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THE ROLE OF ARTIFICIAL INTELLIGENCE TECHNOLOGIES IN ENHANCING ENGLISH LANGUAGE LEARNING ACCORDING TO THE PERSPECTIVES OF A SAMPLE OF PHD STUDENTS

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Abstract: This study explores the role of artificial intelligence applications in improving English learning for PhD Students, focusing on their views on the effectiveness of these tools. With the increasing academic dependence on the English language in research publishing, participation in conferences, and international cooperation, applications such as Grammarly, Duolingo and ChatGPT have become innovative solutions to face language learning challenges. However, there is still a research gap in assessing these tools' effectiveness from the users' perspective. This study used a quantitative approach, employing a 35-item questionnaire to gather data on the use of AI applications in English language learning. A total of 122 PhD students from various disciplines participated. The survey included questions on the frequency of AI tool usage, perceived effectiveness, and specific language skills improvement. Statistical significance was tested using regression analysis and ANOVA, with a significance level set at 0.05, targeting PhD Students from different specialisations with experience in using artificial intelligence applications to learn languages. The study demonstrates that AI techniques play a significant role in enhancing English language learning, particularly in improving core language skills. AI-driven tools, such as chatbots and personalized learning systems, have shown potential in reshaping language learning practices by offering more interactive and effective experiences. According to the participants' perceptions, these tools support improved reading, writing, listening, and speaking skills more efficiently than traditional methods. The findings indicate that AI serves as a valuable support tool in academic language acquisition, helping PhD students access scholarly resources in English, expand their domain knowledge, and stay up to date with the latest research.

Keywords: Artificial Intelligence; English Language Learning; PhD Students; AI-driven Learning Tools; Chatbots; Personalized Language Acquisition; AI in Education; Technology-enhanced Learning; Language Skill Development.

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1. Introduction

Recent advancements in artificial intelligence applications have made them indispensable for researchers and learners, including PhD candidates, as they significantly enhance English language acquisition through various tools that improve language proficiency (Jeon, 2024; Wylde et al., 2023), provide personalised learning experiences, and enrich cultural understanding. Artificial intelligence offers a wide array of technologies, including chatbots, intelligent tutoring systems, speech recognition software, and immediate feedback, which enhance learning environments beyond traditional language acquisition methods. Despite these advantages, persistent unresolved issues and challenges remain, such as accessibility and usability, ethical dilemmas, and the risk of excessive dependence on AI tools. An analysis of the benefits and drawbacks will clarify how artificial intelligence can influence the enhancement of English language proficiency. In recent decades, significant advancements in artificial intelligence and modern technologies have enriched foreign language acquisition, especially in English, by providing customized and interactive learning experiences. This study aims to analyse PhD students' perspectives on the impact of artificial intelligence applications in enhancing English language learning, using SPSS findings.

1.1.Study problem

Many academics and learners rely on artificial intelligence applications to improve their English language skills. However, the effectiveness of these tools and their true impact on language acquisition requires comprehensive scientific research to determine which techniques help them learn the language. To determine the effectiveness of artificial intelligence tools in enhancing

English language learning among doctoral students, we pose the following question:

To what extent do artificial intelligence techniques influence the enhancement of English language learning among doctoral students?

1.2.Study objectives

The research aims are:

- To Analyses of the use of PhD students for artificial intelligence applications in learning the English language.
- To Evaluate the effectiveness of these applications in improving language skills (reading, writing, listening, and speaking).
- To Study the relationship between the use of these applications and progress at the English language level.
- To Submit recommendations based on the study results to improve the learning experience through artificial intelligence.

1.3.Significance of the Research

The importance of this study stems from its ability to provide an accurate overview of artificial intelligence techniques applied to English language learning. This study contributes to enhancing the language skills of doctoral students who need to master the English language to conduct research and studies. We highlight the most important techniques useful for language learning and offer some recommendations for improving current strategies and developing future directions for applying artificial intelligence techniques to English language learning.

2. Literature Review

2.1 The Role of Artificial Intelligence in Language Learning: Definitions, The Role in Language Learning

The application of Artificial Intelligence (AI) in education, particularly language learning, has been widely discussed in recent literature. AI tools such as speech recognition, personalized feedback systems, and language processing applications have shown promise in enhancing learning experiences. This review examines the effectiveness of these AI tools, the role they play in improving language skills, and the ethical challenges they present.

