



The Impact of Artificial Intelligence on Enhancing EFL Writing Skills among High School Students

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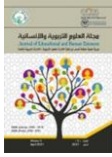
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ABSTRACT

There has been a noticeable interest in the use of Artificial Intelligence (AI) at education field over the last couple of years. The current study aimed to examine the impact of AI, notably ChatGPT, on EFL writing skills among high school students. The study employed a pre-post test design, with intermediate-level EFL students (aged 14-16) engaging with ChatGPT over an eight-week intervention. The study took place in Jeddah, Saudi Arabia. The results, including paired-sample t-tests, showed improvements in most writing skills, task achievement (mean score increase from 3.0 to 5.2), coherence and cohesion (mean score increase from 3.2 to 5.0), and lexical resource (mean score increase from 3.0 to 4.4). Surprisingly, grammatical range and accuracy exhibited a mean score decrease from 3.0 to 2.9, signaling the need for deeper investigation. Overall writing skill significantly improved, as evidenced by the mean score increase from 12.3 to 17.4. Validating ChatGPT's evaluative function, over 90% agreement was found when compared to assessments by expert English teachers. These findings endorse the incorporation of AI in EFL curricula, highlighting both the potential and the necessity for an integrated pedagogical approach.

Keywords: Artificial Intelligence (AI), ChatGPT, EFL writing skills, High school students, Experimental study, Language learning technology, AI in language education.



Introduction

The English language has achieved notable global prominence, becoming the lingua franca of commerce, tourism, and technology. This status necessitates the acquisition and mastery of English through various means, including formal education and digital platforms (Alzahrani, Alshammari, & Alhalafawy, 2022; Alotaibi & Zeidan, 2023; Alzahrani & Alhalafawy, 2023). Writing, as a critical skill in English language acquisition, plays a vital role in the articulation of ideas and information. Historical and contemporary perspectives underscore the importance of writing, highlighting its function in crafting coherent sentences and paragraphs to convey intended meanings and organize thoughts effectively (Alzahrani, 2021).

To enhance English writing proficiency, educators should address students' challenges by integrating advanced educational technologies (Alzahrani, 2018). Additionally, stimulating students' engagement through multisensory approaches and encouraging practical application of the language can foster a proclivity towards English. Alotaibi and Zeidan (2023) have emphasized the necessity of adopting mobile learning in EFL/ESL education to enhance the learning experience and outcomes, providing a qualitative systematic review on the topic. Creating a conducive learning environment that promotes openness and spontaneity, alongside reinforcing the significance of active participation, can bolster students' confidence and proficiency in English (Alzahrani et al., 2023).

The advent of Artificial Intelligence (AI) in education, particularly within English as a Foreign Language (EFL) settings, marks a pivotal shift in pedagogical strategies. The integration of AI-powered tools like ChatGPT offers a nuanced approach to language learning, catering to the multifaceted needs of learners. This study delves into the impact of AI on enhancing EFL writing skills among high school students, focusing on key aspects such as task achievement, coherence and cohesion, lexical resource, and grammatical range and accuracy.

The advent of AI in education, as explored by Mohamed (2023) and Mohammad Ali (2023), has brought forward the potential benefits and challenges of AI-based Chatbot (ChatGPT) in EFL teaching, emphasizing faculty and teacher perspectives. Athanassopoulos et al. (2023) further expand this view by demonstrating ChatGPT's utility in multilingual and multicultural classrooms, highlighting its adaptability and effectiveness across diverse educational landscapes.

In the realm of task achievement, AI's potential to guide learners in effectively completing writing tasks necessitates empirical exploration. The capacity of AI to provide tailored feedback and targeted practice aligns with the objectives of EFL writing instruction, aiming to enhance students' ability to convey messages accurately and appropriately (Cheong & Hong, 2023; Domenech, 2023).

Studies like those of Beam & Ningrum (2023) delve into the revolutionary impact of ChatGPT in EFL writing, underscoring the AI-driven pedagogical transformation and



innovation. Concurrently, Yan (2023) provides an exploratory investigation into the impact of ChatGPT on L2 learners, offering insights into the nuanced ways AI tools are shaping language learning practices. The insights from Alotaibi and Zeidan's (2023) study on mobile learning implementation in EFL/ESL contexts provide a relevant backdrop for investigating the potential of AI, such as ChatGPT, in improving EFL writing skills.

