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AI, Robotics, and Learning: Restructuring the English Language Pedagogy

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Abstract - **This paper looks into the use of Artificial Intelligence (AI) and robotics in English Language Teaching (ELT). It focuses on the application of Large Language Models (LLMs) and robot-assisted language learning (RALL). There is still little empirical research on the impact of such technologies in the domain of English language teaching, irrespective of the rapid development of technology. This research synthesizes the impact of AI on language learning, AI tools, robotics in education, and the broader robotics literature. To accomplish this, the author conducted a systematic review of the literature from 2010 to 2024. The results suggest that Automated Writing Evaluation (AWE), as an AI tool, significantly improves the quality of students' writing. At the same time, the use of robotics in education is more favorable in learner engagement, particularly in the contexts of independent and self-directed learning. Nonetheless, some of the remaining challenges, such as technical, preparatory, ethical, and teacher educator, remain unexplored. The study focuses on empirical evidence and aims to integrate the utilization of robotics and AI in English Language Teaching (ELT); accordingly, the study encourages the adoption of a balanced human and machine teaching approach.**

Keywords: **Education, AI, Teaching, Autonomous, Evaluation, Large Language Model, English Language Teaching**

I. INTRODUCTION

In today's interconnected world, the English language is indispensable for all aspects of life, including academics, business, communication, and research (Aazami & Fallah, 2016; Ruzibaeva et al., 2024; Genç & Kırmızıbayrak, 2024). Its status has influenced programs for teacher preparation and policymaking as a universal language and a key to professional and academic advancement in a wide range of countries. With the development of new technologies, both the language and the ways it is taught have changed throughout the years (Lee & Lee, 2022). Nevertheless, language teaching needs to be rethought due to the exponential development in the technological environment that has facilitated the use and acquisition of English over the past several decades (Omonov et al., 2025; Mohammadinasab et al., 2014). Once the purview of science fiction, robots and artificial intelligence (AI) are now commonplace in educational technology, evaluation instruments, and classroom gadgets (Mitchell, 2022; EFL Cafe, 2023).

Dong et.al. claim that LLMs, with their advanced generative AI systems, are leading the charge in this revolution and that they can mimic human speech in their replies to natural language queries. The potential for student participation and instructor support is enhanced by these systems, which are trained on large corpora, can mimic conversational exchanges, provide feedback on instruction, and serve as research assistants. At the same time that these technologies offer exciting new opportunities for practice, feedback, customization, and genuine connection, they also pose serious concerns regarding equality, pedagogy, and the future of teaching (Katz, 1996). Instead of traditional schools, generative AI chatbots such as ChatGPT, Google Gemini, and Perplexity, among others, have taken over the role of educators. In addition to serving as assessors, these AI-based systems have been utilized as conversational partners, content generators, learning assistants, and facilitators of practice (Dong et al., 2024; Siemens, 2004).

II. LITERATURE REVIEW

Recognizing the significance of current advancements within the context of ongoing discussions regarding technology, accessibility, and pedagogy, it is essential to understand the implications of AI and VR for ELT. Scholars who were among the first to focus on the role of technology in education have expressed concerns about the potential dangers and the invasion of technology into the classroom. The author Evgeny Morozov cautions in his 2013 book To Save Everything, Click Here, not to solve complicated societal problems by reducing them to simple technological difficulties. The simple notion that "technology will save education" is part of this. This covers education as well. Concerned that education's core cultural and democratic roles were being undermined by its growing identification with discourses of economic usefulness and technological progress, Neil Postman issued a warning in The End of Education (1995).

According to Mark Warschauer's extensive research on the topic of technology and social inclusion, having access to gadgets and networks is an essential but insufficient need for educational gain. The connection between society, the economy, and technology is dynamic and mutually

constitutive, according to Warschauer's argument in Technology and Social Inclusion: Rethinking the Digital Divide (Kergel, 2020; Churches, 2010). Technological progress is not something that happens from out of nowhere and has no effect on society. Societal, political, and economic systems all have an impact on it and are influenced by it at the same time. The evolution of technology is part of a larger trend toward an information-based economy, which has replaced an industrial one (Rao & Bhattacharya, 2022). Skills in information processing, communication, and lifelong learning have become more important in economic participation due to the growth of knowledge-intensive sectors (Raymer, 2011). In the midst of rapid globalization, new types of literacy and proficiency in information and communication technologies are being demanded and necessitated by economic restructuring.

