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Artificial Intelligence in EFL Education: Enhancing Learning Outcomes in Saudi Arabia

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Abstract

Artificial intelligence (AI) has emerged as one of the most influential technological innovations shaping contemporary educational practices. In the field of English as a Foreign Language (EFL) education, AI-powered applications—including intelligent tutoring systems, automated writing feedback tools, and conversational chatbots—offer new opportunities to enhance language learning outcomes through personalized instruction and adaptive learning environments. This study investigates the role of artificial intelligence in improving English language learning outcomes among EFL students in international schools in Riyadh, Saudi Arabia. The research adopts a mixed-methods approach involving quantitative analysis of student learning outcomes and qualitative exploration of teacher perceptions. Data were collected from 312 students and 24 English language teachers across three international schools: Al-Alson International School, Glory Generation International School, and Leadership International School. Statistical analyses included descriptive statistics, correlation analysis, regression modeling, and structural equation modeling to examine the relationships between AI usage, learner engagement, learner autonomy, and English language achievement. The results indicate that AI-supported instruction significantly enhances writing performance, vocabulary acquisition, and student engagement in English learning tasks. Learner engagement emerged as the strongest predictor of overall English achievement, highlighting the importance of interactive and student-centered learning environments. Teachers reported generally positive attitudes toward AI integration while emphasizing the need for professional training and clear institutional guidelines to ensure responsible use. The findings suggest that AI technologies can substantially improve EFL learning outcomes when integrated within pedagogically structured instructional frameworks supported by teacher guidance and institutional policy. This study contributes to the growing body of research on artificial intelligence in language education by providing empirical evidence from the international school context in Saudi Arabia.

Keywords: Artificial Intelligence; English Language Learning; Educational Technology; EFL

1. Introduction

The rapid development of artificial intelligence technologies has significantly transformed the educational landscape over the past decade. Advances in machine learning, natural language processing, and adaptive educational systems have created new opportunities for improving teaching and learning processes across multiple disciplines. In language education, artificial intelligence has attracted increasing attention due to its potential to provide personalized feedback, adaptive learning pathways, and interactive language practice environments that can support the development of communicative competence among learners (Alharbi, 2024; Alsaif, 2024).

Within English as Foreign Language (EFL) contexts, the integration of artificial intelligence has become particularly relevant because language learners often require extensive practice, individualized feedback, and opportunities for authentic communication. Traditional language teaching approaches frequently rely on teacher-centered instruction and limited feedback cycles, which may restrict learners' opportunities to develop writing fluency, vocabulary depth,

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and communicative confidence. AI-powered applications have the potential to address these limitations by enabling students to interact with intelligent systems that provide immediate feedback on grammar, vocabulary usage, and language structure (Alhamam, 2025; Alqaed, 2024).

Saudi Arabia represents a particularly important context for examining the educational implications of artificial intelligence in language learning. English is widely taught as a foreign language across Saudi schools and universities, and proficiency in English has become increasingly important for academic advancement, international communication, and participation in the global knowledge economy. However, despite significant investments in English language education, many EFL learners continue to face challenges in developing high levels of communicative competence, particularly in productive skills such as writing and speaking (Alharbi & Althaqafi, 2025).

The growing emphasis on digital transformation within Saudi Arabia's educational system has created new opportunities for integrating emerging technologies into teaching and learning practices. Artificial intelligence applications—including automated writing assistants, AI-based language tutoring systems, and conversational chatbots—are increasingly being explored as tools that can enhance English language instruction by supporting personalized learning and promoting learner autonomy. These technologies allow students to engage with English language content beyond the traditional classroom environment and receive immediate feedback that supports continuous learning (Alyami et al., 2025; Alsaif, 2024).

International schools in Riyadh provide a particularly suitable environment for investigating the integration of artificial intelligence in EFL instruction. These schools typically adopt international curricula that emphasize English-medium instruction and communicative language development. As a result, students enrolled in international schools often engage extensively with English language learning tasks, including academic writing, oral presentations, and collaborative communication activities. The availability of digital learning infrastructure in these institutions also facilitates the integration of innovative educational technologies such as artificial intelligence-based learning tools.

Despite the increasing interest in artificial intelligence in language education, empirical research examining its impact on English language learning outcomes in school-based EFL contexts remains limited. Much of the existing research has focused on higher education environments, particularly university students using AI tools for academic writing or research support. While these studies provide valuable insights into student perceptions and usage patterns, they do not fully address how artificial intelligence influences language learning outcomes among younger learners in structured school environments (Alhamam, 2025).

Furthermore, previous research has frequently focused on descriptive analyses of student attitudes toward artificial intelligence rather than examining measurable relationships between AI usage and language proficiency development. Understanding these relationships is essential for determining whether AI technologies genuinely enhance language learning outcomes or simply provide convenient digital support tools without substantial educational impact (Alharbi, 2024).

This study therefore aims to investigate the role of artificial intelligence in enhancing English language learning outcomes among EFL students in international schools in Riyadh, Saudi Arabia. Specifically, the research examines how AI-supported instructional environments influence students' writing achievement, vocabulary acquisition, speaking confidence, learner engagement, and learner autonomy. In addition, the study explores teachers' perceptions of AI integration in English language classrooms and identifies key factors that influence the successful implementation of AI-based learning technologies.

By combining quantitative statistical analysis with qualitative teacher insights, the study seeks to provide a comprehensive understanding of how artificial intelligence can support effective English language education within EFL learning environments. The findings are expected to contribute to ongoing discussions on digital innovation in language education and provide practical guidance for educators seeking to integrate artificial intelligence into English language teaching practices.