2.1.1 Definition of artificial intelligence (AI)

Artificial Intelligence (AI) is a discipline within computer science and engineering focused on the computational understanding of what is commonly termed intelligent conduct, as well as the development of products that demonstrate this behaviour. To explore this notion further, we can examine the domain from three perspectives: computational psychology, computational philosophy, and machine learning intelligence (Shapiro, 2003) . Recent advancements have made AI tools increasingly sophisticated, with applications ranging from natural language processing to machine learning .Artificial Intelligence (AI) denotes the ability of machines, including computers and robots, to demonstrate human-like intelligence. International Business Machines Corporation Artificial Intelligence is characterised by a machine's capacity to replicate human functions, including decision-making, problem-solving, language processing, and experiential learning. It collects and examines data to automate processes and facilitate effective decision-making. Typical applications of AI encompass speech and picture recognition, real-time recommendations, virus detection, stock trading, ride-sharing, autopilot systems, and natural language processing utilised in chatbots and digital assistants. Artificial intelligence is ubiquitous, and its efficacy is consistently enhanced by mimicking human behaviour and interactions (Abimanto & Sumarsono, 2024).

For example, artificial intelligence is used in technology and innovation, industry, healthcare sector and education. The basis of artificial intelligence is expert systems, robotics, natural language processing, computer vision, speech and understanding. Techniques of artificial intelligence include machine learning, artificial neural networks, deep learning, expert systems, genetic algorithms and fuzzy algorithms (Göde & Kalkan, 2023).

2.1.2 Exploring the Role of Artificial Intelligence in Language Learning: A Review of Previous Literature

This section explores the role of artificial intelligence in language learning, providing an overview of previous studies that have investigated its impact on improving language skills, such as speaking, writing, and listening.

Artificial Intelligence (AI) is increasingly regarded as valuable in English learning due to its effectiveness in enhancing educational outcomes, particularly for advanced learners such as PhD students. AI tools offer personalised learning experiences, prompt feedback, and heightened engagement, which are crucial for advancing sophisticated language acquisition. These technologies, including chatbots, intelligent tutoring systems, and speech recognition software, have proven effective in improving language skills, especially in speaking and writing. However, successfully integrating AI into language learning requires addressing challenges related to accessibility, teacher preparedness, and ethical considerations. Several studies have explored the role of artificial intelligence in English language learning.

Kristian, Bashar, and Pradana (2024) studied the impact of artificial intelligence technologies on education, highlighting their ability to enhance learner engagement and provide personalised learning, particularly in language skills. Their research emphasises the importance of ethical standards and targeted teacher training to effectively leverage AI tools like chatbots and intelligent tutoring systems. These tools, including Grammarly and AI

Speak, offer timely feedback and support iterative learning, demonstrating the need for careful implementation in English language education (Kristiawan et al., 2024).

Eslit (2024) explores AI's significant impact on language learning, emphasising its role in intelligent tutoring systems, real-time translation, and adaptive learning platforms. These technologies enhance English language acquisition by offering personalised feedback and immersive experiences while promoting cultural understanding and global awareness.

AI addresses issues of accessibility and resources, fostering inclusive educational environments for all learners, including PhD students. By integrating AI tools, language education improves linguistic skills and introduces diverse cultural nuances, promoting empathy and creating a fairer learning landscape (Eslit, 2024).

In a study by Harahsheh (2024), the relationship between AI applications in education and secondary school students' engagement in learning English was explored in Kasbah Al-Mafraq. Using a descriptive correlational approach, data were gathered through a questionnaire created by the researcher, including a sample of 200 students. The findings revealed extensive use of AI tools in learning English, such as ChatGPT, Duolingo, Google Translate, and Grammarly. Additionally, students showed intense engagement levels, primarily in cognitive engagement, closely trailed by behavioural and emotional engagement. The research also found a positive link between the utilization of AI applications and students' engagement in English learning, implying that AI tools play a crucial role in motivating learners and improving their language acquisition journey (Aaouda Alah, 2024).

Sahli and Benamer (2025) investigate the use of ChatGPT as a supplementary tool to enhance the understanding of lectures among second-year English students at Mentouri University. Using a quasi-experimental approach, the study compares the comprehension of students before and after utilizing ChatGPT for lecture revision. The 60 participants were divided into an experimental group, which used ChatGPT for revising and outlining lectures, and a control group that relied on traditional resources. Pre- and post-tests were conducted to assess the effectiveness of ChatGPT in improving students' overall understanding and performance. The experiment, focusing on the Language and Culture module, revealed that the experimental group demonstrated a statistically significant improvement in lecture comprehension compared to the control group. The findings indicate that, while traditional resources can enhance lecture understanding, ChatGPT acts as an effective digital assistant, supporting students in grasping complex lecture content more effectively (Sahli & Benamer, 2025).