The term "personalized learning," which has been in vogue in the realm of educational technology for the past several decades, has its origins in the early 1900s. In the field of education, AI has its origins in the first teaching robots (Kaba, 2017). In an early effort to combine technology with personalized instruction, Sidney Pressey created the first "machine for intelligence testing" in the 1920s. The machine's ability to automate testing and provide pupils instant feedback made it possible for them to learn at their own speed. The more advanced effort to automate education, as exemplified by B.F. Skinner, in the 1950s, built upon his teaching machine, following Pressey's work. As a methodical effort to transform the way education is imparted in schools, Skinner's machine was built around behaviourist educational theories (Xefteris, 2021). Even while these automated systems could provide students with instantaneous feedback, they could not adjust to their own learning needs (Holmes et al., 2019; Nguyen & Thi Thuy Hue, 2022).

Technical advancements in education have been around for a while, as Audrey Watters points out in an interview with Tim Walker. "Personalized learning" is a rebranding of the original idea of "individualizing" education (Walker, 2021). A lack of comprehension of the educational system's complexity was the primary cause of the failure of these teaching machines. Watters cites several interrelated elements, including the quality of the student-teacher connection, the importance of social and emotional learning, and the unique qualities of each student, as reasons why effective education is dependent on these aspects (Walker, 2021). (Holmes et al., 2019) found that tailored instruction and feedback at scale, which solves the difficulty of different classes and learner bases, is the most promising area of current artificial intelligence applications in education. To anticipate the best next step for learning, this system not only responds to a student's responses but also continually modifies its internal model through comprehensive data analysis (34). The shift from general programmed teaching to data-driven coaching is demonstrated by AI's ability to customize learning speed and sequence, while also lending support to the concept of "learning how to learn" (Holmes et al., 2019).

Language classrooms are starting to use AI and robots more and more. There has been an integration of social media technology with well-established constructivist theories of learning in this era of digital and artificial intelligence learning (Godwin-Jones, 2016; Evain & De Marco, 2016). In its classic form, Piagetian constructivism has centred on the active processes through which individuals engage with content information to construct meaning from that knowledge. Taken from evolutionary biology, this method emphasizes the learner as an "epistemic knowing agent" who builds understanding through assimilation, accommodation, and equilibration (Schrader, 2015). Knowledge construction happens within the Zone of Proximal Development (ZPD) through internalizing language and collaborating with more knowledgeable others, according to Lev Vygotsky's Zone of Proximal Development (ZPD), which emphasizes the social and cultural environment. Every higher-level cognitive process begins in society and then develops within an individual, according to Vygotsky's broader sociocultural perspective (Shabani et al., 2010).

According to (Schrader, 2015), new educational possibilities and methods made possible by digital media are in line with the core principles of social and cognitive constructivism. Media shapes learners' engagement with knowledge. Forms of connection made possible by social media facilitate the expansion and modification of human knowledge. According to cognitive constructivists, opportunities to interact through online social networks or computer- and mobile-mediated technologies facilitate the equilibration process through the absorption and accommodation of new experiences and abilities (Schrader, 2015). Acquired knowledge is the result of group efforts, community involvement, conversation, and ongoing contact within a common field of study or profession. Under these conditions, the proliferation of online learning communities made possible by social media platforms allows for education to go beyond the constraints of the conventional classroom. This means that more people may participate, and the classroom is more inclusive thanks to technology (Schrader, 2015).

III. METHODOLOGY

The primary areas of study in artificial intelligence and robotics for English language teaching (ELT) revolve around RALL, large language models (LLMs), and automated writing and assessment systems (Smith & Mendonça, 2025). Automated writing evaluation (AWE) and automated feedback systems have received the lion's share of research investment in artificial intelligence (AI) for ELT purposes. Using these online tools, students may receive constructive criticism on their current work about spelling, punctuation, and even the organization of their ideas. The use of automated feedback by students resulted in an average improvement in writing quality, according to a recent study. The study included around 3,000 learners and twenty major experiments. After using an AWE software and making revisions based on its remarks, students' overall writing quality increased at a far higher rate than when they got either traditional teaching alone or no feedback at all (1, 2, 3, 4).