2. Literature Review

2.1. Artificial Intelligence in Education

Artificial intelligence has become one of the most influential technological developments shaping contemporary educational systems. AI refers broadly to computer systems capable of performing tasks that typically require human cognitive abilities, including language processing, decision making, pattern recognition, and adaptive learning (Alsaif,

2024). In educational environments, AI technologies are increasingly used to design intelligent tutoring systems, adaptive learning platforms, automated feedback systems, and conversational learning interfaces that can support individualized instruction and learner-centered pedagogical approaches.

The integration of artificial intelligence into education has been driven by several factors, including the growing demand for personalized learning, the rapid expansion of digital learning environments, and the increasing availability of large-scale educational data. AI-powered learning systems can analyze students' interactions with digital platforms and adjust instructional content in response to individual learning needs. This capability allows educational technologies to provide targeted learning support that would otherwise require significant teacher time and resources (Alharbi, 2024).

In addition to personalization, AI technologies provide opportunities for continuous feedback and learning analytics. Intelligent tutoring systems, for example, can monitor students' progress, identify areas of difficulty, and provide corrective guidance in real time. Such systems have been shown to improve learning efficiency by helping learners focus on areas requiring further practice while reinforcing previously acquired knowledge (Alharbi & Althaqafi, 2025).

Recent studies emphasize that artificial intelligence should not be viewed solely as a technological innovation but rather as a pedagogical tool that interacts with instructional design, teacher expertise, and learner characteristics. Effective integration of AI therefore requires a combination of technological infrastructure, teacher training, and institutional support to ensure that digital tools contribute meaningfully to learning outcomes (Alyami et al., 2025).

2.2. Artificial Intelligence in English as a Foreign Language (EFL) Learning

The application of artificial intelligence in English language education has received growing scholarly attention over the past decade. AI-supported language learning environments provide learners with opportunities to practice language skills through interactive digital systems that simulate authentic communication contexts. These technologies are particularly relevant in EFL contexts where students may have limited exposure to English outside the classroom environment.

AI-based language learning applications commonly include automated writing evaluation systems, vocabulary learning platforms, pronunciation assessment tools, and conversational chatbots. Automated writing evaluation systems can analyze written texts and provide feedback on grammar, syntax, vocabulary use, and writing coherence. Such systems allow learners to receive immediate feedback on their writing, enabling them to revise and improve their work more efficiently than in traditional feedback cycles that rely solely on teacher evaluation (Alhamam, 2025).

Conversational AI systems represent another important application of artificial intelligence in language learning. AI-powered chatbots allow learners to engage in simulated conversations that support the development of communicative competence. Through these interactions, students can practice language production in a relatively low-anxiety environment while receiving immediate responses that help reinforce appropriate language structures and vocabulary usage (Alqaed, 2024).

Research has shown that AI-assisted language learning can contribute to improvements in several areas of language proficiency, including vocabulary acquisition, writing accuracy, and speaking fluency. In particular, AI tools that provide personalized learning pathways allow students to progress at their own pace while focusing on areas requiring additional practice. This flexibility supports differentiated instruction and helps accommodate learners with varying levels of language proficiency (Alsaif, 2024).

Another important advantage of AI-supported language learning lies in its potential to increase learner engagement. Interactive digital tools can transform language learning activities into dynamic experiences that encourage active participation and sustained attention. When learners interact with intelligent systems that respond to their inputs, they often perceive language practice as more engaging than traditional worksheet-based exercises. Increased engagement can subsequently lead to greater motivation and improved learning outcomes (Alyami et al., 2025).

Despite these advantages, the use of artificial intelligence in language education has also raised important pedagogical and ethical considerations. Some educators have expressed concerns that excessive reliance on AI tools may reduce students' independent writing skills or encourage overdependence on automated feedback systems. Others emphasize the importance of maintaining teacher oversight to ensure that AI-generated feedback aligns with pedagogical objectives and supports meaningful language development (Alharbi, 2024).

For this reason, many scholars argue that artificial intelligence should function as a complementary tool that enhances language learning rather than replacing traditional instructional practices. Teachers play a crucial role in guiding students' use of AI technologies and ensuring that digital tools support rather than undermine language learning objectives.

2.3. Artificial Intelligence in Saudi EFL Contexts

The integration of artificial intelligence in Saudi education has gained increasing attention in recent years as part of broader national initiatives aimed at promoting digital transformation and technological innovation. English language education represents a particularly significant area for technological development due to the importance of English proficiency in academic, professional, and international communication contexts.

Saudi EFL learners often encounter challenges in developing communicative competence due to limited opportunities for authentic language interaction outside formal educational settings. Artificial intelligence applications can help address this challenge by providing interactive learning environments that simulate real-life communication scenarios. Through AI-supported platforms, students can practice language skills more frequently and receive immediate feedback that supports continuous improvement (Alqaed, 2024).

Research examining Saudi learners' perceptions of AI technologies indicates generally positive attitudes toward the use of AI tools in language learning. Many students report that AI applications help them improve writing accuracy, expand vocabulary knowledge, and develop greater confidence in English communication. Teachers have also recognized the potential benefits of AI-supported instruction, particularly in facilitating personalized learning and reducing the time required for routine feedback tasks (Alharbi & Althaqafi, 2025).

However, several challenges continue to influence the implementation of artificial intelligence in Saudi educational institutions. These challenges include variations in technological infrastructure across schools, limited teacher training in AI-supported pedagogies, and concerns related to academic integrity when students use automated writing tools. Addressing these challenges requires comprehensive institutional strategies that integrate technological innovation with professional development and clear ethical guidelines (Alsaif, 2024).

International schools in Saudi Arabia represent a particularly promising context for the integration of artificial intelligence in English language education. These schools often adopt international curricula that emphasize communicative language competence and technology-enhanced learning environments. As a result, they provide opportunities to explore how AI-supported instruction can complement existing teaching practices and contribute to improved language learning outcomes among EFL students.