Sehlaoui (2024) explores the integration of AI in foreign language teaching and learning, emphasizing its role in fostering learner autonomy. The study investigates the use of AI tools in an Algerian university, highlighting their impact on self-directed learning in French and English as foreign languages. The findings reveal a high level of AI tool usage among students, with no statistically significant difference between French and English learners. The research underscores AI’s transformative potential in language education, offering insights into how AI-equipped support enhances autonomous learning (Sehlaoui, 2024).

Saab and Abu Melhem (2025) examine the impact of artificial intelligence tools on vocabulary acquisition among university students at the Islamic University of Lebanon. Their mixed-method research involves pre-tests, post-tests, and interviews with 80 students divided into an experimental group and a control group. The study addresses the persistent deficiency in academic vocabulary, which hinders students' reading and writing proficiency in English as a Foreign Language (EFL). Findings indicate that students exposed to AI-supported instruction significantly improved their vocabulary retention and usage in academic writing. The research confirms that integrating AI tools fosters vocabulary development, enabling learners to comprehend, retain, and apply new academic terms effectively. This underscores

AI's potential as a catalyst for enriching EFL instruction and expanding learners' lexical repertoires (Saab & Abu Melhem, 2025).

Lam Ky Nhan (2024) explored students' perceptions of AI-powered assistants in enhancing English-speaking proficiency at Nam Can Tho University. The study found that AI tools, such as chatbots and virtual tutors, significantly improved speaking skills by providing personalised instruction and real-time feedback. However, students expressed concerns about diminished human interaction and an over-reliance on AI-driven methods. While this research highlights the effectiveness of AI in developing oral communication skills, it does not focus on PhD students or academic writing (Ky Nhan, 2024).

More recently, Sehlaoui (2024) examined the role of AI in university-level language teaching, emphasising the integration of AI-driven applications such as Speak, Ewa, Grammarly, Duolingo, Get Pronounce, and Hello Talk. The study was conducted in response to French higher education policies promoting English language proficiency, and it highlights how AI tools support language learning through pronunciation practice, sentence construction, and audio recordings. Furthermore, the study includes a questionnaire that examines the perspectives of students studying English and French regarding AI applications. It highlights the increasing reliance on AI for language learning; however, it does not explicitly assess its impact on PhD students or academic writing (Sehlaoui, 2024).

Artificial intelligence (AI) enhances language education by improving learning experiences, providing instant feedback, and increasing participation. However, it raises data privacy and ethical concerns, along with the need for equal access. AI supports personalised learning pathways and automated assessments, helping educators and students tackle challenges. This exploration highlights AI's potential to create inclusive learning environments, making resources accessible to diverse student populations. Its integration in language acquisition enhances educational outcomes and promotes equity. Beyond traditional computer-assisted instruction, AI includes intelligent tutoring systems (ITS) that mimic human tutors, offering immediate, relevant feedback that addresses individual learner needs and fosters proficiency and engagement (Pokrivcakova, 2019; Tafazoli et al., 2019).

The following sections delve into the key aspects of AI's role in language learning.

Personalised Learning and Engagement. Personalized learning refers to educational approaches that adjust learning experiences to meet the individual needs, preferences, and pace of each student. This method allows learners to engage with content that is relevant to their unique learning styles(Priya, 2024).

Artificial intelligence (AI) plays a crucial role in facilitating personalized learning by using algorithms to analyse students' strengths and weaknesses, thus creating customized learning paths. For example, AI-driven applications can modify lesson difficulty based on a student's proficiency level, ensuring that the material is neither too easy nor too challenging. By leveraging technologies such as chatbots, spaced repetition techniques, and real-time object recognition systems, these applications enhance user engagement and make learning more interactive (Priya, 2024).