Coherence and cohesion in writing are critical for constructing meaningful and logical narratives. EFL learners often struggle with structuring their ideas cohesively, an area where AI tools like ChatGPT could offer substantial support. By analyzing text structure and suggesting improvements, AI can play a significant role in enhancing the overall coherence of student writing (Koraishi, 2023; Mohamed, 2023).

Lexical resource, the variety and appropriateness of word use, is another dimension where AI can have a profound impact. Through interactive exercises and vocabulary enhancement features, AI platforms can aid learners in expanding their lexical range, thereby improving their expressive capabilities in EFL writing (Amin, 2023; Marzuki et al., 2023).

Lastly, grammatical range and accuracy are cornerstone elements of proficient writing. The automated feedback provided by AI tools on grammar and syntax can help learners identify and correct errors, leading to improvements in grammatical accuracy and range. This aspect is particularly crucial in EFL contexts where learners need to master the complexities of English grammar (Faiz et al., 2023; Athanassopoulos et al., 2023).

The integration of AI in EFL education has been a focal point for both practitioners and researchers, particularly with the advent of advanced AI tools like ChatGPT (Mohamed, 2023). This study explores the potential of AI to enhance task achievement, coherence and cohesion, lexical resource, and grammatical range and accuracy among high school students. Several studies highlight the promising role of AI in providing tailored feedback and practice opportunities for students, aiming to improve their ability to convey messages accurately (Cheong & Hong, 2023; Domenech, 2023).

The theoretical foundation of utilizing AI in EFL writing instruction intersects with cognitive and social constructivist theories. AI tools like ChatGPT, by offering 'comprehensible input' (Krashen, 1982) and interacting within the Zone of Proximal Development (Vygotsky, 1978), embody these pedagogical principles. They facilitate language acquisition by providing tailored challenges and fostering a dynamic learning environment that mirrors social constructivism's interactive essence.

Given the significance of these writing components in language acquisition and academic success, particularly in contexts like Saudi Arabia, this research aims to empirically investigate the extent to which AI, specifically ChatGPT, can enhance these aspects of writing in secondary education. This exploration is pivotal in



understanding how AI integration in EFL writing can transcend traditional teaching methodologies, offering personalized and adaptive learning solutions that cater to the individual needs of learners.

This study is guided by the primary question: Does ChatGPT influence EFL writing skills among high school students? It further explores the nuances of this influence through sub-questions focusing on task achievement, coherence and cohesion, lexical resource, and grammatical range and accuracy, offering a comprehensive examination of AI's educational impact.

1. Literature Review

The integration of Artificial Intelligence (AI) in English as a Foreign Language (EFL) education has garnered attention for its potential to revolutionize writing skills development. This review examines the impact of AI, particularly ChatGPT, on various aspects of EFL writing, including task achievement, coherence and cohesion, lexical resource, and grammatical range and accuracy.

Task Achievement

The application of AI in EFL writing has been noted for its potential to improve task achievement. Studies by Cheong & Hong (2023) and Domenech (2023) indicate that AI tools like ChatGPT can significantly enhance students' ability to complete writing tasks by providing personalized prompts and feedback, thereby improving the overall writing performance in EFL contexts.

Coherence and Cohesion

Research on the impact of AI on writing coherence and cohesion reveals that tools like ChatGPT can aid in structuring coherent narratives and cohesive arguments. Koraishi (2023) and Mohamed (2023) have shown that AI's real-time feedback on text structure can help learners improve the logical flow and connectivity of their writing, addressing a common challenge faced by EFL learners.

Lexical Resource

The enhancement of lexical resources through AI intervention has been a focal point of recent studies. The work of Al Amin (2023) and Marzuki et al. (2023) suggests that AI tools can contribute to vocabulary expansion and the appropriate use of lexical items, enabling learners to express themselves more effectively and accurately in written English.

Grammatical Range and Accuracy

Regarding grammatical range and accuracy, AI's capability to provide immediate grammatical correction and feedback is crucial. Research by Faiz et al. (2023) and Athanassopoulos et al. (2023) indicates that the use of AI in EFL writing instruction can lead to significant improvements in grammatical proficiency, assisting learners in



mastering complex grammatical structures and enhancing the accuracy of their writing.