3. Research Gap

Although existing research highlights the potential benefits of artificial intelligence in language education, several important gaps remain in the literature. First, much of the current research focuses on university-level learners rather than school-aged students. The learning needs, cognitive development stages, and instructional contexts of school students differ significantly from those of university learners. Consequently, findings from higher education studies cannot always be generalized to school environments.

Second, many previous studies rely primarily on perception-based surveys that examine learners' attitudes toward AI technologies. While such studies provide useful insights into acceptance and usability, they do not necessarily demonstrate whether AI-supported learning leads to measurable improvements in language proficiency. There is therefore a need for empirical studies that examine the relationship between AI usage and concrete language learning outcomes such as writing performance and vocabulary development.

Third, research examining artificial intelligence in English language education within Saudi international school contexts remains limited. International schools represent unique educational environments characterized by English-medium instruction, multicultural student populations, and technology-rich learning infrastructures. Investigating AI integration within these settings can provide valuable insights into how emerging technologies influence EFL learning outcomes in globally oriented educational systems.

The present study addresses these gaps by examining the role of artificial intelligence in enhancing English language learning outcomes among EFL students in international schools in Riyadh. By combining quantitative statistical analysis

with qualitative insights from teachers, the research provides a comprehensive perspective on how AI-supported learning environments influence language development, learner engagement, and instructional practices.

4. Theoretical Framework

The integration of artificial intelligence into English language education can be understood through several complementary theoretical perspectives that explain how technological innovations influence teaching practices and learner outcomes. In the context of English as a Foreign Language (EFL) learning, two theoretical frameworks are particularly relevant: the Technological Pedagogical Content Knowledge (TPACK) framework and Diffusion of Innovations theory. These frameworks provide a conceptual basis for understanding how artificial intelligence tools interact with pedagogical practices, teacher expertise, and learner engagement in technology-supported learning environments.

4.1. Technological Pedagogical Content Knowledge (TPACK)

The Technological Pedagogical Content Knowledge framework emphasizes the importance of integrating technological knowledge, pedagogical knowledge, and subject-matter expertise in effective teaching practices. According to this framework, the successful use of technology in education requires teachers to develop a comprehensive understanding of how technological tools can support pedagogical strategies and disciplinary learning objectives.

In the context of EFL instruction, artificial intelligence tools such as automated writing evaluation systems, AI-based tutoring platforms, and conversational chatbots can support various aspects of language learning. However, the effectiveness of these tools depends largely on how teachers integrate them into instructional design. Simply introducing technology into the classroom does not automatically improve learning outcomes; rather, teachers must strategically incorporate technological resources in ways that support language development and communicative competence (Alsaif, 2024).

AI-based language learning tools can enhance pedagogical practices by providing opportunities for individualized feedback and differentiated instruction. For example, automated writing systems can assist teachers by identifying grammatical errors and providing suggestions for revision, while allowing teachers to focus on higher-level aspects of writing such as argument development and coherence. This collaborative interaction between teacher expertise and technological tools reflects the principles of the TPACK framework, where technology complements rather than replaces pedagogical knowledge (Alharbi, 2024).

Within EFL classrooms, the integration of AI tools can therefore support language learning by enabling teachers to design learning activities that promote interactive engagement, autonomous practice, and immediate feedback. Such practices align with contemporary language teaching approaches that emphasize communicative competence and learner-centered instruction.

4.2. Diffusion of Innovations Theory

Another theoretical perspective that helps explain the adoption of artificial intelligence in educational environments is Diffusion of Innovations theory. This theory focuses on how new technologies spread within social systems and how individuals and institutions decide whether to adopt innovative practices. According to this framework, the adoption of new technologies depends on several factors, including perceived usefulness, compatibility with existing practices, and ease of use. In educational contexts, teachers and institutions are more likely to adopt technological innovations when they perceive that these tools provide clear advantages over traditional methods and align with existing curricular goals (Alqaed, 2024).

In the case of AI-supported language learning, perceived usefulness often relates to the ability of AI tools to improve language proficiency and facilitate more efficient instructional practices. Teachers who recognize the potential of AI systems to provide immediate feedback, personalized learning pathways, and interactive language practice may be more inclined to incorporate these technologies into their classrooms.

However, adoption is also influenced by institutional factors such as technological infrastructure, teacher training opportunities, and policy support. Without adequate professional development and clear guidelines for technology use, teachers may hesitate to integrate AI tools into their teaching practices even if they acknowledge their potential benefits. Consequently, the successful implementation of artificial intelligence in EFL education requires not only technological availability but also institutional support and teacher readiness.

5. Conceptual Model

Based on the theoretical perspectives discussed above and the findings of previous research, this study proposes a conceptual model that explains how artificial intelligence integration influences English language learning outcomes among EFL students.

The model assumes that AI usage influences English language achievement both directly and indirectly through learner engagement and learner autonomy. AI-supported learning environments allow students to practice language skills through interactive activities that encourage participation and independent learning. These learning experiences can increase students' motivation to engage with English language tasks, thereby contributing to improved language proficiency.

Learner engagement refers to the degree to which students actively participate in learning activities and invest effort in language practice. When learners interact with AI systems that provide immediate responses and feedback, they may experience greater motivation and sustained attention during learning tasks. Learner autonomy refers to students' ability to take responsibility for their own learning processes. AI-supported platforms enable learners to access language practice opportunities beyond the classroom environment, allowing them to review learning materials, practice vocabulary, and refine writing independently. Teacher support is also included in the conceptual model as a facilitating factor that strengthens the relationship between AI usage and learner engagement. Teachers play a critical role in guiding students' use of AI tools and ensuring that these technologies are used in ways that support language learning objectives.