Cultural Competence and Pragmatic Skills. Artificial intelligence is being utilised in education, particularly in language acquisition, which is essential in our networked society. This technology extends beyond merely distributing the learning experience; it also offers immediate feedback and resources tailored to the individual needs of each learner. Consequently, students can enhance their verbal abilities more swiftly, enabling them to engage in authentic discussions sooner. Furthermore, artificial intelligence-supported platforms are distinguished by their capacity to adjust to varying efficiency levels, ensuring that learners are consistently challenged while receiving essential support throughout their educational experience. This adaptability fosters a more inclusive educational environment, enabling students from diverse backgrounds to thrive. Ultimately, the incorporation of

artificial intelligence in language education can facilitate the development of confident speakers capable of navigating the global landscape with agility. Acquiring a new language facilitates cultural connection and trade, hence reinforcing tyranny. Artificial intelligence solutions, including educational systems and translation software, employ sophisticated technology to deliver personalised feedback and immersive experiences, thereby enhancing the learning process (Eslit, 2024).

Challenges and Ethical Considerations. The application of Artificial Intelligence (AI) in academic writing raises ethical concerns regarding originality and critical analysis. Students express apprehension regarding the potential for inadvertent plagiarism and misrepresentation while relying on AI for their essays. AI platforms that collect student data for personalised educational experiences have concerns around privacy, autonomy, and potential prejudice that must be addressed. The advent of AI presents worldwide ethical dilemmas in research, encompassing transparency, accountability, and data bias. Specific rules and guidelines for AI are essential to efficiently traverse these challenges.

Tackling the ethical landscape of AI requires focus on privacy, autonomy, fairness, and bias in both educational and healthcare settings, underscoring the need for developing strong standards for responsible usage(Priya, 2024).

Establishing a practical framework for AI ethics in education is likely to be challenging and long-term due to the diversity of interpretations within the community. The framework will need to address current ethics-related issues while also allowing for flexibility to adapt to new knowledge and changes in science, socio-cultural norms, values, and educational systems over time (Holmes et al., 2022) .

Immersive, Interactive, and Contextually Rich Environments. AI enhances language learning by offering immersive and contextually rich learning environments. Through interactive simulations, virtual environments, and AI-enabled chatbots, learners receive extensive language input and real-time communication opportunities that mimic authentic language use.(Jia et al., 2022; Kohnke et al., 2023)

3. Methodology

This section examines the impact of artificial intelligence (AI) technology on improving English language acquisition from the viewpoints of a sample of PhD students. Before exploring the practical aspects, we shall succinctly characterise the intelligent applications examined in this study to elucidate their function in teaching English to PhD students in Algeria.

This study relied on the analytical approach, which is suitable for determining relationships between variables using numerical data (Creswell & Creswell, 2017) . A questionnaire was selected as the primary data collection tool, consistent with research practices in language education (Cohen et al., 2002). The instrument's reliability was assessed using Cronbach's Alpha, a commonly accepted measure of internal consistency (Tavakol & Dennick, 2011).

3.1 Research Design and Instrumentation

3.1.1 Study Sample

The study targeted PhD students enrolled in various Algerian universities engaged in English language learning as part of their academic activities, particularly for research, writing, and participation in international conferences. The total sample consisted of 122 PhD students from diverse academic disciplines, ensuring a broad representation across fields where English proficiency is essential.

Participants were selected based on their experience with using artificial intelligence applications, such as Grammarly, Duolingo, and ChatGPT, as tools to support their English language acquisition. These criteria ensured that the respondents had relevant exposure to the

AI-based technologies under investigation, allowing for meaningful insights into their effectiveness.

Demographic data, including gender, age, and frequency of AI tool usage, were also collected to understand the participants' backgrounds better and ensure that the analysis reflected a representative and diverse sample of users.

3.1.2 Sampling Technique

A purposive sampling technique was used to select participants who met specific criteria relevant to the research objectives—PhD students with experience using artificial intelligence applications to learn English. This method ensured that the collected data reflected informed perspectives and directly aligned with the scope of the study.

3.1.3 Research Design

This study followed a quantitative research design, employing a survey methodology to collect data on PhD students' use of AI tools for language learning. According to Cohen et al. (2002), surveys are widely used in educational research to gather structured data on participants' experiences, attitudes, and behaviours (Cohen et al., 2002). The research relied on structured data collection through a survey questionnaire, and the data were analyzed using SPSS Version 23. The statistical procedures included:

Simple linear regression analysis to test the study's hypotheses.

ANOVA (Analysis of Variance) to assess the overall model significance.

Calculation of regression coefficients, R and R^2 values, t-tests, and F-values at a 0.05 significance level.

This design allowed the researchers to establish statistical relationships between the use of AI tools and improvements in English language skills.

