’s concept of education as a means of liberation. Freire (1976/2009) avers that "Liberating education consists of acts of cognition, not transferrals of information" (79). In practical terms, students must be able to create and to communicate knowledge and not simply recall knowledge, which spoken fluency promotes.



AI language tools offer a constructivist approach in contrast to rote learning. AI language tools such as chatbots and speech recognition apps as well as virtual tutors and pronunciation coaches offer learners real-time, individualized, and scalable learning opportunities. As Stevens (2022) states, "AI signifies an extension of communicative methodology... whilst also providing learners with a consistent, adaptive conversation partner." AI language tools can also be understood in terms of Vygotsky's (1978) "Zone of Proximal Development, "where AI can act as a "more capable peer" who affords language learners opportunities to advance their language learning through interactions.

The significance of such tools is particularly acute in rural regions. Learners in Nagapattinam, for instance, seldom possess a linguistic environment from which to foster oral fluency. AI tools provide that environment; they offer guaranteed exposure to the new language, opportunities for practice free from the fear of mistaken identity, and immediate corrections of errors. Krashen's understandings of SLA stress that comprehensible input and low-anxiety conditions are necessary for language acquisition to be successful (Krashen 3). AI chat bots and virtual tutors are able to eliminate the barriers of peer scrutiny and embarrassment that exist in the L2 classroom so that anxiety does not inhibit the SLA process.



The basic premise of constructivism, that we construct knowledge from our experiences and interactions, fits naturally with the implementation of AI in the language learning context. As Wang and Vásquez point out, one of the benefits of using digital tools for language learning is the autonomy afforded to learners—they can learn at their own pace, receive quick feedback, and go back and revisit the learning moments they are unsure of (Wang and Vásquez 101)-all advantages for EAL learners, but especially within the context of rural educational institutions where one teacher can service 40-50 students at a time.

In the national context, the National Education Policy (NEP) 2020 has promoted digital learning as a means of closing educational gaps between urban and rural areas, which has included "technology-based education platforms, especially in rural and disadvantaged parts of the country" (Ministry of Education 47). AI tools in conjunction with language learning can integrate nicely into this vision while providing an efficient, scalable solution to improve fluency in students from underserved areas.

As well, the voices of global technology leaders present strong support for the AI's destabilizing potential. Sundar Pichai, CEO of Google, said "AI is one of the most profound things we're working on. It has broad implications for education, especially where access to teachers is limited" (Pichai). His vision parallels the author's original intent behind this study: to see if AI can provide a digital bridge to fluency for rural engineering students who have had little to no meaningful opportunity to practice and improve spoken English.

This Researcah Sets out to Answer the Following Primary Questions

How can AI-based tools used enhance English speaking fluency with rural engineering students?

What are the perceptions and students responses to the AI-based tools?

Can AI-based Tools be Integrated & Sustained in Rural Language Curriculum?

By addressing these questions the study hopes to contribute to tangible knowledge on the pedagogical, psychological, and technological value of AI in rural language education.

Literature Review

The impact of Artificial Intelligence (AI) use in language education is bringing new horizons and opportunities for developing oral proficiency, particularly in contexts where traditional, faceto-face language instruction is not available. Research and expert opinion agree on the profound affordance potential available through AI tools for language learning, especially in the areas of fluency, engagement, and learner autonomy. According to Huang and Lin, AI chatbots provide a low-stress environment for students to interact and learn with "less fear of falling down, making mistakes, or being embarrassed by their production." Their systematic review of artificial intelligence in language learning supports the analysis that tools like chatbots and voice assistants offer students a rich opportunity to develop fluency through meaningful interaction (Huang and Lin). It is reasonable to conclude that based on their findings, "AI can be both teacher and peer while providing students with a hybrid environment for communication that is both environmentally safe and socially and pedagogically rich" (Huang and Lin).

More recent research by Kim, toned, reported how voice-enabled AI tools with speech recognition and pronunciation apps engaged and achieved oral fluency better than the traditional methods or tools in EFL (English as a Foreign Language) contexts. Kim, toned noted, "When students are speaking with machines, they feel less threatened, and this feeling allows for more frequent and more fluent practice of the language under the ore preparatory context of using the machine as an interlocutor (Kim 52).

Renowned linguist Stephen Krashen, who has a solid understanding of the principles underlying the significant conversations about the utility of AI in language learning, does not reference AI directly but does point out the key concept that language acquisition entails meaningful communication instead of grammar instruction directly. He states, "Language acquisition requires meaningful interaction in the target language- natural communication- in which the speakers are not concerned with the form of their utterances but with the messages they are conveying and understanding" (Krashen 3). The AI tools in this area create the contexts which allow learners to communicate and not just think about the correctness of their output.

