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Leveraging Artificial Intelligence (AI) to Enhance English Language Acquisition of Stem Learners

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Abstract

Artificial intelligence (AI) is transforming the paradigm of English language teaching and learning. Specifically for STEM (Science, Technology, Engineering, and Mathematics) learners, AI-based tools assist in developing the academic and technical language. An English Language Acquisition of STEM learner is essential to present ideas and proposals, publish research works, and report the findings of their study. This paper sheds light on the assistance of AI in improving the English language acquisition skills of STEM learners. It highlights the role of digital tools in enhancing technical writing, communication, vocabulary, grammatical, and lexical competency. AI usage fosters self-paced learning, personalized instruction, and ethical implications. The findings of the research reveal that AI can aid in improving the English language skills of STEM learners. It can effectively assist the traditional methods of teaching and learning, but it cannot replace the traditional methods. Achieving exceptional English language skills is essential for an individual. Particularly for STEM learners, it helps in attaining the global forum of research and academic success.

Keywords: artificial intelligence, STEM learners, English Language Learning (ELL), digital tools, technical language, YouGlish, ELSA speak

Introduction

In contemporary times, the world is increasingly digital and tech-driven. The English language serves as the medium for worldwide communication. Proficiency in the English language is essential for global communication and wider outreach (Crystal, 2003). For STEM (Science, Technology, Engineering, and Mathematics) learners, English proficiency is a must to explore the wide range of research articles, journals, publications, and reports. Language barrier not only impedes the academic performance of STEM learners but also limits their participation in global research and innovation networks. The integration of Artificial Intelligence (AI) into the current education system has opened up new ventures to explore.

Incorporating AI into the field of English language learning has become indispensable. It provides transformative possibilities for mastering the language. AI tools adapt to an individual learner's pace and time, creating more engaging and self-tailored models for each individual by providing personalized support (Luckin et al., 2016). For STEM learners, the assistance of AI is essential for writing research papers, delivering presentations, and participating in global academic forums. This paper explores the assistance of AI in improving the English language acquisition skills of STEM learners. It highlights the role of digital tools in enhancing technical writing, communication, vocabulary, grammatical, and lexical competency.

The English Language and its Significance

The English language had its introduction with three phases in India, the first phase was to familiarize the language through Christian missionaries, the next one was developing the desire to acquire English as their second language, and the last phase of its development was the formulation of Indian educational Policies. English, being the global lingua franca, serves as the common medium of interaction among multiple native language speakers, and that facilitates global connectivity (Jenkins, 2014). English is an international language of science, academia, research, diplomacy, trade, politics, business, tourism, maritime, aviation, and technology. The substantial scope of this language promotes unity and contributes to social mobility and economic growth. Its wide historical spread and neutral accessibility of language are the ultimate reasons for its dominance. English is also regarded as the common digital language of media and social networks. Language learning intensifies the skills of active listening, communication, and social connection. It builds the confidence, self-esteem, and resilience of an individual. Thus, proficiency in the English language helps an individual to actively participate in a global forum to enrich their opportunities for learning and employment.

NEP's Insights on English Education

Though the National Education Policy (2020) stresses mother tongue usage for strong foundational cognition in growing children, it also extensively emphasizes the inquiry-based English language learning through modern pedagogies and activity-based approaches *(Ministry of Education, 2020)*. NEP's salient thrusts of English Language learning are

- In a multidimensional approach, NEP advocates a holistic development of English Language Teaching / Learning.
- NEP (2020) adopts a multidisciplinary perspective and provides equal importance for Mathematics, Language, Science, Social Studies, Arts, and Sports. It also encourages multilingualism and possesses a constructivist outlook on English Language Learning.
- The aim of teaching English to Secondary school learners is to make them understand the global heritage and world culture.
- It emphasizes teaching the English language by concentrating on interaction and conversational skills. It also accentuates the significance of Literature, grammar, and vocabulary of the English Language.
- In the domain of activities based on English Language Learning, NEP signifies enquiry-based and project-based learning.

The Role of Artificial Intelligence in Education

Artificial intelligence is a trailblazing innovation in this ever-evolving world. It reshapes fundamental domains of the universe with its distinct transformative touch. AI is the technology that enables machines and computers to simulate human learning, comprehension, problem-solving, decision-making, creativity, and Autonomy *(Russell & Norvig, 2021)*. AI can be classified into three types based on its capabilities. They are Artificial Narrow Intelligence (ANI), Artificial Generative Intelligence (AGI), and Artificial Super Intelligence (ASI). Narrow AI is based on machine learning, whereas the other two are based on machine Intelligence and machine consciousness, respectively. Currently, when compared with generative AI and super AI, the narrow AI is widely preferred. Image recognition systems, Google Assistant, Siri, and chatbots are the applications of narrow AI (Russell & Norvig, 2021). It has revolutionized various fields like education, medicine, cyber security, transportation, finance, and marketing. In education, AI has brought out tremendous transformation to kindle the interest of both facilitators and learners. The teaching-learning paradigm of the Gen Z generation is modified by AI. The ways in which students learn and the teacher instructs are made innovative and simple. The adaptive skills of artificial intelligence will aid in replacing the one-size-fits-all method of our traditional classroom. AI-driven education focuses on personalized learning, self-tutoring, automated tasks,

gamification, adaptive learning platforms, interactive modules, and more. It can also facilitate interactive collaboration, content creation, and automated assessments.