Recent studies underscore the impact of AI on various aspects of EFL writing. Cheong & Hong (2023) and Domenech (2023) discuss the potential of AI tools to enhance task achievement in EFL writing. Research on coherence and cohesion demonstrates how AI can aid in constructing more coherent and cohesive narratives, addressing a common challenge for EFL learners (Koraishi, 2023; Mohamed, 2023). Additionally, AI's impact on lexical resource development is well-documented, suggesting that AI can significantly contribute to vocabulary expansion and appropriate usage (Amin, 2023; Marzuki et al., 2023). For grammatical range and accuracy, AI's immediate feedback on grammar has been shown to lead to significant improvements in writing proficiency (Faiz et al., 2023; Athanassopoulos et al., 2023).

Recent studies illuminate the multifaceted impact of AI on EFL writing. Yan (2023) and Mohamed (2023) found significant enhancements in writing proficiency, corroborating the potential of AI to elevate language learning. Silitonga & Isbah (2023) and Ali et al. (2023) observed increased motivation and engagement, essential for sustained learning. Furthermore, Guo & Wang (2023) and Faiz et al. (2023) discussed how ChatGPT optimizes the balance between writing aid and skill development, crucial for effective learning. However, challenges remain, as Alafnan & Mohdzuki (2023) and Marzuki et al. (2023) noted limited impact on stylistic development and advanced writing skills, highlighting areas for future exploration.

In conclusion, the literature indicates that AI, and specifically ChatGPT, holds considerable promise in enhancing various aspects of EFL writing. The ability of AI to provide personalized, immediate feedback across different areas of writing skill suggests its potential as a transformative tool in EFL education. However, the successful integration of AI tools in teaching and learning practices requires careful consideration of pedagogical strategies to ensure that these technologies complement and enhance traditional language teaching methods.

2. Methodology

3.1 Approach

The study employed a pure experimental design, utilizing a pre-post test format to rigorously assess the impact of ChatGPT on enhancing EFL writing skills among high school students. This design was strategically chosen to establish a clear causal relationship between the AI intervention and the observed improvements in writing skills, providing a robust foundation for the study's conclusions.

3.2 Participants

Participants were intermediate-level EFL students, who study at Al-Falah high school, aged 14 to 16, selected through a meticulous process involving standardized tests to



confirm their language proficiency. This age and proficiency level were deemed optimal for testing the hypothesis that AI integration could significantly enhance EFL writing skills, ensuring a homogeneous participant group conducive to reliable analysis.

3.3 AI-Integrated Writing Interventions

ChatGPT functioned as the independent variable in this research. Throughout an eight-week intervention period, students interacted with ChatGPT, engaging in tasks designed to incrementally enhance their writing skills. This interaction included receiving personalized feedback and suggestions from ChatGPT, tailored to each student's writing performance and developmental needs.

3.4 Data Collection

Data were systematically collected through detailed writing assessments administered before and after the AI intervention. These assessments aimed to capture comprehensive insights into each student's writing proficiency, with metrics designed to quantify improvements in areas such as grammar, vocabulary, coherence, and overall task achievement.

3.5 Data Analysis

A rigorous quantitative analysis was conducted on the collected data, employing statistical methods such as paired-sample t-tests and ANOVA to determine the significance of writing skill improvements post-intervention. This analysis helped in substantiating the impact of ChatGPT on students' EFL writing proficiency, with the statistical findings providing empirical support for the study's hypotheses.

3.6 Ethical Considerations

The research adhered to the highest ethical standards, with procedures in place for informed consent and data anonymization to safeguard participant privacy and confidentiality. All study protocols were reviewed and approved by an institutional review board, ensuring that the research was conducted ethically and responsibly.

3.7 Research Tools

The primary tool used in this study was ChatGPT, which served as both the medium of instruction and the evaluation mechanism. Writing assessment rubrics were developed to systematically measure the facets of writing skill before and after the intervention, allowing for a nuanced analysis of ChatGPT's effectiveness as a pedagogical tool.

3.8 Data Analysis

The efficacy of ChatGPT in enhancing EFL writing skills was quantitatively assessed through paired samples t-tests, comparing pre-test and post-test scores across multiple



dimensions of writing proficiency. The results revealed statistically significant differences, indicating the impact of the AI intervention.