3.1.4 Data Collection Instrument

The primary data collection instrument was a structured questionnaire developed by the researchers. It consisted of 35 items divided into two main parts:

Part One: Collected demographic data such as gender, age, and level of engagement with AI tools.

Part Two: Comprised two sections

The first section focused on AI technologies, with 20 items covering four dimensions: learner profile, chatbot systems, smart branches, and fraud prevention.

The second section addressed English language learning, including 15 items measuring aspects such as listening, writing, and pronunciation skills.

3.1.5 Instrument Reliability

The questionnaire's reliability was validated by Cronbach's Alpha, yielding an overall coefficient of 0.943, which signifies exceptional internal consistency and renders it appropriate for fulfilling the study's aims.

3.1.6 Instrument Validity

To ensure the validity of the research instrument, the questionnaire was reviewed by a panel of subject matter experts in educational technology and language learning. Their feedback was used to revise unclear items and ensure content relevance, coverage, and appropriateness to the research objectives. This expert validation process helped establish content validity. In addition, the structure of the questionnaire was aligned with constructs used in prior validated studies, which further supports its construct validity.

3.2 Participants

The research involved a cohort of PhD students from Algerian universities who are acquiring English for academic purposes, specifically in relation to academic writing, research, and communication. A purposive sample method was utilised to recruit participants with experience in using AI technologies for language acquisition. This strategy guaranteed that the sample comprised persons with pertinent firsthand experience related to the study's aims.

Participants were selected based on their involvement with English for academic objectives, thereby ensuring the study's pertinence. The selection criteria focused on students who had utilised AI-driven language learning tools or expressed interest in incorporating such technology into their academic pursuits.

3.3 AI Applications Used in English Language Learning

In this research, and through the questionnaire items, we focused on several applications that rely on AI and significantly contribute to English language learning. These applications include:

a. Duolingo utilizes gamification and adaptive learning techniques to enhance vocabulary and reading skills. While its reward system increases learner engagement, critics argue that it offers limited depth in grammatical instruction without personalized teacher guidance (Ramazonov, 2024).

b. ChatGPT provides interactive dialogue and contextual support, which can simulate conversation and offer writing assistance. Yet, due to its generative nature, it may occasionally produce inaccurate language structures or inappropriate responses, requiring critical user oversight (Nugroho et al., 2023).

c. Grammarly, unlike generative tools, focuses strictly on error correction and style. It excels at surface-level revision but does not promote linguistic creativity or comprehension of language rules(Ramazonov, 2024).

After presenting the applications examined in our study, it is important to note that we selected them for inclusion in the questionnaire based on previous studies that confirmed their effectiveness in teaching English to students across various academic levels.

The selection of AI tools was guided by their alignment with specific language skills. Duolingo primarily targets listening and reading comprehension through gamified exercises. ChatGPT supports writing and speaking through simulated dialogue and feedback. Grammarly is focused on improving written accuracy and grammar. Each tool’s features were mapped against the research objectives to evaluate their effectiveness across the four main language competencies.

3.4 Procedures

Data collection was carried out using a 35-item questionnaire, which was intended to assess PhD students' usage of AI tools in language learning. To confirm the validity of the questionnaire, expert validation was done. A team of three experts in the fields of educational technology and language learning examined the instrument for content validity. Based on their feedback, the questionnaire was amended to ensure that the questions appropriately reflected the study’s research aims. Additionally, construct validity was examined by matching the questionnaire items with important constructs from existing literature on language acquisition and AI applications (Cohen et al., 2002). Once the validation procedure was completed, the redesigned questionnaire was administered to the participants.

Note: The data presented in these tables is original and has been compiled by the researchers based on the outputs generated from the SPSS-V23 program. No external sources were used in the creation of this data.

3.4.1 Research Instrument

A questionnaire was developed as the principal research tool to gather primary data from the study sample. The survey was segmented into two sections. The initial section comprised demographic data regarding the participants, including gender, age, and level of AI application use. The second half comprised two primary sections:

- The first section focused on AI technologies and included 20 questions across four dimensions: customer profiling, chatbot systems, smart branches, and fraud prevention.

- The second section focused on the dependent variable—English language learning—and comprised 15 questions covering key aspects of language learning assessment, including listening, writing, and pronunciation skills.
- It is worth noting that the dimensions related to the AI variable were selected after reviewing previous studies, particularly those based on the dimensions proposed by(Hineche, 2025).

