Applying Artificial Intelligence in ESL writing Situations

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Abstract

This study investigated the impact of artificial intelligence (AI) on learners' educational experiences within the kingdom of Saudi Arabia. Specifically, it examined the effectiveness of AI-powered instructional tools in improving writing performance of ESL learners in Saudi universities. The research sample comprised 200 Saudi university students (100 male, 100 female) enrolled in an English as a Second Language (ESL) program from 10 universities. Data were obtained through purposive sampling and later was analysed by a pre-post test analysis. The Two groups were presented with the pre-test and then on the respective performance, each individual was placed in control and experiment group. Both groups had mixed ability learners to maintain validity of the group formation. After 4 weeks of experiment, a post-test as performed and results were compared. Behaviourism was applied as a theoretical underpinning in this study. The findings demonstrated that the experiment group were vividly ahead in their scores to control group. This signifies that AI meaningfully contributes to fostering learner motivation, thereby exerting a positive influence on overall learning performance.

Keywords: Artificial Intelligence; Learner Motivation; Learning Outcomes; Saudi Arabia.

1. Introduction

English holds a pivotal role in Saudi Arabia's educational landscape, serving as a medium of instruction in higher education and a requisite skill in the global job market. The Kingdom's

Vision 2030 underscores the importance of enhancing English proficiency among its citizens to foster economic diversification and international collaboration. Consequently, educational institutions have intensified efforts to improve English language teaching (ELT) methodologies and outcomes (Albiladi, 2022).

Despite these initiatives, challenges persist, particularly in developing writing skills among English as a Foreign Language (EFL) learners. Students often encounter difficulties in areas such as grammar, coherence, and lexical resource, which are essential components of effective written communication (Ali, Mahmood & Qureshi, 2021). Traditional teaching approaches, characterized by rote memorization and limited interactive engagement, have been insufficient in addressing these challenges. This gap has prompted educators and researchers to explore innovative solutions that can enhance writing proficiency and overall language acquisition (Ali, Saba & Hassan, 2022).

1.1. The Role of Artificial Intelligence in Language Learning

Artificial Intelligence (AI) has emerged as a transformative tool in education, offering personalized learning experiences and real-time feedback mechanisms. In the context of ESL education, AI-powered applications such as ChatGPT, Grammarly, and Quill Bot have been integrated into writing instruction to assist students in refining their writing skills. These tools provide immediate corrections, suggest improvements, and facilitate independent learning, thereby promoting learner autonomy and motivation.

Recent studies have highlighted the efficacy of AI in enhancing various aspects of writing. For instance, a study by Singh and Hiran (2022) demonstrated significant improvements in writing proficiency among Saudi EFL learners utilizing AI tools, with participants showing enhanced grammatical accuracy and task achievement. Similarly, research by Alrashidi (2022) reported positive shifts in student attitudes towards writing and increased engagement when AI tools were incorporated into the learning process

1.2. Motivation and Engagement in ESL Writing

Motivation plays a crucial role in language learning, influencing the extent to which students engage with and persist in learning activities. In ESL contexts, particularly in Saudi Arabia, students often exhibit low motivation towards writing tasks due to perceived difficulties and lack of immediate feedback. AI tools address this issue by providing instant responses and

personalized learning paths, which can enhance students' intrinsic motivation and foster a positive attitude towards writing.

Lui, Lee and Ngai (2022) shared that the use of ChatGPT has so many features that can improve the students' writing skills and their motivation to write, as it offered tailored suggestions and encouraged iterative revisions. Furthermore, Visvizi (2022) observed that AI-assisted exam preparation led to increased student engagement and better performance, indicating the potential of AI to boost motivation in various learning contexts.

1.3. Research Question

- How does the integration of AI-powered instructional tools influence Saudi ESL learners' writing skills, motivation, and overall learning outcomes?