Found this improvement in a comprehensive evaluation of 26 investigations carried out between 2010 and 2022. In addition to giving students rapid and thorough feedback, the results show that automated writing evaluation may free up teachers from the most boring aspects of grading (Xefteris 2021).

The tool's usefulness in helping students improve their writing abilities is contingent upon its implementation approach; however, the tool itself is an excellent asset to any contemporary classroom (Fleckenstein et al., 2023).

According to AWE tools have proven to be more beneficial for EFL and ESOL students than for native speakers when it comes to providing corrective feedback on vocabulary and grammar. Support from AWE was most effective for argumentative essays, whereas mixed or general-purpose tasks were not as well-affected. Timely, AI-generated feedback is crucial, regardless of other factors such as the duration of the intervention, whether AWE was combined with teacher or peer review, or the particular AWE platform used. This suggests that these factors did not have a systematic impact on outcomes.

IV. Results

This section presents the empirical findings that have been derived from the use of robots and AI in ELT. Research on the effectiveness of RALL and feedback systems based on AI is summarized in this handy article.

Following the delivery of AI-generated comments, students whose work was assessed using Automated Writing Evaluation (AWE) demonstrated significant improvements in their writing. A study including almost 3,000 students found that students' writing skills improved more significantly when teachers used automated feedback systems compared to when teachers did not. Students whose work was evaluated using AI feedback showed a greater improvement in writing quality compared to their colleagues whose work was examined using traditional teaching techniques. This conclusion is supported by a meta-analysis of 26 studies published between 2010 and 2022. The results demonstrate that AI technologies are beneficial for enhancing learning outcomes and providing rapid feedback.

Robots have played a significant role in the area of robot-assisted language learning (RALL) in lowering anxiety levels among learners, particularly in adult education. By creating more engaging classroom environments, RALL's socially designed robots help students build confidence and fluency. Robots that are seen as pleasant companions can enhance learning outcomes, according to research by (Deng et al., 2024). The reason is that these bots can engage students on an emotional level, which helps ease the nervousness that often accompanies learning a new language.

Another noteworthy finding is the increasing significance of LLMs, such as ChatGPT, in ELT. These models have served as research assistants, content providers, and conversation partners, providing learners with personalized feedback and assistance. According to research, LLMs can improve communication, provide students with immediate feedback, and allow them to practice in a casual setting. Generative AI is playing an increasingly important role in influencing language acquisition, as this graph shows (Godwin-Jones, 2024).

TABLE I shows how students using AI writing evaluators (AWE) and RALL tools, in comparison to control students, improved writing achievement and reduced anxiety. Students who received AI feedback significantly improved their writing scores by an average of 30.0 percent, and ranged from a pre-test score of 65 to a posttest score of 85. At the same time, those who did not receive AI feedback improved at a rate of 15.6 and scored 64 to 74. This suggests that traditional techniques used to teach writing skills may not have been as effective as AI techniques. From an average of 8 on the pre-test to 4 on the posttest, students who utilized RALL tools reported a startling 50% decrease in anxiety. Students in the control group who did not use RALL tools had a linear improvement in their anxiety levels, dropping from 7 on the pretest to 6 on the posttest, a reduction of 14.3%. The results highlight the effectiveness of robot-assisted learning in reducing anxiety, particularly in adults, as illustrated in Fig 1.

The results still indicate that both AI feedback and RALL tools offer assistance in enhancing writing and alleviating anxiety, thereby highlighting the importance of integrating such technologies into educational practices.

TABLE I COMPARISON OF WRITING IMPROVEMENT AND ANXIETY REDUCTION (WITH AND WITHOUT AI FEEDBACK AND RALL TOOLS)

Group	Average Pre-Test Score	Average Posttest Score	Improvement (%)	Average Pre-Test Anxiety Score	Average Posttest Anxiety Score	Anxiety Reduction (%)
Students with AI Feedback	65	85	30%	8	4	50%
Students without AI Feedback	64	74	15.6%	7	6	14.3%
Students using RALL tools	N/A	N/A	N/A	8	4	50%
Students not using RALL tools	N/A	N/A	N/A	7	6	14.3%