In discussing the Indian context, Kumar and Murthy mention that rural learners face systemic challenges in acquiring spoken English due to the lack of adequate infrastructure along with trained faculty, which makes the meaningful communication even more difficult. Their research finds that rural students, prior to the introduction of AI, "continue to be tied to passive learning, and remain almost unable to communicate, with no opportunity for communicative practice" (Kumar and Murthy 118). In the case for rural learners, AI tools are potential ways to level engagement with speaking practice and, allow for scalable, self-paced practice, to make up for the deficits in the resources of people.

Vance Stevens, a CALL advocate, claims that AI is "an extension of communicative methodology, now in a digital form" (Stevens 103). He favors AI-tools for engaging students in spontaneous, responsive communication, which are critical variables to develop fluency. His position is consistent with constructivist learning, in which a learner actively constructs knowledge based on interaction and reflection.

Wang and Vásquez (2021) examined AI and Web 2.0 tools connected to learner autonomy. They had students use apps such as Duolingo and ELSA Speak. They found that students were continually setting goals, practicing autonomously, reviewing feedback from the app, and actively self-correcting (Wang and Vásquez 101). They conclude, "students are no longer waiting for teacher feedback—they are generating, analyzing, and responding to input in real-time."

The National Education Policy (NEP) 2020 reinforces the inevitable limitation of technology for language learning, especially for rural student learners of engineering: "educators to encourage and ensure the extensive use of technology…" (Ministry of Education 42)

Furthermore, the policy focuses on "removing language barriers" and "equitable access" (Ministry of Education 42). These learning outcomes are necessary and reassuring for rural student use of AI for language learning.

However, there are worries. Selwyn is wondering whether AI can scale the emotional intelligence and cultural awareness that human educators provide. He points out the "depersonalization of pedagogy", arguing that language is fundamentally a human and social phenomenon that cannot be digitized (Selwyn 159). Hence, even critics agree AI has promise as one more ally in teaching and learning, especially it seems, in resource-poor settings.

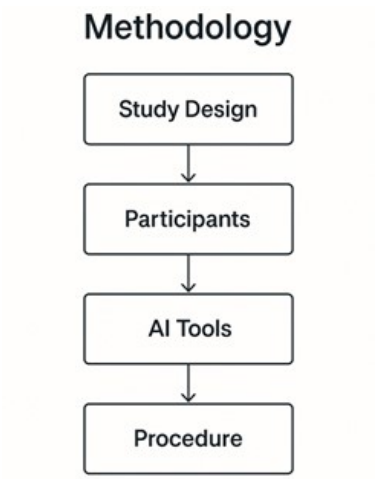
On a much larger scale, industry leaders like Sundar Pichai, the CEO of Google, are familiar with how AI can transform education. In a 2020 interview, he mentions "In the future, AI will help teachers focus on learning, and work to scale education and personalized education, especially in places where limited resources are present" (Pichai)

In conclusion, the literature makes clear that the phenomenological implications of adopting AI in supporting language education can be vast. While AI will not replace the human experience, it can offer unique, varied, personalized, and accessible ways to support students in developing fluency, especially in poorly resourced and rural classrooms. Using the studies referenced, this study proposes to investigate the effect of an AI-based tool on the improvement of speaking fluency of engineering students in the Nagapattinam district.

Methodology

Participants

The study was conducted at Arifa Institute of Technology, Esanoor, which is situated in the rural belt of Nagapattinam district Tamil Nadu, where the students have little exposure to English speaking. A total of 90 second-year undergraduate engineering students from various departments (Computer Science, Electrical, Civil, and Mechanical Engineering.) volunteered to participate in the study. The students ranged in age from 18-20 years of age with a mixture of urban and predominantly rural backgrounds.



In order to implement a systematic experimental design, participants were randomly assigned to each of two groups:

- Experimental Group (n = 45): AI-enhanced instruction.
- Control Group (n = 45): Traditional classroom instruction.

All of the students had taken the prerequisite English communication courses set by the university and did not have demographic differences related to academic performance, gender, or language ability (assessed through an oral screener) before they were assign to an experimental condition.

All students gave informed consent prior to the start of formal classes. The research method was approved by the Head of the Department of English and the Principal of Arifa Institute of Technology, in compliance with university ethical procedures.

