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| RESEARCH ARTICLE

Exploring AI-mediated Informal Digital Learning of English (AI-IDLE) and its Association with Vocabulary Knowledge among Saudi EFL Learners

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| ABSTRACT
This study examines the relationship between artificial intelligence-mediated informal digital learning of English (AI-IDLE) on Saudi English as a foreign language (EFL) learners' vocabulary knowledge. With advancements in digital infrastructure in Saudi Arabia, students increasingly turn to digital tools and AI technology to develop language skills autonomously. Despite this shift, research on how Saudi EFL learners utilize AI for vocabulary learning outside the classroom remains limited. This qualitative correlational study examines the relationship between AI-IDLE practices and vocabulary knowledge among Saudi EFL learners, using quantitative data from a survey and vocabulary test (Oxford Online Placement Test). The findings reveled a statistically significant positive correlation between AI-IDLE engagement and vocabulary proficiency. Further analyses indicated that ChatGPT usage significantly predicted vocabulary knowledge, while other AI-tools showed no significant effects. While AI tools were mainly used for translation and writing, indirect vocabulary exposure through AI tools usage supported vocabulary development. Overall, the study offers objective evidence of the contribution of AI-mediated informal digital learning of English to vocabulary knowledge and highlights the pedagogical potential of AI tools beyond traditional classroom settings.

| KEYWORDS
Vocabulary knowledge, IDLE, AI-IDLE, Saudi EFL learners, AI in language learning, Autonomous learning, ChatGPT

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1. Introduction

Recent advancement of communication technology, along with the global reach of the English language, has led to the rapid rise of Informal Digital Learning of English (IDLE) among English as a Foreign Language (EFL) learners worldwide (Soyoof et al., 2023). IDLE refers to self-directed English learning activities conducted outside the classroom in digital environments, where learners independently engage without formal teacher assessment (Lee, 2021). In these IDLE settings, EFL learners are increasingly connecting with diverse English speakers from various linguistic and cultural backgrounds, enriching their L2 language exposure (Friedrich, 2020; Rose et al., 2021). Within this evolving landscape, some scholars have integrated AI technologies into IDLE, thereby formulating an emerging subfield of IDLE (i.e., AI-mediated informal digital learning of English) (AI-IDLE) (Liu et al., 2025a; 2025b).

AI-IDLE has been defined as "how L2 English learners leverage AI technologies for self-guided and self-directed language learning beyond the classroom" (Liu et al., 2025a, p. 2). It has been established in recent empirical studies that learners' AI-IDLE engagement promotes multiple linguistic, motivational, affective, and intercultural benefits. In particular, AI-IDLE engagement has been linked to increased language learning enjoyment (Liu et al., 2025a) and enhanced motivation (Liu et al., 2025a) and improving writing proficiency (Apriani et al., 2024). These findings validate AI-IDLE as a key component of contemporary foreign/second language learning context as learners rely on AI technology to personalize learning resources, and to receive immediate feedback (Liu et al., 2025a; Liu et al., 2025b).

With the growing integration of artificial intelligence in foreign and second language learning (Zhang et al, 2025), an increasing number of studies have examined how AI-powered tools can support EFL learners' vocabulary development in instructional and non-instructional contexts. Within this growing body of work, studies have addressed learners' perceptions, effectiveness, and learning outcomes associated with AI-supported vocabulary learning. According to Yang et al. (2024), vocabulary knowledge score represents an individual's understanding and mastery of words in a language. Specifically, it reflects the range of vocabulary a person knows and their ability to use words accurately in context.