3.4.2 Research Instrument Reliability

The reliability of the research instrument refers to the extent to which the same or similar results can be obtained if the research is repeated under similar conditions using the same instrument. We calculated Cronbach's Alpha to measure reliability, as it is one of the most widely used reliability measurement tools.

Table 1. *Reliability and Validity Coefficients of the Study.*

The variable	The number of measurement statements	Cronbach's Alpha Coefficient
Learner profile	05	0.826
Chatbots	05	0.811
Smart branches	05	0.839
Fraud prevention	05	0.2
Artificial intelligence techniques	20	0.921
Learn English	15	0.862
The questionnaire as a whole	35	0.943

Intelligence Techniques is 0.921, significantly exceeding the acceptable threshold of

The data presented in Table 1 indicates that the Cronbach's alpha value for Artificial is 0.60, This suggests a high level of reliability for this independent variable.

The research questionnaire's reliability coefficient is high, with a Cronbach's alpha value of 0.943, equivalent to 94.3%. This very high percentage confirms that the research questionnaire is reliable and suitable for fulfilling the requirements of our study.

3.5 Results and Hypothesis Testing

3.5.1 Normality Test (Skewness and Kurtosis Coefficients)

To verify this, the skewness and kurtosis coefficients for the research variables and the dimensions of artificial intelligence were calculated. Upon reviewing studies in this field, we find that most research suggests that if the skewness coefficient falls between (+3 and -3) and the kurtosis coefficient falls between (+10 and -10), the data can be considered approximately normally distributed. The results related to normality distribution can be illustrated in the following table:

Table 2. *The Coefficient of Asymmetry and Kurtosis of the Study Variables*

The variable	Coefficient of Asymmetry	Coefficient of Kurtosis
Learner profile	-1.067	1.173
Chatbots	-0.730	0.096
Smart branches	-0.935	0.782
Fraud prevention	-0.548	0.371
Artificial intelligence techniques	-0.822	0.720
Learn English	-0.805	0.276
The questionnaire as a whole	-0.781	0.544

According to the results presented in Table 2, the skewness coefficient values for all dimensions of the artificial intelligence techniques variable range from -1.067 to -0.54. These values are within the acceptable range. Additionally, the kurtosis coefficients range from 0.096 to 1.173, which also falls within the acceptable limits. This suggests that the research data closely resembles a normal distribution.

3.5.2 Hypothesis Testing

Before testing the research hypotheses, we note that we employed simple regression analysis for hypothesis testing. This approach relied on analysing the results of ANOVA, using Fisher's test (D) to determine the overall significance of the model. Additionally, we utilized the analysis of the correlation and determination coefficients, as well as the Coefficients analysis, which provides the values for the student's t-test (t) and significance level (sig). The results for each hypothesis were summarized in a table that includes all the aforementioned tests.

The main hypothesis of our research states:

There is a statistically significant role of artificial intelligence techniques in enhancing English language learning, according to the perspectives of a sample of PhD students, at a significance level of (0.05).

To test this hypothesis, we relied on the results of variance analysis (ANOVA) for linear regression to verify the model's validity for testing this hypothesis. Table 3 presents these results.

Table 3.

Testing the Main Hypothesis

The Independent Variable	The Dependent Variable	Regression Fixed	Regression Coefficient	R	R Square	The Calculated (T) Value	The Calculated (F) Value	Indication Level (Sig)
Artificial intelligence techniques	**Learn English**	1.094	0.747	0.815	0.664	15.384	236.671	0.000

The results presented in Table 3 demonstrate the stability of the model's validity in testing the main hypothesis. The computed F-value reached (236.671) with a significance level (sig=0.000), which is lower than the adopted significance threshold for measurement (α=0.05). The same table indicates that the independent variable in its overall form, which represents artificial intelligence technologies in this model, explains 81.5% of the variance in the English language learning variable. Based on this analysis, we accept the main hypothesis stating:

- There is a statistically significant role of artificial intelligence technologies in enhancing English language learning according to the perspectives of a sample of PhD students at a significance level of (0.05).

A. Testing the Sub-Hypotheses and Discussing the Results

Testing the First Sub-Hypothesis

- There is a statistically significant role of learner profile technologies in enhancing English language learning according to the perspectives of a sample of PhD students at a significance level of (0.05).

To test this hypothesis, we relied on the results of the analysis of variance (ANOVA) for linear regression, as illustrated in Table 4.

Table 4.