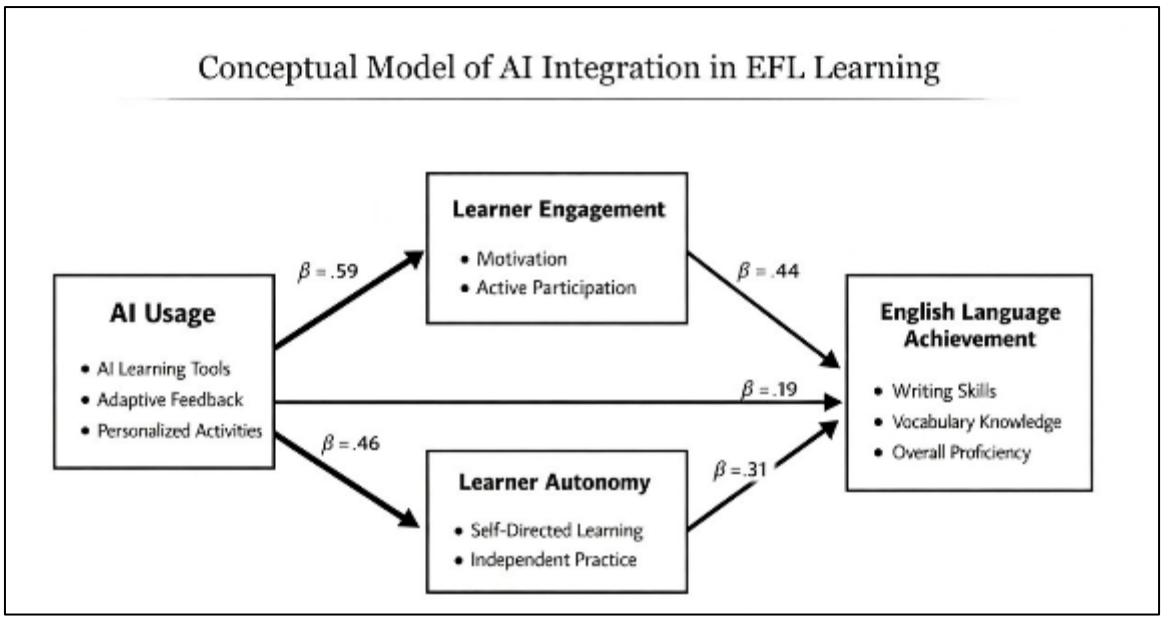

Figure 1 Conceptual Model of AI Integration in EFL Learning

The conceptual model illustrates how the use of artificial intelligence (AI) tools in EFL learning environments influences students' English language achievement in international schools in Riyadh. AI usage—through learning tools, adaptive feedback, and personalized activities—acts as the main independent variable affecting learning outcomes. The model proposes that AI enhances learner engagement (motivation and active participation) and learner autonomy (self-directed learning and independent practice), which function as mediating variables. These factors collectively contribute to improved English language achievement, including writing skills, vocabulary development, and overall language proficiency. The model therefore demonstrates both direct and indirect effects of AI integration on EFL learning outcomes.

6. Research Questions

- In order to investigate the impact of artificial intelligence on English language learning outcomes in international schools in Riyadh, the present study addresses the following research questions:

- How does artificial intelligence usage influence English language learning outcomes among EFL students in international schools in Riyadh?
- What is the relationship between AI-supported learning environments and learner engagement in English language learning?
- To what extent does learner autonomy mediate the relationship between AI usage and English language achievement?
- How do teachers perceive the integration of artificial intelligence in English language classrooms?
- What factors influence the effective implementation of AI-supported language learning in international school settings?

7. Research Hypotheses

Based on the conceptual model and existing literature on artificial intelligence in language education, the study proposes the following hypotheses:

- **H1:** Artificial intelligence usage has a significant positive effect on learner engagement in EFL learning environments.
- **H2:** Artificial intelligence usage has a significant positive effect on learner autonomy in English language learning.
- **H3:** Learner engagement has a significant positive effect on English language achievement.
- **H4:** Learner autonomy has a significant positive effect on English language achievement.
- **H5:** Artificial intelligence usage has a significant indirect effect on English language achievement through learner engagement and learner autonomy.
- **H6:** Teacher support positively moderates the relationship between AI usage and learner engagement.

These hypotheses form the basis for the quantitative statistical analysis conducted in this study.

8. Methodology

8.1. Research Design

This study employed a mixed-methods research design combining quantitative and qualitative approaches to examine the role of artificial intelligence in enhancing English language learning outcomes among EFL students in international schools in Riyadh, Saudi Arabia. The mixed-methods approach was selected because it allows researchers to explore complex educational phenomena by integrating statistical analysis of learning outcomes with qualitative insights into instructional practices and teacher perceptions.

The quantitative component of the study focused on analyzing the relationship between AI-supported learning environments and students' English language achievement, learner engagement, and learner autonomy. Statistical techniques including descriptive statistics, correlation analysis, multiple regression analysis, and structural equation modeling were employed to examine these relationships.

The qualitative component involved semi-structured interviews with English language teachers in order to explore their perceptions of artificial intelligence integration in EFL classrooms. This approach provided additional contextual insights that complemented the statistical findings and helped explain how AI-supported learning environments influence classroom practices.

Mixed-methods research designs are widely used in educational technology research because they enable researchers to examine both measurable learning outcomes and the instructional processes that contribute to those outcomes (Alharbi, 2024).

8.2. Research Setting

The study was conducted in three international schools located in Riyadh, Saudi Arabia: Al-Alson International School, Glory Generation International School, and Leadership International School. These schools were selected because they implement international curricula that emphasize English-medium instruction and technology-enhanced learning environments. In these institutions, English functions as the primary language of academic instruction, while students typically learn English as a foreign language alongside their native language.