Tools Used

The experimental group employed a type of AI-based language learning experience because they have been identified as:

- ELSA Speak – An AI-based app used to support pronunciation coaching, correcting stress and intonation, and also monitoring fluency.
- Google Read Along & Voice Typing – Tools that enhance oral reading, spontaneous speaking, and clarity of pronunciation.
- ChatGPT & Replika – AI-based curtains to simulate human interaction to practice vocabulary and fluency.
- Duolingo & HelloTalk – AI applications that allow gamified speaking experiences and peer-to-peer interaction with English speakers around the world.

Every one of the participants in the experimental group received a smartphone and access to the college computer lab to connect with language learning tools. Exposure and orientation sessions established the foundation for digital literacy and confidence with usage. We believe, more generally, these tools were particularly effective because they were free and offered an offline supported option whereby the students could have supported spoken English while learning out in the "real world."

Procedure

Over the eight-week period, the intervention took place, and both the experimental and control groups continued the same English communication classes that were planned in the institution's syllabus. The experimental group was provided with an increased two hours of instruction per week that directly focused on using AI tools to enhance their speaking practice.

Key Components of the Experimental Instruction Included

- AI-enabled pronunciation practice with ELSA Speak
- Chat based spoken tasks with ChatGPT and Replika on general topics
- Read-aloud fluency tasks with Google's Read Along
- Peer voice messaging exchanges with HelloTalk for cross-cultural speaking
- Fluency leaderboards and progress tracking, leveraging gamification to motivate learners

The control group received the standard curriculum, with a focus on grammar, reading comprehension, essay writing, and traditional spoken exercises with no technology.

To Measure the Effect of the Intervention, the Study used a Pre-test/post-test Experimental Design. Participants Were Assessed using

An informal fluency rating scale based on CEFR (Common European Framework of Reference)

A formal oral assessment rubric that included criteria for:

- Speech rate / fluency / continuity
- Pronunciation / intonation
- Lexical and grammatical accuracy
- Content relevancy and cohesiveness
- Interactive competence

All oral tests were done face to face, recorded, and assessed by two independent assessors of English language competence. Assessors were 'blind' to the groups, in order to eliminate bias. Scores from both groups were analyzed to find statistically

significant differences in learners' development of speaking skills.

The study also collected qualitative data, including student reflections, focus groups, and weekly progress logs to provide further insights into their experiences utilizing AI tools.

Results and Discussion

This section describes the outcomes of the research and offers a discussion of the responses to the quantitative and qualitative data. The effectiveness of the AI-based tools on engineering students' speaking fluency from Arifa Institute of Technology was explored with pre and post-tests and participant reflection responses.

Quantitative Results

The pre-test and post-test oral assessments were evaluated using a rubric based on the CEFR. The average pre-test score for both the control and experimental groups was nearly the same indicating a comparable point of entry. Post intervention, the experimental group showed statistically significant improvement in all parameters of fluency:

Mean post-test fluency score (Experimental): 7.8/10 - Mean post-test fluency score (Control): 5.6/10

The t-tests conducted on independent samples, confirmed that the improvements in the experimental group were statistically significant ($p < 0.01$), particularly in the areas of pronunciation, continuity of speech and lexical range.

Qualitative Insights

Feedback for participants was collected via journals, weekly progress records, and a focus group discussion. Many of the students in the experimental group said that the AI tools had permitted them to feel more confident, decreased their hesitation, and allowed for practice without the judgement.

Quotes from Students

- "I was shy speaking English in class, but talking to the chatbot gave me the confidence."
- "The chatbot told me exact pronunciation. I practiced many times until I could say it."
- "I liked the competition with myself and seeing my scores get higher."

The teachers also saw a higher level of engagement in the experimental group with regards to participation in class and marked improvements in students speaking naturally during conversations.

Discussion

The results demonstrate the promise of building AI-based tools to support English fluency for rural engineering students. The dramatic improvement seen by the experimental group below highlights the benefit of augmented technology together with traditional teaching methods and how AI helped provide personalized and interactive opportunities for language practice outside the classroom.

The control group was limited to textbook conventions, whereas the experimental group was able to have opportunities for varied and meaningful oral communication. These results align with Krashen's input hypothesis and Vygotsky's scaffolding theory that advocate for immersive and responsive opportunities to develop language. That said, they also faced challenges, including limited access to the internet, required devices, and teacher resistance to new technology. All of this will require concerted support from educational institutions along with training teachers as best we can to ensure sustainability when it is easy for students in today' context; to surrender to learn.