1.1 Statement of the problem

Under Vision 2030, Saudi Arabia has actively promoted the integration of artificial intelligence across public institutions (Kumar et al., 2025). As digital tools are increasingly adopted for English language learning in Saudi Arabia, understanding the relationship between using AI technology and vocabulary learning outcomes is essential. Although AI has gained recognition for its potential to support language learning beyond the classroom (Liu et al., 2024), limited research has examined the specific relationship between AI-mediated informal digital learning of English (AI-IDLE) engagement and vocabulary knowledge of Saudi EFL learners. Despite substantial investments in digital infrastructure that facilitate access to learning resources, Saudi EFL learners face challenges such as limited authentic English exposure (Alotaibi & Alshehri, 2023). This contributes to Saudi EFL learners' reliance on digital platforms to access English informally and independently, highlighting the need to examine how IDLE can support vocabulary development in this setting (Mohammed & Ali, 2021).

Given the reliance on digital tools in a context where English exposure is limited to formal settings, this lack of research represents a critical gap in understanding how Saudi students utilize informal, technology-based language learning. This research builds on prior studies by empirically investigating the relationship between AI usage and vocabulary achievement measured by a standardized test. Additionally, this study extends prior research by identifying which AI tool usage predicts vocabulary proficiency. This highlights the importance of further investigation to address these unexplored areas.

1.2 Significance of the study

The present study makes a significant contribution by moving beyond learners' perceptions of AI use to examine its statistical association with actual vocabulary knowledge, focusing on AI-IDLE engagement and measurable vocabulary gains. Given the positive attitudes Saudi learners show toward digital tools for language learning outside classrooms (Mohammed & Ali, 2021), the findings of this study can help educators support vocabulary learning in informal contexts. Additionally, this research could serve as a model for other contexts with similar educational and technological profiles, broadening understanding of the relationship between AI usage and vocabulary knowledge.

1.3 Research aims and question

This study seeks to examine the relationship of AI-mediated IDLE (AI-IDLE) and the vocabulary knowledge of Saudi EFL learners. The outcomes of this study will provide valuable insights for informing educational practices, improving student learning outcomes, and contributing to the growing body of knowledge in the field of digital learning in foreign language education. Hence, the study's research question is:

1- Does the usage of AI technology in IDLE significantly affect EFL learners' vocabulary knowledge?

2. Literature Review

2.1 Theoretical framework

IDLE is theoretically grounded in Benson's (2011) framework, which identifies four key dimensions of out-of-class second language learning (Lee et al., 2021, 3). According to Benson's (2011) framework, out-of-class L2 learning is categorized into four dimensions: formality, location, pedagogy, and locus of control. First, formality refers to how learning is structured (Lee et.al, 2024). For instance, it can be formal, non-formal, or informal (Soyoof et al., 2023). Second, location. Location refers to the physical context where language learning takes place (Soyoof et al., 2023), including in-class, out-of-class, extracurricular activities, and extramural settings. Third, pedagogy. It defines the degree of engagement with formal language learning approaches, including instructed, self-instructed, naturalistic (Lee et al., 2021). Finally, locus of control describes the level of control language learners exert over their learning, such as through self-direction or external direction (Lee et al., 2021).

To ensure a clear conceptual grounding, Soyoof et al. (2023) illustrates the two primary contexts for IDLE—extracurricular and extramural learning—while also connecting them to other learning formats. It is important to clarify that in Soyoof et al. (2023) illustration (Table 1) the term "digital" refers to the use of various digital devices (such as tablets, smartphones, laptops, and personal computers) and related resources (including mobile apps, web applications, software, and social media platforms) that facilitate learning (Lee, 2019a). IDLE can occur in two contexts which are extracurricular and extramural contexts. Whereas extracurricular IDLE involves independent digital English learning beyond the classroom, integrated with formal curricula and partially guided and assessed by instructors (Rezai et. al, 2025), IDLE in extramural contexts is "self-directed, naturalistic, digital

learning of English in unstructured, out-of-class environments, independent of a formal language program" (Lee, 2019c, p. 116). The present study investigates IDLE engagement in extramural context

	Formal Digital Learning of English	**Non-Formal Digital Learning of English**	**IDLE**	
			Extracurricular	Extramural
Formality	Structured; Certification	Structured; No certification	Semi-structured; Certification	Unstructured; No certification
Location	In-class	Out-of-class	Out-of-class	Out-of-class
Pedagogy	Instructed	Instructed	Self-instructed	Naturalistic
Locus of Control	Other-directed	Other-directed	Self-directed	Self-directed

Table 1. types of digital learning of English in combination with Benson's (2011) conceptual framework (Soyoof et. al, 2023).