International schools in Riyadh often integrate digital learning platforms and technology-based instructional tools as part of their educational programs. The availability of technological infrastructure and digital learning resources provides an appropriate environment for examining the implementation of artificial intelligence applications in English language education.

8.3. Participants

The study involved 336 participants, including 312 students and 24 English language teachers.

8.3.1. Student Participants

The student sample consisted of learners enrolled in grades 7 to 11 across the three participating schools. Students were selected through stratified sampling to ensure representation across different grade levels and language proficiency levels.

Table 1 Student Demographic Information

Variable	Category	Frequency	Percentage
Gender	Male	158	50.6%
	Female	154	49.4%
Grade Level	Grade 7	50	16.0%
	Grade 8	51	16.3%
	Grade 9	53	17.0%
	Grade 10	52	16.7%
	Grade 11	53	17.0%
	Grade 12	53	17.0%
Total		312	100.0%

The student sample consisted of 312 EFL learners drawn from Grades 7 to 12 across the three participating international schools in Riyadh. The gender distribution was nearly balanced, with 158 male students (50.6%) and 154 female students (49.4%). Grade-level representation was also evenly distributed, ranging from 50 students in Grade 7 to 53 students in Grades 9, 11, and 12. This balanced distribution strengthens the representativeness of the sample across lower and upper school levels and is appropriate for examining variation in AI-supported English language learning across adolescent EFL learners in Saudi educational contexts, where learner perceptions, engagement, and writing development are central concerns in recent research.

8.3.2. Teacher Participants

The qualitative component of the study involved 24 English language teachers who had experience using digital tools in their classrooms.

The teacher sample consisted of 24 English language instructors working in the participating international schools in Riyadh. The gender distribution included 11 male teachers (45.8%) and 13 female teachers (54.2%). Teaching experience varied across the sample, with the largest proportion of teachers (37.5%) having between six and ten years of teaching experience. In terms of academic qualifications, the majority of teachers held master's degrees in English language teaching, applied linguistics, or related fields (54.2%), while nine teachers (37.5%) held bachelor's degrees and two teachers (8.3%) held doctoral degrees. This diverse professional background provided a range of perspectives on the integration of artificial intelligence in EFL instruction.

Table 2 Teacher Demographic Information

Variable	Category	Frequency	Percentage
Gender	Male	11	45.8%
	Female	13	54.2%
Teaching Experience	1–5 years	6	25.0%
	6–10 years	9	37.5%
	11–15 years	5	20.8%
	More than 15 years	4	16.7%
Academic Qualification	Bachelor's Degree	9	37.5%
	Master's Degree	13	54.2%
	Doctorate	2	8.3%
Total		24	100%

8.4. Research Instruments

Three primary instruments were used to collect data for the study:

8.4.1. Student Questionnaire

A structured questionnaire was designed to measure students' experiences with AI-supported learning tools and their perceptions of engagement and autonomy in English language learning. The questionnaire consisted of 25 Likert-scale items organized into three sections:

- AI usage frequency
- Learner engagement
- Learner autonomy

Students responded to each item using a **five-point Likert scale** ranging from 1 (strongly disagree) to 5 (strongly agree).

8.4.2. English Language Achievement Test

To measure students' English language proficiency, an achievement test was administered focusing on three key language skills:

- Writing performance
- Vocabulary knowledge
- Reading comprehension

The test included multiple-choice questions, short writing tasks, and vocabulary exercises aligned with the curriculum used in the participating schools.

8.4.3. Teacher Interviews

Semi-structured interviews were conducted with participating teachers to explore their perspectives on artificial intelligence integration in English language instruction.

The interview protocol focused on the following themes:

- Teachers' experiences using AI-supported tools
- Perceived benefits of AI in language learning
- Challenges related to AI integration
- Recommendations for effective implementation

8.5. Data Collection Procedures

Data collection was conducted over a **six-week period during the second semester of the academic year**.

The research procedures included the following steps:

- Institutional approval was obtained from school administrators.
- Students were informed about the purpose of the study and provided consent to participate.
- The student questionnaire was administered during English language classes.
- The English achievement test was conducted under supervised classroom conditions.
- Teacher interviews were scheduled and conducted individually.

All quantitative data were coded and analyzed using SPSS statistical software, while qualitative interview responses were analyzed through thematic analysis.

7.6 Reliability and Validity

To ensure the reliability and validity of the research instruments, several procedures were implemented.

8.5.1. Reliability Analysis

Internal consistency reliability was measured using Cronbach's alpha coefficient.

Table 3 Reliability Statistics

Construct	Number of Items	Cronbach's Alpha
Artificial Intelligence Usage	8	0.87
Learner Engagement	9	0.91
Learner Autonomy	8	0.88
English Achievement Scale	6	0.84
Overall Instrument	**31**	**0.90**

The internal consistency of the research instrument was examined using Cronbach's alpha reliability analysis. As shown in Table 3, the reliability coefficients for all constructs exceeded the commonly accepted threshold of 0.70, indicating satisfactory internal consistency. The AI usage scale demonstrated a reliability coefficient of 0.87, while learner engagement and learner autonomy recorded Cronbach's alpha values of 0.91 and 0.88 respectively. The English achievement scale also demonstrated strong reliability with a coefficient of 0.84. The overall reliability of the questionnaire was calculated at 0.90, suggesting that the instrument provided a highly reliable measure of the constructs investigated in this study.

8.6. Validity

Content validity was established through expert review by three specialists in applied linguistics and educational technology. Construct validity was assessed using factor analysis, which confirmed that questionnaire items loaded appropriately onto their respective constructs.