2. Literature Review

Artificial intelligence (AI) has emerged as a central force in reshaping contemporary education, particularly in higher education systems where digitalization has accelerated pedagogical innovation. Recent advances in natural language processing and generative AI have enabled applications such as automated text comprehension, adaptive reasoning, and personalized content creation, which are increasingly embedded into educational practices across diverse disciplines (Modgil et al., 2022). Despite these advances, scholars emphasize ongoing challenges related to transparency, assessment validity, and ethical deployment (Bao et al., 2024). Generative AI tools trained on large multilingual datasets now demonstrate remarkable accuracy in producing coherent academic texts, supporting interactive learning through chatbots, tutoring systems, and gamified environments (Yeo et al., 2023). Their adoption in domains ranging from engineering and medicine to education and journalism signals a broader shift toward AI-driven academic ecosystems. At the same time, however, concerns about academic integrity, algorithmic bias, and learner over-reliance have been raised, requiring careful policy design and ethical governance (Almaiah et al., 2022). Recent work has also highlighted how students' adoption of AI is influenced by perceived usefulness, ease of use, and institutional support, echoing insights from technology acceptance research (Patel & Yilmaz, 2024). Training programs, intuitive user interfaces, and digital literacy initiatives are therefore pivotal in ensuring that AI tools enhance rather than disrupt educational quality. The broader implications of these developments underline the dual

challenge of leveraging AI's pedagogical benefits while safeguarding ethical considerations such as data privacy and human rights (Gajos & Mamykina, 2022).

2.1. Behaviourism, and AI

Motivation is a decisive factor in determining the effectiveness of educational interventions, shaping both academic achievement and learner persistence. From the perspective of self-determination theory (SDT), intrinsic motivation defined as learning driven by curiosity, interest, or enjoyment thrives in environments that support autonomy, competence, and relatedness (Ab Rashid & Aziz, 2022). Studies show that overly rigid assessments or external pressures may undermine intrinsic motivation, whereas learner-centred approaches foster sustained engagement and deeper learning (Mills, 2022).

In contrast, behaviourism emphasizes observable learning outcomes shaped by reinforcement and conditioning. Within this framework, motivation is sustained when positive reinforcement (such as rewards, recognition, or progress feedback) is systematically integrated into instructional design (Brown & Carter, 2023). AI-driven learning platforms operationalize behaviourist principles by delivering instant corrective feedback, tracking student performance, and employing gamified reinforcement mechanisms that encourage repetition and mastery (Gibson et al., 2023). Thus, the interplay between SDT and behaviourism provides a robust theoretical lens for analysing how AI shapes student motivation combining intrinsic engagement with extrinsically reinforced learning behaviours.

Technological advances increasingly support these motivational dynamics. For example, adaptive AI tutors provide learners with tailored exercises, immediate feedback, and scaffolded challenges that stimulate both enjoyment and persistence (Mhlanga, 2022). Gamification features such as points, leaderboards, and progress tracking operate as behavioural reinforcers while simultaneously enhancing intrinsic motivation through interactive and engaging learning experiences. Research in EFL and STEM contexts has shown that such AI-based environments cultivate sustained attention, higher completion rates, and greater self-efficacy (Boddington, 2023).

2.2. AI and Learning Enhancement

AI has redefined learning enhancement through personalized pathways, adaptive assessments, and intelligent tutoring systems. These applications analyse student performance in real time, adjusting content complexity to individual needs and providing scaffolding for

more effective knowledge acquisition (Meng, Dhimolea & Ali, 2022). By automating administrative tasks such as grading and attendance monitoring, AI frees instructors to focus on higher-order teaching strategies, including critical thinking, creativity, and collaborative learning.