Testing the first sub-hypothesis

The Independent Variable	The Dependent Variable	Regression Fixed	Regression Coefficient	R	R Square	The Calculated (T) Value	The Calculated (F) Value	Indication Level (Sig)
Learner profile	**Learn English**	2.052	0.511	0.673	0.453	9.978	99.562	0.000

The table 4 shows that the independent variable, Learner profile, accounts for 67.3% of the variance in the dependent variable, Learn English. This substantial percentage suggests that the customer's fingerprint plays a significant role in enhancing English language learning. Based on this, we accept the first sub-hypothesis, which states:

- There is a statistically significant role of the customer's fingerprint in enhancing English language learning, according to the opinions of a sample of PhD students at a significance level of (0.05).

The role of the customer's fingerprint in English language learning is evident through identifying the learner's level and adapting content according to their abilities, recognising repeated mistakes for each learner and suggesting corrections based on their learning patterns—helping them avoid future errors. Additionally, it involves analysing word pronunciation and recommending improvements based on the customer's voice fingerprint, thereby aiding in the development of pronunciation and listening skills with greater accuracy. Moreover, it supports the proposal of personalised learning pathways tailored to the learner's style, whether they prefer learning through reading, listening, or direct interaction.

Testing the second sub-hypothesis

- Chatbots have a statistically significant role in enhancing English language learning, according to the opinions of a sample of PhD students at a significance level of (0.05).

Table 5:

Testing the second sub-hypothesis

The Independent Variable	The Dependent Variable	Regression Fixed	Regression Coefficient	R	R Square	The Calculated (T) Value	The Calculated (F) Value	Indication Level (Sig)
Chatbots	Learn English	2.132	0.501	0.681	0.464	10.187	103.777	0.000

The table indicates that the second dimension, chatbots, in this model accounts for 68.1% of the variance in English language learning. Based on the aforementioned findings, we accept the second sub-hypothesis, which states:

- Chatbots have a statistically significant role in enhancing English language learning, according to the opinions of a sample of PhD students, at a significance level of (0.05).

This result can be explained by the use of chatbots provides an interactive environment that simulates real-life conversations, helping learners improve their speaking, listening, and writing skills naturally without the need for a human partner. Additionally, some advanced chatbots that employ Natural Language Processing (NLP) and speech recognition can correct users' pronunciation and analyse their responses to enhance their listening and speaking skills. Moreover, chatbots offer an engaging experience through language games, short quizzes, and daily challenges, which help motivate learners and make the learning process more appealing.

Testing the third sub-hypothesis

There is a statistically significant role of digital branches in enhancing English language learning, according to the opinions of a sample of PhD students, at a significance level of (0.05).

We utilised the results of variance analysis for regression to test this hypothesis, as illustrated in Table 6.

Table 6:

Testing the third sub-hypothesis

The Independent Variable	The Dependent Variable	Regression Fixed	Regression Coefficient	R	R Square	The Calculated (T) Value	The Calculated (F) Value	Indication Level (Sig)
Smart branches	Learn English	2.130	0.504	0.707	0.501	10.966	120.242	0.000

Based on Table 6, we accept the third sub-hypothesis, which states:

- There is a statistically significant role of intelligent branches in enhancing English language learning according to the opinions of a sample of PhD students at a significance level of (0.05).

The third dimension of the model, smart branches, explains 70.7% of the variance in English language learning. This result can be interpreted because intelligent branches rely on user data analysis to provide content that aligns with their language proficiency level and learning style. They also offer personalized recommendations based on learner performance, such as suggesting specific exercises or lessons. Additionally, they incorporate augmented reality (AR) and virtual reality (VR) technologies, creating an immersive environment that enables learners to interact with the English language in realistic contexts. Furthermore, intelligent branches provide periodic reports to monitor progress by offering detailed insights into learners' strengths and weaknesses, thereby assisting them in developing effective learning plans.

Testing the fourth sub-hypothesis

- There is a statistically significant role of fraud prevention in enhancing English language learning according to the opinions of a sample of PhD students at a significance level of (0.05).

We relied on regression variance analysis to test this hypothesis, as illustrated in Table 7.