AI Tools for English Language Learning

Language is not a genetic gift; it is a social gift *(Smith, 1990, p. 17)*. Flawless learning is the ultimate need for language acquisition. Artificial Intelligence (AI) aids in the growth of Listening, Speaking, Reading, and Writing skills of an individual. In the process of English Language Learning (ELL), AI tools can assist in grammar correction, vocabulary development, speech analysis, and content analysis. AI is a multidimensional technology with three distinct categories of digital tools; they are student focused, teacher focused, and system focused. Pupil centered tools are based on improving their language acquisition ability. Teacher centered tools are based on improving teaching ability. System based tools are used for maintaining both pupil centered and teacher centered learning and teaching skills. Digital tools like Writing and Communication assistants, automated feedback and evaluation systems can ameliorate personalized learning experience, provide immediate feedback with adaptive solutions, and encourage self-paced learning (Sánchez-Villalón et al., 2022). Digital tools that can address the needs of STEM learners in the context of language acquisition are Grammarly, Wordtune, YouGlish, ProWritingAid, Memrise, ChatGPT, Gemini, QuillBot, Duolingo Max, Lexical AI, ELSA Speak, Speechling, and more.

Significance of STEM Education

STEM Education integrates the fields of Science, Technology, Engineering, and Mathematics to enhance the practical learning, computational thinking, and critical analysis of real-world applications. The blended way of learning/teaching is a significant factor that distinguishes STEM education from traditional science and math subjects. STEM education is now revamped as STEAM education (Yakman & Lee, 2020). The inclusion of the arts in STEM education has the ability to expand its limits and produce potential outcomes. The Indian Ministry of Education promotes STEM education through the Vidyasakthi initiatives to strengthen the knowledge of rural learners (Ministry of Education & IIT Madras Pravartak Technologies Foundation, 2023). The U.S. Bureau of Labor Statistics 2025 predicts that between the years 2023 and 2033, the growth of STEM-related occupations will be 10.4 % and other non-STEM-related occupations will be 3.6 % (U.S. Bureau of Labor Statistics, 2025). Therefore, the employability rate of STEM learners is high when compared to other fields. The current status of learners who learn STEM education is comparatively low, and thus, it has resulted in a wider skill gap. In order to overcome this gap, the government is taking initiatives to incorporate STEM education, basically from elementary school to graduation. The initial stage provides inquiry-based and real-world application-based learning. The aim is to create the interest of learners and to make them actively participate in experimentation. At the middle school and high school levels, STEM learners are presented with deeper subject knowledge, exploration of careers, and applications of perceived subjects. Graduation fills the gap between employment and the skills of learning. The Council of Scientific and Industrial Research (CSIR), has also taken initiatives like Vigyan Jyoti and Vigyan Dhara to improve the female ratio in the pathways of STEM-based career opportunities (Department of Science & Technology, Government of India, 2024; Vigyan Jyoti Programme, n.d.).

Impact of AI on STEM Learners

STEM learners have to actively participate in the public forum of research to expose their ideas, technicalities, results, and findings. They have to publish the research paper in journals, report the findings as research reports, create proposals, send e-mails, present at conferences, and talk about the key findings and improvements. For all these, the English language serves as the medium of communication. Thus, the use of AI tools to improve the English language of STEM learners has positive outcomes. Grammar checking, tone, and style correction tools are often found useful for STEM learners in publishing their research papers and project reports

with an excellent academic tone, clarity and precision (Cotos, 2014). Writing assistants can generate an outline, structure, and help in improving technical vocabulary. Few tools like Quillbot and Wordtune assist in rewriting the contents, which is highly beneficial for STEM learners to understand the complex subjects and simplify the technical structure of the published documents and reports. Tools like YouGlish and ELSA Speak enriches the learner's accent and pronunciation by specifically providing automotive feedback and real time exposure (Hoang Thi Minh, 2024; Talkpal, 2025). This brings clarity of communication among STEM learners. This guides them in effective presentation of their ideas in oral presentations, collaborative Projects, and conferences. These kinds of AI tools create a virtual language learning environment, where STEM learners can inculcate the English language through technical contexts of scientific reports, documentation, coding explanation, project proposals, and experimentation.

Conclusion

The English language acquisition of STEM learners can be revolutionized through integrating Artificial Intelligence (AI). It provides real-time individual support, personalized and interactive learning to attain proficiency in the target language. AI tools assist STEM learners in exhibiting their expertise in the global forum of academic research. AI can never replace the role of a human instructor, but it can transform the role of a teacher into a facilitator. AI complements the traditional method of teaching and learning by giving specific importance to areas such as grammar competency, pronunciation, vocabulary, and technical writing. An automated feedback and assessment system provides learners with an immediate assessment and encourages self-paced learning. It serves as an excellent supplementary resource that transforms difficulties into advantages of learning. The future of AI in English learning lies in the hybridization of new models that combine both AI and human instruction. Thus, AI enables STEM learners to achieve great linguistic ability, enabling them to surpass the global research, cross-cultural communication, and industrial collaboration.

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