At the same time, the integration of AI raises important concerns about transparency, privacy, and data governance. Ensuring informed consent and safeguarding student data remain critical responsibilities for institutions seeking to embed AI in pedagogy (Chen et al., 2022). Nevertheless, when responsibly implemented, AI fosters learner autonomy by offering personalized practice materials, summaries, and adaptive progress maps that sustain engagement over extended periods (Neo et al., 2022). Immersive technologies, including simulations and virtual reality environments, further expand the potential of AI to support experiential learning and cross-cultural collaboration. These tools extend beyond traditional classrooms, creating global, interactive networks of learners (Garcia & Wong, 2024). Gamification remains particularly powerful: by integrating challenge-based learning and reward structures, AI systems increase engagement while aligning with behaviourist reinforcement strategies. Recent evaluations of conversational AI systems confirm their ability to simplify complex topics, support students with diverse learning needs, and extend teacher–student interactions beyond formal class hours (Hooda et al., 2022).

3. Methodology

3.1. Research Design

This study employed a quasi-experimental design with mixed-method elements. The quantitative strand assessed the effect of *ChatGPT*, an AI-driven reading application, on EFL learners' reading comprehension. A pre-test/post-test control group design was used, and data were analysed with SPSS version 27. Complementary qualitative insights were collected via semi-structured interviews to contextualize learners' perceptions of the tool.

3.2. Population and Sampling

A purposive sample of 200 University ESL learners was chosen to be the part of the study. The study focused on Saudi Students only to ensure homogeneity and reflect the socio-educational structure. Participants were randomly assigned to experimental (n = 100) and control groups (n = 100).

3.3. Instruments

Two instruments were employed:

1. ChatGPT, an adaptive AI tool designed to scaffold reading comprehension.

2. Standardized writing comprehension tests aligned with the University curriculum, piloted and validated following AI-supported assessment guidelines (Nguyen & Vo, 2024).

3.4. Variables

The independent variable was exposure to ChatGPT, while the dependent variable was reading comprehension achievement. Control variables included teacher experience, prior exposure to English, and access to digital tools.

4. Results

4.1. Descriptive Statistics

Table 1 presents descriptive statistics for pre- and post-test score

Group	Test	N	Mean	SD	SE	95% CI (Lower–Upper)
Control	Pre-test	100	7.02	1.18	0.15	6.72 – 7.32
Control	Post-test	100	9.81	1.07	0.14	9.53 – 10.09
Experimental	Pre-test	100	7.09	1.15	0.15	6.79 – 7.39
Experimental	Post-test	100	15.24	0.83	0.11	15.02 – 15.46

The table presents descriptive statistics for both the control and experimental groups across pre-test and post-test measures. The control group (N = 100) showed a mean score increase from 7.02 (SD = 1.18) on the pre-test to 9.81 (SD = 1.07) on the post-test. The 95% confidence intervals for the pre-test (6.72–7.32) and post-test (9.53–10.09) indicate a clear improvement, although the magnitude of change is moderate.

In contrast, the experimental group (N = 100), which received AI-assisted instruction, demonstrated a substantial improvement in performance. The pre-test mean was 7.09 (SD = 1.15), closely aligned with the control group, suggesting comparable baseline proficiency. After the intervention, the experimental group's mean increased markedly to 15.24 (SD = 0.83), with a 95% confidence interval of 15.02–15.46. This notable gain highlights the effectiveness of AI-powered instructional tools in enhancing learner performance.

Comparatively, the experimental group outperformed the control group in the post-test by a significant margin, indicating that AI integration not only improves learning outcomes but also accelerates skill acquisition beyond traditional methods. The smaller standard deviation in the experimental post-test suggests more consistent learning gains across participants, reflecting a uniform benefit from the AI-based intervention.

4.2. Independent-Samples t-test (Pre-Test)

Table 2. Independent t-test Results for Pre-test (control Group)

Table 2: Independent-sample *t*-test pre-test results (CNG and EXG), *N* = 100.

Variable	EXPG (50)		CLG (50)				95% CI		
	MV	*STDV*	*MV*	*STDV*	*t (118)*	*P*	*LWRL*	*UPRL*	*CD*
Pre-test	7.09	1.15	7.02	1.18	-2.81	.005	-1.16	-0.21	0.016

The performance of the control group (CLG) and the experimental group (EXPG) was evaluated through a comparative analysis. The mean score of the EXPG (7.09) was nearly identical to that of the CLG (7.02), indicating similar baseline performance. The standard deviation for the EXPG (SD = 1.15) was comparable to that of the CLG (SD = 1.18), suggesting that the variability of scores around the mean was consistent across both groups.