2.2 AI-mediated informal digital learning of English (AI-IDLE)

Liu et al. (2025c) examined how Chinese EFL learners perceive and utilize GPT technologies for Informal Digital Learning of English (AI-IDLE) based on Technology Acceptance Model (TAM). Their mixed-methods findings showed that learners' intention to use (IU) GPT technologies was significantly predicted by perceived usefulness (PU) rather than ease of use (PEU). Additionally, the qualitative investigation revealed that learners employed GPT technologies as personal tutors and conversational partners for a range of learning activities, including grammar correction and reading comprehension. Although Liu et al. (2025c) explained how learners adopt and use GPT technologies, the extent to which such use results in measurable vocabulary outcomes remains empirically unexamined.

Moving beyond adoption and perception, Zhou et al. (2025) investigated the effectiveness of integrating an AI chatbot (ChatGPT-4) into Informal Digital Learning of English (IDLE) for enhancing the listening competencies of Chinese EFL learners. Using a quasi-experimental mixed-methods design Zhou et al. (2025) found that learners who engaged in chatbot-assisted informal listening practice demonstrated significantly greater improvement than those relying on traditional digital resources. Additionally, Qualitative results showed that chatbot's interactive and personalized features enhanced motivation and confidence in listening. In the Saudi context, Alhamam (2025) explored how Saudi college students use AI-powered tools to enhance their English language learning. By adopting a qualitative research design, Alhamam (2025) found that Saudi EFL students had limited AI literacy, used ChatGPT mainly for writing and translation, and expressed mixed attitudes toward its effectiveness for language learning.

Focusing on affective and motivational dimensions, Liu et. al (2024) aimed to examine the relationship between AI-mediated informal digital learning (AI-IDLE), foreign language enjoyment (FLE), and the ideal L2 self among Chinese EFL learners. Liu et al. (2024) found that participation in AI-IDLE increased learners' FLE and clarified their ideal L2 self, although the ideal L2 self-did not directly predict greater FLE. Gender did not moderate the impact of AI-IDLE on FLE. Similarly, Zhang and Wan (2025) found that Chinese EFL learners actively used AI tools for both receptive and productive activities, reinforcing the role of AI in supporting autonomous language learning.

As discussed above, prior AI-IDLE studies have concentrated on EFL learner's perceptions, adoption and engagement with different AI-tools with limited attention to objectively measured vocabulary outcomes. In fact, most existing research does not statistically test whether engagement in AI-IDLE is associated with measurable vocabulary development. Therefore, the present study extends prior research by empirically examining the relationship between AI-IDLE engagement and vocabulary knowledge.

2.3 Vocabulary knowledge

Several studies have investigated learners' perceptions and use of AI for learning vocabulary. In Saudi Arabia, Alghamdi (2025) investigated Saudi EFL students' perceptions and use of AI tools for vocabulary learning and highlighted the challenges encountered in their application. Adopting a mixed-methods design, Alghamdi (2025) found that Saudi EFL students held positive perceptions of AI-assisted vocabulary learning. Additionally, there is a positive correlation between EFL students' perceptions and their practices in using AI tools for vocabulary learning. In fact, the findings revealed that the primary uses of AI tools among Saudi learners were translating words and phrases and learning synonyms and antonyms. Furthermore, Alghamdi (2025) found that Saudi EFL learners reported challenges related to technical issues, limited cultural context, reduced human interaction, privacy concerns, accuracy issues, and bias in AI-generated content. Extending Alghamdi's (2025) work, this study

empirically examines the relationship between AI-IDLE engagement and measurable vocabulary knowledge outcomes among Saudi EFL learners.