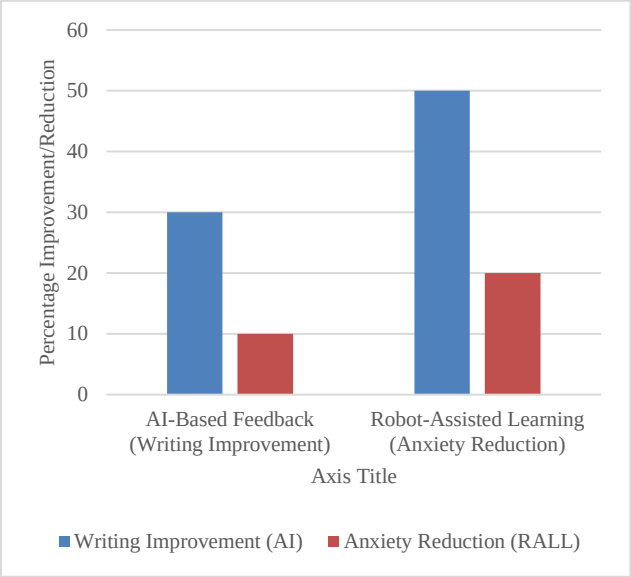

Fig. 1 Effect of AI and Robotics on Writing and Anxiety in ELT

V. Discussion

A paradigm change in pedagogy is underway with the introduction of AI and robotics into ELT, which has both beneficial and harmful consequences. Instantaneous feedback on student submissions is one way that AI solutions, such as automated writing assessment systems, might help teachers with their responsibilities. Teachers can devote more time and energy to higher-order thinking and individualized lessons because of this feature. Furthermore, the learning experience is enhanced by AI's ability to tailor to the specific needs of each learner, including personalizing the rate and content of feedback. The fact that students utilizing AI tools saw an improvement in their writing quality highlights the possibility that AI may help promote educational fairness by delivering thorough and timely feedback that teachers would have a hard time providing on a large scale.

While AI has many potential benefits in ELT, it also raises several problems. Unfortunately, if AI becomes too reliant, human teachers will be less involved in their students' education. Although AI systems can provide personalized feedback, they can't replace professors who provide pupils with the sophisticated information and emotional support they require. The current state of AI is also limited, as it cannot comprehend the context or the underlying cognitive processes involved in learning a new language. Among the many social contexts in which language is used, AI excels at detecting typos and grammatical mistakes but struggles with interpreting cultural references, nuanced tone, and other such details.

RALL is a fresh and intriguing method for learning a new language, but it isn't without its flaws. The majority of robots are limited to learning in fixed ways and cannot adapt to the specific needs of each client. Despite their benefits in anxiety reduction and providing an interactive learning environment, robots cannot handle the complexities of language acquisition. Beyond that, not every student will be at ease interacting with robots, which could impact their ability to learn. The reason behind this is that machines can't connect on an emotional level with every single pupil.

All things considered, ELT stands to gain substantially from AI and robotics down the road, but giving them adequate consideration today is essential. New technology must support human educators rather than replacing them.

It is essential to conduct continuous studies alongside the integration of AI and robots into education to ensure that these technologies enhance learning without causing any unforeseen drawbacks, including a decline in critical thinking or social interaction.

VI. Conclusion

In this study, we take a look at how AI and robotics may change ELT, specifically looking at how R robot-assisted language Learning (RALL) and Large Language Models (LLMs) could work together. Based on the aggregated data of the systematic literature review that covers the years 2010–2024, there has been significant development in the field of improving writing abilities using AI-powered tools like AWE systems that focus on personalized feedback. Similarly, robotics has been proven to foster more learner engagement and reduce anxiety, especially in self-regulated learning settings.

Not all of the more favorable and constructive results related to the problems mentioned in the previous paragraph have been proven. Maybe the reason might be attributed to a lack of thoughtful contemplation. There are several obstacles to overcome, including concerns about technology, the preparedness of educators to utilize AI, and opinions on the appropriateness of AI in the classroom. Despite AI's unquestionable positive influence in the education arena, this study argues that it should not be relied upon, particularly as a foundation in the prevailing method of English language teaching (ELT).

Instead, that should be, especially, complemented, augmented, improved, advanced, alongside developed, blended, created with, or, in more general terms, integrated, along the teacher’s approach, or Hybrid Pedagogy as defined (Daniela, 2020).

The findings found that further empirical research is necessary if one is to understand the full implications of AI and robotics in language teaching. These technologies have the potential to revolutionize the future of English language teaching if they were to be integrated into traditional pedagogy. They would make learning more dynamic, personalized, and successful.

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