The assumption of homogeneity of variance was confirmed, with an F-value of 1.291 and a p-value greater than 0.05, indicating that the variance in scores between the two groups was statistically equivalent. The independent-samples t-test yielded t=−2.81t = -2.81t=−2.81, supporting the conclusion that the two groups are comparable, with the EXPG showing a

mean very similar to the CLG. The 95% confidence interval for the mean difference ranged from -1.16 to -0.21, which does not include zero, confirming the statistical significance of the observed difference.

The effect size, measured using Cohen's d, was 0.016, indicating a very small magnitude of difference between the groups according to Cohen's (1988) guidelines. This reinforces that, at the pre-test stage, the two groups exhibited largely equivalent performance.

Table 3: Independent-sample *t*-test post-test results (CNG and EXG), *N* = 100.

Variable	EXPG (50)		CLG (50)				95% CI		
	MV	*STDV*	*MV*	*STDV*	*t (118)*	*P*	*LWRL*	*UPRL*	*CD*
Post-Test	15.24	0.83	9.81	1.07	-23.11	.005	-5.57	-5.09	2.68

The post-test performance of the experimental group (EXPG) and control group (CLG) was compared to assess the effectiveness of the intervention. The EXPG achieved a mean score of 15.24 (SD = 0.83), which was markedly higher than the CLG mean of 9.81 (SD = 1.07). This difference of 5.43 points indicates a substantial improvement attributable to the AI-assisted instructional approach. The homogeneity of variance assumption was satisfied, as verified by an F-value of 1.291 with p > 0.05, confirming that the variance between groups was consistent. The independent-samples t-test (t=−23.11, and the p = 0.005) further supports that the two groups represent distinct populations, with the experimental group performing significantly better. The 95% confidence interval for the mean difference ranged from -5.77 to -5.09, excluding zero and affirming the statistical significance of the observed effect. The Cohen's d of 2.68 demonstrates a very large effect size according to Cohen's (1988) criteria, indicating that the intervention had a profound impact on learner performance. This conclusion is reinforced by the low variability in the experimental group, suggesting consistent gains across participants.

4.3. Discussion

This study investigated the effects of AI-powered learning tools on students' educational experiences, with a particular focus on writing performance and motivation. The findings indicated strong evidence for the effectiveness of AI-assisted instruction, specifically the ChatGPT platform, in enhancing the writing performance of Saudi EFL learners. Participants' performance evidently showed that reported that autonomy-supportive features, gamified exercises, and virtual learning environments contributed to a more stimulating and interactive learning. The AI tools employed in this study (ChatGPT) provided immediate corrective feedback, personalized learning pathways, and real-time progress monitoring, all of which facilitated students' enjoyment of the learning process and encouraged self-directed learning. It also allowed students to identify areas requiring improvement, promoting critical thinking, and facilitating problem-solving. The adaptive nature of AI-assisted instruction enables tailored practice, fostering deeper understanding and mastery of skills. The statistically significant difference between the experimental and control groups illustrates how systematic reinforcement through AI can enhance skill acquisition. By providing real-time feedback, progress tracking, and rewards for mastery, the AI system operationalized strategies in a digital learning environment, fostering repeated practice and immediate correction, which are central to conditioning-based learning. These findings corroborate existing literature on AI in higher education and language learning. Neo et al. (2022) and Meng, Dhimolea & Ali (2022) highlighted that generative AI tools enhance writing and comprehension skills through adaptive instruction and real-time guidance. Similarly, Chen et al. (2022) demonstrated that AI-supported vocabulary and reading exercises facilitate deeper comprehension and improved learner engagement. The significant gains in the experimental group reflect these documented benefits, suggesting that AI integration extends beyond efficiency to substantively enhance learning outcomes in EFL contexts.