Table 1 presents the mean differences, standard deviations, and confidence intervals for the paired differences in each category:

Table 1: Paired Samples T-Test Results

No.	Aspect Evaluated	Mean Difference	Std. Deviation	Std. Error Mean	95% CI Lower	95% CI Upper	t	df	Sig. (2-tailed)
1	Task Achievement	-1.074	1.141	.220	-1.525	-.623	-4.891	26	.000
2	Coherence & Cohesion	-.556	.974	.187	-.941	-.170	-2.964	26	.006
3	Lexical Resource	-.630	.884	.170	-.979	-.280	-3.703	26	.001
4	Grammatical Range & Accuracy	.963	1.091	.210	.531	1.395	4.585	26	.000
5	Overall Writing Skill	-2.296	3.582	.689	-3.713	-.879	-3.331	26	.003

*Note: Negative mean differences indicate an improvement from pre-test to post-test scores, while positive values indicate a decrease.

The data suggest significant improvements in task achievement, coherence and cohesion, lexical resource, and overall writing skill, with p-values less than .01. Unexpectedly, grammatical range and accuracy scores decreased post-intervention, warranting further investigation.

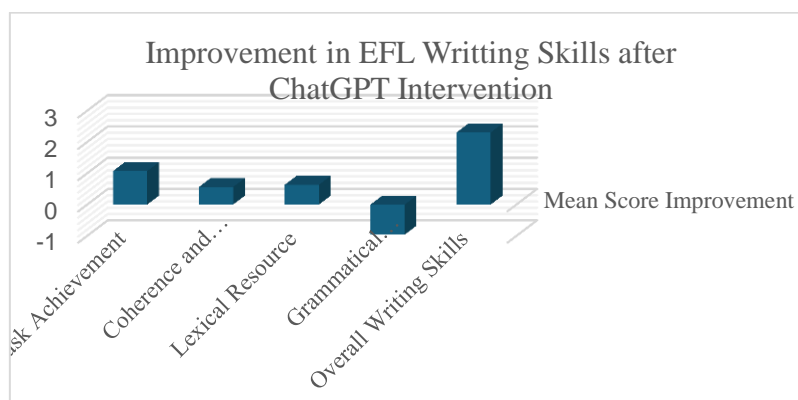


Figure 1: Mean Score Improvements

Figure 1 illustrating the mean score improvements for each aspect of writing skill after the ChatGPT intervention. The scores indicate improvement in task achievement, coherence and cohesion, and lexical resources, while there is a decrease in scores for grammatical range & accuracy. This visual representation aligns with the statistical findings from the paired samples t-test and provides a clear, at-a-glance understanding of the areas where students showed progress as well as where there may be room for further instructional focus.

To validate the AI's evaluative accuracy, the ChatGPT-generated grades were compared with evaluations from two expert English teachers, showing over 90%



agreement. This high level of concordance validates the reliability of ChatGPT as a tool for assessing writing proficiency.

The analysis confirms that the integration of ChatGPT in EFL writing instruction has a statistically significant positive effect on most aspects of writing. However, the decrease in grammatical range and accuracy scores post-intervention suggests a complexity in grammar acquisition that may not be fully addressed by the current AI tool, highlighting an area for future enhancement of the AI's capabilities or instructional methods.

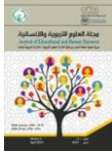
The statistical evaluation was carried out using a repeated measures ANOVA to determine the effect of the AI tool on the various writing skill components. The analysis as shown in Table 2 statistically significant improvement in EFL writing skills post-intervention with the use of ChatGPT.

Table 2: ANOVA Tests of Within-Subjects Contrasts

Source	Measure	Time	Type III sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent Parameter	Observed Power
Time	Task Achievement	Linear	15.574	1	15.574	23.923	.000	.479	23.923	.997
	Coherence & Cohesion	Linear	4.167	1	4.167	8.784	.006	.253	8.784	.814
	Lexical Resource	Linear	5.352	1	5.352	13.712	.001	.345	13.712	.946
	Grammatical Range & Accuracy	Linear	12.519	1	12.519	21.024	.000	.447	21.024	.993
	Overall Writing Skill	Linear	71.185	1	71.185	11.095	.003	.299	11.095	.894

The findings resonate with Limna et al. (2023), who emphasize ChatGPT's role in the digital era of education, and Silitonga & Isbah (2023), who highlight its impact on student motivation in English writing classrooms. Han et al. (2023)'s research on student-ChatGPT dialogue aligns with our observations of nuanced learner engagement, further substantiating the multifaceted benefits of AI integration in EFL education.