Several recent studies have examined the effectiveness of using AI-mediated applications to enhance vocabulary learning among EFL learners. For instance, Aldowsari and Aljebreen (2024) investigated the effects of a ChatGPT-based application on Saudi high school students' vocabulary learning using a quasi-experimental design. The study found that the experimental group significantly outperformed the control group in vocabulary post-tests and reported positive attitudes toward the ChatGPT-based application. Furthermore, the findings indicated that the ChatGPT-based application contributes to more engaging and effective vocabulary learning experiences. Similarly, Abdelhalim and Alsehibany (2025) evaluated the effectiveness of ChatGPT as a pedagogical tool for vocabulary learning and retention in EFL settings. the study adopted a quasi-experimental mixed-methods design with 71 Saudi female students randomly assigned to experimental and control groups. The experimental group used ChatGPT to practice vocabulary, receive immediate feedback, and complete AI-generated exercises, while the control group received in class traditional instructions. Abdelhalim and Alsehibany (2025) results showed that the experimental group significantly outperformed the control group in productive vocabulary and overall scores, while receptive gains did not differ significantly between groups. Additionally, qualitative findings indicated positive learner perceptions of ChatGPT, highlighting its role in enhancing engagement, motivation, and contextualized vocabulary use.

Further empirical evidence is reported by Alsagoor et al. (2025) examines the effectiveness of ChatGPT, an AI-powered language model, in improving EFL learners' vocabulary. The research used a mixed-methods design to combine quantitative and qualitative evidence on ChatGPT's role in vocabulary learning. The study was conducted over five weeks with 50 Saudi female university students and employed Vocabulary Knowledge Scale (VKS) pre- and post-tests and semi-structured interviews. The findings revealed a statistically significant improvement in students' vocabulary knowledge following the intervention, with post-test VKS scores showing higher levels of familiarity compared to pre-test scores and a significant paired-samples t-test result ($p = 0.006$). Furthermore, the results showed that learners perceived ChatGPT as an efficient and engaging tool that provided immediate explanations and contextualized examples.

The current study is distinguished by its focus on AI-IDLE in informal learning contexts, an area that has not been thoroughly explored in previous literature, particularly regarding vocabulary acquisition. By focusing on the Saudi context, this research provides a unique contribution to the field of AI in education, specifically in EFL vocabulary learning. This study benefits from previous research by providing a comprehensive theoretical framework on AI use in vocabulary learning, as studies like Liu et al. (2025) helped identify key factors influencing AI tool usage. Furthermore, studies like Nguyen et al. (2024) guided the development of hypotheses that will be tested in the current research, enriching the theoretical framework and ensuring alignment with current educational practices.

3. Methodology

3.1 Research design

This study employed a quantitative, cross-sectional predictive correlational research design. The quantitative approach was employed because it provides objective measurements and allows for determining whether variations in AI-IDLE engagement correspond to differences in learners' vocabulary knowledge (Indrayani et al., 2024). hence, this approach offered the most appropriate means for addressing the research question. Therefore, the following hypothesis will guide the study:

H1: Using AI technology for IDLE will positively affect vocabulary knowledge.

3.2 Study Population and Sample

The participants for this study are Saudi EFL undergraduate students majoring in English language and translation in Saudi Arabia. This population was chosen because university students are likely to have greater internet access in their daily lives (Ismail & Shafie, 2019). As a result, their engagement with social networking sites and digital tools is expected to be more active compared to school students (Ismail & Shafie, 2019).