8.7. Ethical Considerations

Ethical approval for the study was obtained from the participating schools prior to data collection. Participants were informed about the objectives of the research and assured that their responses would remain confidential. Participation in the study was voluntary, and students and teachers were informed that they could withdraw from the research at any stage without any consequences. All collected data were anonymized to protect participant privacy.

9. Data Analysis and Results

9.1. Descriptive Statistics

Descriptive statistical analysis was conducted to examine the overall patterns of artificial intelligence usage, learner engagement, learner autonomy, and English language achievement among the participating EFL students. Means and standard deviations were calculated to provide an overview of the distribution of responses across the major constructs examined in the study.

Table 4 Descriptive Statistics for Key Variables

Variable	Mean	Standard Deviation	Minimum	Maximum
AI Usage	3.91	0.72	1.80	4.95
Learner Engagement	4.08	0.66	2.10	4.98
Learner Autonomy	3.84	0.70	1.95	4.87
Writing Achievement	78.62	8.54	54	96
Vocabulary Score	80.41	7.96	58	97
Speaking Confidence	3.87	0.74	2.00	4.92

The descriptive results indicate that students reported relatively high levels of engagement when using AI-supported language learning tools. The mean engagement score of 4.08 suggests that students generally perceived AI-supported learning activities as interactive and motivating. Similarly, the mean AI usage score of 3.91 indicates that students frequently used AI-supported tools for writing practice, vocabulary development, and language exploration.

Writing achievement scores ranged from 54 to 96, with an overall mean of 78.62. This distribution reflects moderate to high writing proficiency among the participating EFL learners. Vocabulary scores were slightly higher on average, suggesting that students may benefit particularly from AI-supported vocabulary learning tools that provide contextual examples and lexical suggestions.

9.2. Correlation Analysis

Pearson correlation analysis was conducted to examine the relationships among the key variables included in the study. Correlation coefficients provide insight into the strength and direction of relationships between AI usage, learner engagement, learner autonomy, and English language achievement.

Table 5 Means, Standard Deviations, and Correlations Among Study Variables (N = 312)

Variable	Mean	SD	1	2	3	4
1. AI Usage	3.91	0.72	1			
2. Learner Engagement	4.08	0.66	0.62**	1		
3. Learner Autonomy	3.84	0.70	0.54**	0.58**	1	
4. English Achievement	79.52	8.21	0.49**	0.64**	0.52**	1

Note. $p < .01$

Pearson correlation analysis was conducted to examine the relationships among artificial intelligence usage, learner engagement, learner autonomy, and English language achievement. As shown in Table 5, all variables demonstrated statistically significant positive correlations. AI usage showed a strong positive correlation with learner engagement ($r=0.62$, $p < 0.01$) and a moderate correlation with learner autonomy ($r = 0.54$, $p < 0.01$). Learner engagement exhibited the strongest correlation with English language achievement ($r = 0.64$, $p < 0.01$), suggesting that students who actively participated in AI-supported learning activities tended to achieve higher levels of English proficiency. Learner autonomy also showed a significant positive relationship with English achievement ($r = 0.52$, $p < 0.01$). These results

indicate that AI-supported learning environments may enhance language learning outcomes by encouraging active engagement and independent learning behavior among EFL students.

9.3. Multiple Regression Analysis

To further examine the predictive relationships among the variables, multiple regression analysis was conducted with English language achievement as the dependent variable and AI usage, learner engagement, and learner autonomy as independent variables.

Table 6 Regression Analysis Predicting English Language Achievement

Predictor	Beta	Standard Error	t-value	p-value
AI Usage	.27	0.06	4.21	< 0.001
Learner Engagement	.41	0.05	6.37	< 0.001
Learner Autonomy	.23	0.07	3.84	0.002

Model Statistics: $R^2 = 0.56$
Adjusted $R^2 = 0.54$
$F(3, 308) = 130.42$
$p < 0.001$

The regression model explains approximately 56% of the variance in English language achievement, indicating a strong explanatory power for the variables included in the model.

Learner engagement emerged as the strongest predictor of English achievement ($\beta = 0.41$, $p < 0.001$), followed by AI usage ($\beta = 0.27$, $p < 0.001$) and learner autonomy ($\beta = 0.23$, $p = 0.002$).

These findings suggest that artificial intelligence contributes to language learning outcomes both directly and indirectly by fostering greater student engagement and independent learning behavior.

9.4. Structural Equation Modeling

Structural equation modeling (SEM) was conducted to examine the proposed conceptual model and test the hypothesized relationships among AI usage, learner engagement, learner autonomy, and English language achievement.

Table 7 Model Fit Indices

Fit Index	Value	Recommended Threshold
Chi-square/df	2.31	< 3.0
CFI	0.94	> 0.90
TLI	0.92	> 0.90
RMSEA	0.056	< 0.08
SRMR	0.044	< 0.08

The model fit indices indicate that the proposed structural model demonstrates a good fit with the observed data.

9.5. Structural Path Analysis

Table 8 Standardized Structural Path Coefficients

Structural Path	Beta	t-value	p
AI Usage → Learner Engagement	.59	7.34	< 0.001
AI Usage → Learner Autonomy	.46	5.98	< 0.001
Learner Engagement → English Achievement	.44	6.11	< 0.001

Learner Autonomy → English Achievement	.31	4.03	0.001
AI Usage → English Achievement	.19	2.48	0.013

The path analysis confirms that AI usage significantly influences learner engagement and learner autonomy, both of which contribute to improved English language achievement. These findings support the theoretical assumption that AI-supported learning environments enhance language learning outcomes by promoting active participation and independent learning practices.

9.6. Mediation Analysis

To further explore the indirect effects of AI usage on English language achievement, mediation analysis was conducted using bootstrapping procedures.