Implications for Teaching

This study's results have important pedagogical implications for teaching English in rural engineering institutions, particularly with regard to curriculum design, teaching development, and institutional policy. To a lesser extent, the way that AI-based language tools can be implemented provides a scalable and powerful approach for developing spoken English fluency for students who have low resource backgrounds.

Curriculum Design and Integration

One of the essential implications is the necessity of reconfiguring and revising language laboratory programmes at rural colleges to incorporate AI-driven tools and applications. In that regard, language laboratories are mainly a series of recorded dialogues and grammar drills. However, they can be dynamic, electronically enhanced language learning environments. Applications like ELSA Speak, Duolingo, and ChatGPT offer taskbased, learner centred activities dealing with fluency that depend on repetition, feedback, and self-assessment.

Institutions could dedicate these AI-based apps as part of a syllabus, where students earn credits for the AI speaking assignments in supplementary modules, or alternatively, students could undertake these assignments without credit. Weekly progress (that is, progress journals), oral practice logs, and assemblages of reflective journals could ensure that students engage (or bypass the object of engagement). By embedding the technologies in the actual language curriculum or syllabuses, we will more effectively close the gap between pure theory and spoken situated realities.

Teacher Training and Professional Development

Context is key for the successful adoption of AI tools in the classroom in terms of teacher awareness and confidence with technology. Many teachers working in rural contexts may lack the awareness of either the pedagogical affordances and possibilities of AI tools or how to effectively use them. Because of this need, there will be a need for workshops and professional development programs that allow teachers to receive training and feel comfortable using AI-integrated pedagogy.

These workshops could focus on:

Presenting examples of how conversational AI tools, voice recognition/comprehension tools, and gamified speaking platforms can be integrated effectively in the classroom.

Demonstrating how AI can support differentiated instruction by offering personalized pathways for students who have different proficiency levels.

Facilitating a move away from being teacher centered and more toward being a facilitator of learning and guiding students to explore independently through technology.

Empowering the teacher through professional development will support sustainability of digital language learning.

Institutional and Policy Recommendations

To ensure the success of AI-enabled language learning in rural colleges, a favorable institutional and policy environment is required. Some examples of needed environmental support are:

Infrastructure support, such as high-speed internet in classrooms and computer labs, sufficient smartphones or tablets for student sharing, and reliable power.

Financial support, including institutional licenses for premium language learning resources (e.g., ELSA Pro, Replika Plus, etc.) as subscriptions so that all students have equal access.

Political and financial recognition and support from both state and central educational authorities in promoting AI-enabled education in rural contexts as part of their digital inclusion ambitions.

Incorporation of AI language learning into national frameworks such as the AICTE's communication skill development modules or the National Education Policy 2020 and the digital education context issued through the Government of India, so it is accepted and become common practice to implement AI-enabled language learning.

An ecosystem-based approach that recognizes the entangled and context-driven feeling of the curriculum, faculty, and administrative structure can support planning and developing AI-based language learning in rural higher education, as described in this study, could pave the way for greater meeting place fluency and, hence, employability and academic confidence of engineering students from marginalized groups.

Conclusion

AI-enabled language learning technologies promise transformative potential for engineering students in

rural India, where implementation of traditional language pedagogy often fails to meet 21st-century workforce communicative demands. This study has shown that AI applications, when implemented appropriately can lead to improvements in spoken English fluency and learner anxiety, as well as increases in learner autonomy. Immediate feedback, engaged practice, and a motivating gamified space are all provided by tools such as ELSA Speak, ChatGPT, and Duolingo that support regularized oral practice; all important for developing fluency. In a world where employability depends on effective communication skills, the use of artificial intelligence in language education presents an equity-based solution for overcoming the urban/rural fluency divide, rather than just an educational innovation. For colleges like Arifa Institute of Technology (and similar rural colleges), it enables students to take on the global academic and professional world confidently. Although the short-term intervention has shown benefits, it is important for further research to examine the long-term retention and transfer of effects of the AI-supported fluency training program. Future research could also investigate how these tools could be used beyond speaking to develop the listening, writing and interaction components of language use together with speaking. Such studies could also extend to comparing other contexts, languages, and learner profiles, enabling broader insights into the scalability and transferability of AI-based instruction to other Indian contexts. In summary, AI-enhanced language learning is not simply a new technology; it is a pathway for rural Indian learners to access linguistic empowerment, boost academic confidence, and improve the socio-economic settings of their lives.

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