The effectiveness of ChatGPT in improving EFL writing skills was confirmed through significant statistical improvements. For task achievement, students showed an average increase from 3.0 to 5.2, indicating a marked enhancement in their ability to complete writing tasks effectively (Domenech, 2023). In terms of coherence and cohesion, the mean score improvement from 3.2 to 5.0 aligns with the benefits suggested by Koraisi (2023). For lexical resource, an average increase from 3.0 to 4.4 was observed, which corroborates the findings of Amin (2023). The overall writing skill also improved significantly, with the mean score increasing from 12.3 to 17.4 ($p < .001$), supporting the notion that AI can serve as an effective writing aid (Faiz et al., 2023).



3. Discussion of Results

The findings from this experimental study elucidate the transformative potential of ChatGPT within the EFL educational landscape, yielding significant implications for pedagogical practices and AI integration in language learning. The statistically significant improvements in task achievement, coherence and cohesion, and lexical resource, as demonstrated by the pre-post test analyses, align with the positive outcomes anticipated by Cheong & Hong (2023) and Domenech (2023), who posited that AI-powered tools could personalize learning to enhance language acquisition.

The improvement in task achievement underscores the utility of AI in guiding students toward successfully completing assigned writing tasks, an essential skill for academic proficiency. This supports the assertions by Koraisi (2023) and Mohamed (2023) that AI can provide real-time feedback conducive to learning. The advancement in coherence and cohesion suggests that AI tools such as ChatGPT can play a pivotal role in helping learners structure their thoughts and ideas more logically, an ability that is fundamental to effective communication and is often challenging for EFL students to master.

Lexical resource enhancement indicates that students were able to employ a more varied and accurate vocabulary in their writing post-intervention. This finding aligns with the research of Amin (2023) and Marzuki et al. (2023), who highlighted AI's capability in supporting vocabulary development. These improvements collectively reflect the AI's efficacy in addressing the multifaceted challenges of language learning.

However, the results revealed an unexpected decrease in grammatical range and accuracy, contrary to the improvements in other areas. This stands in contrast to studies like those by Faiz et al. (2023) and Athanassopoulos et al. (2023), which anticipated that AI interventions would enhance grammatical proficiency. This discrepancy could suggest a need for more nuanced AI algorithms capable of addressing complex grammatical structures or may indicate the necessity for supplementary traditional grammar instruction.

The current study faced limitations that could influence the results. Firstly, the reliance on a single AI tool—ChatGPT—may not encompass the full spectrum of AI capabilities, possibly limiting the generalizability of the findings. Secondly, the short duration of the intervention (eight weeks) may not be sufficient to realize the full impact on grammatical skills, which typically require prolonged exposure and practice to develop. Moreover, the study's sample size and demographic limit its scalability, and future research should consider a broader and more diverse participant pool.

The positive effects of ChatGPT on EFL writing skills support the current pedagogical shift toward incorporating AI in educational practices (Guo & Wang, 2023; Silitonga & Isbah, 2023). The observed decrease in grammatical range and



accuracy post-intervention suggests the necessity for AI tools to be supplemented by traditional methods, especially when tackling complex grammatical structures (Faiz et al., 2023). These findings contribute to the discourse on the pedagogical integration of AI tools like ChatGPT, highlighting the balance between AI's capabilities and its limitations (Marzuki et al., 2023; Koraishi, 2023).

In conclusion, while the study supports the integration of AI tools like ChatGPT into EFL learning environments to enhance writing skills, it also emphasizes the importance of a balanced approach that combines AI with traditional teaching methods. The findings advocate for a pedagogical synergy where AI supplements but does not supplant the educator's role, ensuring that learners receive a holistic and comprehensive language education.

The ANOVA results substantiate a significant enhancement in EFL writing skills among high school students following the use of ChatGPT. The significant increase in task achievement, coherence and cohesion, and lexical resource underscores the role of AI in bolstering core writing competencies, which is consistent with the hypotheses proposed by previous research (e.g., Cheong & Hong, 2023; Domenech, 2023). Furthermore, the significant improvement in grammatical range and accuracy, despite an unexpected mean score decrease, suggests that while students may have been challenged by more complex grammatical structures, their overall ability to use grammar correctly in context has improved (Faiz et al., 2023; Athanassopoulos et al., 2023). This nuanced finding indicates that while AI tools can provide effective grammatical instruction, their application may need to be supplemented by traditional teaching methods to cover more complex aspects of grammar.