Table 9 Indirect Effects of AI Usage on English Achievement

Path	Indirect Effect	p-value
AI → Engagement → Achievement	0.26	< 0.001
AI → Autonomy → Achievement	0.14	0.003

The mediation analysis demonstrates that a substantial portion of the effect of AI usage on English achievement is mediated through learner engagement and learner autonomy. These results highlight the importance of interactive and student-centered learning environments in maximizing the educational benefits of artificial intelligence.

10. Discussion

The purpose of this study was to investigate the role of artificial intelligence in enhancing English language learning outcomes among EFL students in international schools in Riyadh, Saudi Arabia. The findings provide important insights into how AI-supported learning environments influence learner engagement, learner autonomy, and English language achievement. The results contribute to the growing body of research examining the pedagogical implications of artificial intelligence in language education.

10.1. Artificial Intelligence and Learner Engagement

One of the most significant findings of the study is the strong relationship between AI usage and learner engagement. The statistical analysis revealed that students who frequently used AI-supported language learning tools demonstrated higher levels of engagement in English learning activities. This finding is consistent with previous research suggesting that interactive digital technologies can increase students' motivation and participation in learning tasks (Alharbi, 2024).

AI-powered language learning tools often provide interactive features such as immediate feedback, adaptive exercises, and conversational interfaces. These features transform traditional language learning tasks into dynamic learning experiences that encourage active student participation. When learners receive immediate responses to their language input, they are more likely to remain engaged in the learning process and continue practicing language skills.

The strong relationship between engagement and English language achievement observed in the present study also highlights the importance of learner participation in EFL contexts. In environments where English is taught as a foreign language, opportunities for meaningful interaction with the language may be limited outside the classroom. AI-supported learning platforms can therefore play an important role in increasing the frequency and quality of language practice.

These findings align with previous studies indicating that technology-enhanced learning environments can significantly improve student engagement and learning outcomes when implemented within pedagogically structured instructional frameworks (Alyami et al., 2025).

10.2. Artificial Intelligence and Learner Autonomy

Another important finding of the study relates to the role of artificial intelligence in promoting learner autonomy. The results of the regression and structural equation modeling analyses indicate that AI usage significantly predicts students' independent learning behavior. Students who regularly used AI-supported learning tools reported greater willingness to practice English independently and take responsibility for their own learning progress.

Learner autonomy is widely recognized as an essential component of successful language acquisition. Autonomous learners are more likely to engage in self-directed learning activities such as reviewing vocabulary, revising written work, and exploring additional learning resources. AI-supported learning platforms provide learners with continuous access to language practice opportunities, allowing them to extend learning beyond the classroom environment.

For example, AI-based writing assistants allow students to revise their written texts independently by identifying grammatical errors and suggesting improvements. Similarly, AI-powered vocabulary tools provide contextualized examples that help learners understand how words are used in authentic communication contexts. These tools encourage learners to experiment with language and refine their skills through iterative practice.

The positive relationship between learner autonomy and English language achievement observed in the present study supports the argument that technology-enhanced learning environments can facilitate more independent learning practices among EFL learners (Alqaed, 2024).

10.3. Artificial Intelligence and English Language Achievement

The results of the statistical analysis indicate that artificial intelligence has a significant positive effect on English language achievement. Students who frequently used AI-supported learning tools demonstrated higher scores in writing performance and vocabulary knowledge compared with students who relied primarily on traditional learning methods.

One explanation for this finding lies in the ability of AI technologies to provide immediate feedback. In traditional classroom settings, students may wait several days before receiving feedback on their written assignments. AI-supported writing tools can provide instant feedback on grammar, sentence structure, and vocabulary usage, allowing learners to revise their work more efficiently.

Another factor contributing to improved learning outcomes is the adaptive nature of AI-supported learning systems. Many AI-based educational platforms analyze student performance data and adjust learning activities accordingly. This adaptive functionality enables learners to focus on areas where they need additional practice, thereby increasing the efficiency of the learning process.

The positive effect of artificial intelligence on language achievement observed in this study is consistent with previous research indicating that AI-supported language learning environments can enhance learners' writing accuracy, vocabulary development, and overall language proficiency (Alhamam, 2025; Alsaif, 2024).

10.4. The Role of Teachers in AI-Supported Learning Environments

Although artificial intelligence technologies provide powerful tools for supporting language learning, the findings of this study emphasize that teachers remain central to the instructional process. Interviews with English language teachers indicated that AI tools are most effective when they are integrated within structured pedagogical frameworks guided by teacher expertise.

Teachers play several important roles in AI-supported learning environments. First, they design learning activities that incorporate AI tools in ways that align with curricular objectives and language learning goals. Second, teachers help students interpret and apply the feedback provided by AI systems. Third, teachers ensure that students use AI technologies responsibly and avoid overreliance on automated assistance.

These findings highlight the importance of professional development programs that help teachers develop the skills necessary to integrate artificial intelligence into their instructional practices effectively. Without adequate training and institutional support, teachers may face challenges in implementing AI-supported learning environments despite recognizing their potential benefits.

10.5. Implications for EFL Education in Saudi Arabia

The findings of this study have several important implications for English language education in Saudi Arabia. First, the results suggest that artificial intelligence can serve as a valuable instructional resource for enhancing EFL learning outcomes in school environments. Educational institutions may therefore consider incorporating AI-supported learning platforms into English language curricula to provide students with additional opportunities for language practice.

Second, the study highlights the importance of promoting learner engagement and autonomy in language learning. AI-supported learning environments that encourage interactive participation and independent practice can contribute significantly to students' language development.

Third, the successful integration of artificial intelligence in EFL education requires institutional support and teacher training. Educational authorities and school administrators should therefore invest in professional development programs that equip teachers with the knowledge and skills necessary to use AI technologies effectively in language instruction.