Table 7: *Testing the third sub-hypothesis*

The Independent Variable	The Dependent Variable	Regression Fixed	Regression Coefficient	R	R Square	The Calculated (T) Value	The Calculated (F) Value	Indication Level (Sig)
Fraud prevention	Learn English	1.182	0.708	0.530	11.636	11.636	135.386	0.000

The table 7 shows that the fourth dimension—fraud prevention in this model—accounts for 53.0% of the variance in English language learning. Consequently, we accept the fourth sub-hypothesis, which states:

- There is a statistically significant role of fraud prevention in enhancing English language learning, according to the opinions of a sample of PhD students at a significance level of (0.05).

The result can be interpreted as fraud prevention enhances English language learning by employing fraud detection systems in language tests such as TOEFL and IELTS, which identify cheating methods (e.g., using instant translation software or relying on another person). Additionally, some learners depend on automatic translation instead of developing their language skills. Artificial intelligence systems can detect excessive use of translation and propose solutions that encourage thinking directly in English. Furthermore, AI can verify that learners interact with chatbots or virtual instructors rather than merely copying and pasting answers from other sources.

4. Conclusion

This study highlights the significant influence of artificial intelligence (AI) technology on English language learning among PhD students in Algeria. The study demonstrated that applications such as Duolingo, ChatGPT, and Grammarly significantly enhance essential language skills—specifically reading, writing, listening, and grammar—through personalised and interactive learning experiences. Several essential insights were obtained from the analysis: AI technologies enable the provision of tailored content to learners, hence enhancing engagement and effectiveness. Instruments such as learner profiles enable the recognition of learning patterns and the subsequent modification of instruction, thereby improving pronunciation and comprehension. Chatbots enable genuine conversational contexts, permitting students to practise English in a comfortable and stress-free atmosphere. Intelligent technologies provide adaptive, data-driven support aligned with learners' abilities, while integrity measures ensure the authenticity of the educational experience. The integration of AI in educational environments aligns with the evolving demands of higher education, where linguistic proficiency is crucial for research dissemination, academic collaboration, and career progression. Institutions can enhance academic performance and reduce barriers to global intellectual exchange by supporting PhD students' language acquisition with tailored AI-driven solutions of excessive reliance on AI, require the establishment of clear institutional policies. Furthermore, learner support systems are essential for aiding students in the proper utilisation of AI tools, hence maximising benefits and alleviating challenges. An equitable method that considers pedagogical, ethical, and practical factors is crucial for the enduring and effective implementation of AI in language teaching. Besides improving linguistic proficiency, AI provides PhD students with access to academic literature, allows for contributions to international research, and promotes confident participation in conferences and training abroad. These solutions also optimise time and resources, making English learning more accessible and efficient. Artificial intelligence functions as a supplementary tool and a catalyst for equitable, modern language instruction. Future study should examine the sustainable and ethical incorporation of these technologies into higher education to maximise their potential benefit. Artificial intelligence systems that guide doctorate students in this language also assist them in conducting scientific research in English, so allowing their work to reach a wider audience of academics and students worldwide. Furthermore, doctoral students' proficiency in English allows them to perform research in the language, so increasing the visibility of their associated university. Moreover, the attainment of English proficiency by doctoral students amplifies their prospects for collaboration with overseas scholars sharing analogous research interests, facilitating knowledge exchange.

5. Recommendations

From this research paper, the following recommendations can be drawn:

- Developing educational curricula integrating AI, such as interactive chatbots and virtual assistants to improve conversation skills.
- Enhancing language learning platforms that rely on natural language processing (NLP) to improve learner interaction.
- Encouraging the use of chatbots in education.

- Developing AI-powered translation tools to correct language errors and enhance translation quality.
- Creating applications that utilise AI to analyse and improve pronunciation, assisting students in achieving accurate pronunciation.
- Integrating AI with voice recognition technologies to precisely assess students' progress.
- Investigating the impact of AI-based learning on student motivation and engagement in language learning.
- Developing strategies that combine traditional education with modern technologies to maximize benefits.

6. Limitations and Future Research

This study showed positive results about the role of artificial intelligence in improving English language learning. However, it has some limitations. The sample included only PhD students from a few Algerian universities, which may limit how well the results apply to other groups or settings. Also, the study mainly used surveys, which might not fully capture learners' personal experiences and challenges with AI tools. Moreover, only a few AI applications were studied, so other useful technologies were not considered.

For future research, including more participants from diverse backgrounds and different academic levels would be helpful. Using interviews or mixed methods could provide deeper insights into how learners interact with AI. Additionally, exploring newer technologies like virtual and augmented reality in language learning could offer new perspectives. Finally, studying the long-term effects of AI-assisted learning would help understand its lasting impact.

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