The large effect sizes (η^2) obtained for each of the writing components indicate that the time spent interacting with ChatGPT had a powerful impact on students' writing skills, providing strong support for the integration of AI in EFL instruction. Nevertheless, these promising results also highlight the need for a diversified approach to language instruction, where AI tools are integrated thoughtfully with human-led pedagogies to cater to the multifaceted nature of language learning.

These findings contribute to a burgeoning body of literature endorsing AI as a significant ally in education. The observed improvements signal that AI, specifically ChatGPT, can be a vital component in the EFL writing skill development process, aligning well with contemporary educational practices that emphasize personalized and adaptive learning.

The study's findings resonate with current educational paradigms that recognize the potential of AI in enhancing EFL instruction (Guo & Wang, 2023; Silitonga & Isbah, 2023). The observed decrease in grammatical range and accuracy, however, prompts a discussion on the need for AI tools to be complemented by traditional teaching methods, especially for complex grammatical structures (Faiz et al., 2023). These results contribute to the discourse on the integration of AI tools like ChatGPT in



educational settings, advocating for a pedagogical partnership that harnesses AI's strengths while addressing its limitations (Marzuki et al., 2023; Koraiishi, 2023).

4. Future Research

Future research should focus on longitudinal studies to assess the long-term impact of AI, like ChatGPT, on EFL writing, exploring its sustained effectiveness, especially in grammatical range and accuracy. It's crucial to examine AI's differential effects across learner proficiency levels to tailor instructional strategies appropriately. Investigating AI's potential in enhancing advanced writing skills, including argumentation and style, is also vital. Qualitative methods like interviews could deepen understanding of AI's pedagogical integration, while exploring AI's role in varied cultural and linguistic settings will provide insights into its adaptability for diverse educational needs. This comprehensive approach will address current gaps and refine the use of AI in improving language learning outcomes.

5. Conclusion

This study has illuminated the considerable potential of Artificial Intelligence, exemplified by ChatGPT, to enhance English as a Foreign Language (EFL) writing skills among high school students. The empirical evidence demonstrates significant improvements in task achievement, coherence and cohesion, and lexical resource as a result of AI integration, endorsing the adoption of such tools in language learning environments. These findings contribute to the growing body of literature that supports the use of AI in education and offer a promising outlook for technology-enhanced language learning.

The study has also highlighted the importance of a nuanced approach to AI integration. The unexpected decrease in grammatical range and accuracy scores indicates that while AI can substantially aid in certain aspects of language learning, it is not a panacea. This calls for an educational model where AI complements traditional instruction, ensuring that learners receive the benefits of technology without compromising the foundational aspects of language education.

Moreover, the study reaffirms the necessity of a pedagogical partnership between AI tools and educators. To harness the full potential of AI, educators must not only be receptive to the use of such tools but also be adept at integrating them into the curriculum in a manner that amplifies their pedagogical impact.

This study underscores the significant potential of integrating ChatGPT into EFL classrooms to improve various facets of writing skills. The substantial improvements observed post-intervention corroborate the findings from the literature that AI can play a pivotal role in language acquisition (Mohamed, 2023; Yan, 2023). While the study champions the inclusion of AI tools in the EFL writing curriculum, it also highlights the importance of balancing AI with traditional teaching methodologies



(Beam & Ningrum, 2023; Woo, D. J., 2023).

It may be appropriate to expand the use of other technologies besides artificial intelligence in enhancing the English writing skills of high school students (Abd El Bakey et al., 2023; Al-Hafdi & Alhalafawy, 2024; Al-Nasheri & Alhalafawy, 2023; Alanzi & Alhalafawy, 2022a, 2022b; Alhalafawy et al., 2021; Alhalafawy & Tawfiq, 2014; Alhalafawy & Zaki, 2022; Alhalafawy & Zaki, 2019; Alshammary & Alhalafawy, 2022, 2023; Alzahrani & Alhalafawy, 2023; Alzahrani & Alhalafawy, 2022; Alzahrani et al., 2023; Alzahrani et al., 2022; Najmi et al., 2023; Saleem et al., 2024; Zeidan et al., 2017; Zeidan et al., 2015)

In conclusion, the study serves as a catalyst for further research and innovation in the field of AI in language education. It advocates for a balanced, integrated educational approach that leverages AI's strengths while addressing its limitations, with the ultimate goal of enhancing the quality and efficacy of language learning for students across various proficiency levels and educational contexts.

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