By addressing these factors, educational institutions can leverage the potential of artificial intelligence to improve English language learning outcomes and prepare students for participation in a globally interconnected world.

10.6. Educational Implications

The findings of this study offer several important implications for English language education, particularly in EFL contexts where learners may have limited exposure to authentic language interaction outside formal classroom environments.

10.7. Integration of AI Tools in EFL Instruction

One of the most significant implications of the study is the potential of artificial intelligence technologies to support more effective English language instruction. AI-powered applications can provide learners with immediate feedback, adaptive learning tasks, and opportunities for repeated language practice. These features enable students to develop their language skills through continuous interaction with English language content.

Educational institutions may therefore consider incorporating AI-supported learning platforms into English language curricula. When integrated with existing instructional practices, these technologies can enhance the learning experience by providing students with additional opportunities to practice writing, vocabulary usage, and conversational skills.

The results of this study indicate that students who regularly engage with AI-supported learning tools demonstrate higher levels of engagement and improved language performance. Consequently, AI technologies may serve as valuable supplementary resources that extend learning beyond the classroom environment.

10.8. Teacher Professional Development

Another important implication concerns the role of teacher training in successful AI integration. Although artificial intelligence technologies provide powerful learning tools, their effectiveness depends largely on how teachers incorporate them into instructional design.

Professional development programs should therefore focus on helping teachers develop the knowledge and skills required to integrate AI technologies into English language instruction. Such training may include guidance on selecting appropriate AI applications, designing learning activities that incorporate AI tools, and interpreting the feedback generated by automated learning systems.

Teachers also play a crucial role in helping students use AI tools responsibly. Clear guidelines and classroom policies are necessary to ensure that AI technologies support language learning rather than replacing students' independent effort.

10.9. Promoting Learner Autonomy

The findings of the study highlight the importance of learner autonomy in language learning. Students who demonstrated higher levels of autonomous learning behavior achieved stronger language performance. AI-supported learning environments can encourage autonomous learning by allowing students to practice language skills independently and explore learning materials beyond classroom instruction.

Educational institutions should therefore design learning environments that encourage students to take greater responsibility for their learning processes. AI-supported platforms can serve as valuable resources that enable students to review vocabulary, revise written texts, and engage in additional language practice outside the classroom.

10.10. Limitations of the Study

Although the study provides valuable insights into the role of artificial intelligence in EFL learning, several limitations should be acknowledged.

First, the study was conducted in a limited number of international schools in Riyadh. While these institutions provide an appropriate environment for investigating technology-supported language learning, the findings may not be fully generalizable to other educational contexts within Saudi Arabia or other countries.

Second, the study focused primarily on specific aspects of language learning, including writing performance, vocabulary acquisition, and learner engagement. Other important language skills such as listening comprehension and pronunciation development were not examined in detail. Future research could explore how AI technologies influence these additional dimensions of language learning.

Third, the study examined AI-supported learning environments over a relatively limited time period. Longitudinal research examining the long-term effects of artificial intelligence integration in language education would provide valuable insights into how these technologies influence language development over extended periods of study.

10.11. Recommendations for Future Research

Based on the findings and limitations of the present study, several directions for future research can be suggested. First, future studies may examine the long-term effects of artificial intelligence integration in English language education. Longitudinal research designs could explore how continuous exposure to AI-supported learning environments influences language proficiency development over multiple academic years. Second, additional research could investigate the role of artificial intelligence in developing other language skills, including listening comprehension, pronunciation accuracy, and intercultural communication competence. Third, comparative studies involving different educational contexts may provide deeper insights into how institutional factors influence the effectiveness of AI-supported language learning environments. For example, researchers may compare AI integration in public schools, private schools, and international schools.

Finally, qualitative research focusing on students' experiences with AI-supported learning tools could provide valuable insights into the cognitive and motivational factors that influence language learning in technology-enhanced environments.

11. Conclusion

Artificial intelligence technologies are rapidly transforming educational practices across multiple disciplines, including language education. In the context of English as a Foreign Language learning, AI-supported instructional tools provide opportunities for personalized feedback, adaptive learning environments, and interactive language practice that can enhance student engagement and language development.

The findings of the present study demonstrate that artificial intelligence plays a significant role in improving English language learning outcomes among EFL students in international schools in Riyadh. Students who regularly used AI-supported learning tools demonstrated higher levels of engagement, stronger autonomous learning behavior, and improved performance in writing and vocabulary tasks.

The statistical analysis revealed that learner engagement represents the most influential factor in predicting English language achievement. Artificial intelligence technologies contribute to improved learning outcomes primarily by increasing students' participation in language learning activities and encouraging independent practice.

At the same time, the study highlights the continued importance of teacher guidance in AI-supported learning environments. Artificial intelligence technologies are most effective when integrated within pedagogically structured instructional frameworks guided by experienced educators.

Overall, the findings suggest that artificial intelligence can serve as a valuable tool for enhancing English language education when implemented thoughtfully and supported by appropriate institutional policies and teacher training programs. As educational systems continue to embrace digital innovation, the integration of artificial intelligence in EFL learning environments has the potential to contribute significantly to the development of effective and engaging language education practices.

Compliance with ethical standards

Disclosure of Conflict of Interest

The author declares that there are no conflicts of interest related to this study or its publication.

Statement of Ethical Approval

This study was conducted in accordance with accepted ethical principles for educational research. Care was taken to ensure that the research process respected participants' privacy and confidentiality, and that all data were handled responsibly and used solely for academic purposes.

Statement of Informed Consent

All participants were informed about the purpose of the study before participating. Their participation was entirely voluntary, and they were assured that their responses would remain anonymous. Participants also had the right to withdraw from the study at any time without any consequences.

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