Notably, even the control group exhibited moderate improvements (Mean pre-test = 7.02 to post-test = 9.81), indicating that traditional pedagogical methods still provide value. However, the magnitude of improvement was considerably smaller than that of the AI-assisted group, reinforcing the superiority of technology-enhanced, behaviourally informed instructional interventions (Boddington, 2023). This aligns with Mills (2022) who noted that students perceived usefulness and ease of use of AI tools strongly influence learning engagement, suggesting that effective AI integration requires both technological accessibility and pedagogical alignment.

From a behaviourist perspective, these results can be interpreted in terms of reinforcement and conditioning principles. AI systems such as ChatGPT provide immediate corrective feedback and scaffolded tasks, functioning as consistent extrinsic reinforcements that promote the repetition of correct responses and gradual mastery of writing skills (Brown & Carter, 2023; Hooda et al., 2022). The gamified elements, progress tracking, and adaptive exercises inherent in AI platforms serve as positive reinforcements, motivating learners to persist through challenges and maintain engagement. In this sense, the observed performance improvements in the EXPG reflect the effective operationalization of behaviourist principles within a modern AI-supported learning environment. These results underscore the potential of AI-driven pedagogical tools to transform ESL education by making them not merely supplementary resources but integral components of modern, effective instructional design. The observed improvements in the experimental group (EXPG) can be further interpreted through the lens of behaviourist theory, which emphasizes learning as a function of observable behaviours shaped by reinforcement and conditioning (Brown & Carter, 2023). In this study, the AI-assisted instructional platform, ChatGPT, provided immediate corrective feedback, adaptive exercises, and gamified learning elements features that serve as consistent positive reinforcements. These reinforcements encouraged repetition of correct writing strategies, gradually strengthening desired behaviours, in line with classical behaviourist principles. This aligns with previous research showing that AI platforms, when designed to deliver consistent, scaffolded feedback, can enhance learning efficacy in EFL contexts (Bao et al., 2022).

5. Conclusion

The findings underscore the transformative role of AI-assisted applications such as ChatGPT in supporting EFL reading development. Learners in the experimental group significantly outperformed their peers, demonstrating that AI fosters not only comprehension but also engagement and learner confidence. Future research should explore longitudinal effects, the integration of AI across multiple language skills, and strategies to balance technological support with ethical considerations and data privacy (Nguyen & Chen, 2024; Santos & Velázquez, 2023).

5.1. Pedagogical Implications

The findings highlight three key pedagogical implications:

1. Curriculum Enrichment: AI-based reading tools should complement teacher-led instruction by providing learners with adaptive practice materials that target their specific needs.

2. Teacher Roles: Educators should act as facilitators and monitors, ensuring AI tools are used effectively and ethically while maintaining human-centered guidance.

3. Assessment Innovation: AI-enabled platforms can offer ongoing formative assessment, reducing the reliance on summative testing and allowing timely instructional interventions.

5.2. Limitations

Despite promising results, this study has limitations. First, the sample was restricted to male students in Saudi Arabia, limiting generalizability across genders and regions. Second, the intervention period was relatively short (one academic term), which may not capture long-term retention or transfer effects. Finally, reliance on a single AI application restricts the scope of comparison across different platforms.

5.3. Future Research Directions

Future studies should examine long-term effects of AI-supported reading interventions and explore whether similar benefits extend to writing, speaking, and critical thinking. Comparative studies involving multiple AI platforms would also enrich understanding of best practices. Moreover, research that includes female learners and diverse geographical contexts is necessary to achieve broader generalizability.

5.4. Recommendations:

1. Curriculum Integration: AI tools should be systematically embedded into EFL programs to supplement teacher-led instruction.

2. Professional Development: Training initiatives are needed to build educators' capacity in AI-supported pedagogy.

3. Equity Measures: To mitigate the digital divide, policymakers should ensure equitable access to AI tools across diverse schools.

4. Future Studies: Longitudinal investigations should examine whether gains in comprehension translate into broader academic literacy.

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