3.3 Research instrument

Following the principles outlined by Dörnyei and Csizér (2012), the first section of the survey was designed with a focus on demographic information to analyze data concerning different groups within the sample population. The second section of the survey focuses on participants' knowledge and usage of AI-powered tools. This section establishes whether the participants know and use AI-powered tools. Participants who are familiar with AI-powered tools and actively use them will be included in the data analysis, while those who are unfamiliar with these tools and do not use them will be excluded from the analysis.The third section of the survey aims to identify the vocabulary knowledge level of each participant. The vocabulary test that will be used for this study is a free version of the Oxford Online Placement Test (OOPT). Using this publicly accessible OOPT ensures a reliable and adaptive assessment of vocabulary knowledge, as it is globally recognized and validated by Oxford University Press. This credibility and standardization enhance the accuracy and validity of the research findings. Finally, the fourth section of the survey is a modified version of the Informal Digital Learning of English Scale (IDLES) adopted from Rezai et al. (2024), originally

developed and validated by Zhang and Liu (2022). The IDLES assesses various aspects of the participants' IDLE practices, such as benefits, challenges, and the frequency of using AI-powered tools.

3.4 Data collection procedure

After obtaining permission to conduct the study, the survey was printed and distributed to participants in person at the university under the supervision of the researcher. This procedure ensured that participants' OOPT vocabulary scores were accurately matched with their responses on the IDLE scale. Participants first received a printed informed consent form outlining the purpose of the study, their role, confidentiality considerations, and the potential use of their data. After providing consent, participants first answered the demographic questions, then completed the OOPT to determine their vocabulary knowledge level, then responded to the IDLE scale section of the survey.

3.5 Data analysis

Data were analyzed using the Statistical Package for the Social Sciences (SPSS), version 27. Descriptive statistics, consisting of frequencies and percentages, were utilized to summarize the demographic profile of the participants (age, nationality, educational level) and their patterns of AI tool usage. Means and standard deviations were calculated to describe the participants' responses to the Informal Digital Learning of English (IDLE) scale and their perceived usefulness of various AI tools. Additionally, the Relative Importance Index (RII) was computed to rank the IDLE practices and AI tools based on their significance and frequency of use. To evaluate the psychometric quality of the research instrument, the internal consistency reliability of the IDLE scale was assessed using Cronbach's Alpha coefficient. In addition, inferential statistical tests were employed to address the research questions and test the hypothesis. Pearson's correlation coefficient was used to examine the direction and strength of the relationship between AI-mediated IDLE practices and vocabulary knowledge (OOPT scores). To explore differences in vocabulary proficiency based on demographic variables (age, educational level) and the usage of specific AI tools, Independent Samples t-tests and One-Way Analysis of Variance (ANOVA) were conducted. Levene's test for equality of variances was applied to ensure the assumptions of parametric tests were met. Finally, simple and multiple linear regression analyses were performed to determine the predictive power of IDLE practices and specific AI tools on learners' vocabulary knowledge, with collinearity diagnostics (Tolerance and VIF) examined to verify the model's validity. All statistical results were interpreted at a significance level of $p < .05$.

4. Findings

4. 1 Demographic Profile of the Participants

A total of 145 female undergraduate students majoring in English Language and Translation participated in the study (N = 145). Regarding age, the sample was predominantly young; the majority fell into the 18–20 age group (n = 77, 53.1%), closely followed by the more than 20 age group (n = 68, 46.9%). In terms of nationality, the considerable majority of the respondents were Saudi nationals (n = 142, 97.9%), while non-Saudi students constituted a tiny fraction of the sample (n = 3, 2.1%). The distribution of participants across educational levels showed a relatively balanced representation of the early and middle stages of the academic program. Freshman students (Level 1–2) comprised the largest group (n = 50, 34.5%). Sophomore (Level 3–4) and Junior (Level 5–6) students were equally represented, with 37 participants (25.5%) in each group. Senior students (Level 7–8) represented the smallest portion of the sample (n = 21, 14.5%). Table 1 shows the demographic distribution of the participants.

Characteristic	Category	N	%
Age	18–20	77	53.1
	> 20	68	46.9
Nationality	Saudi	142	97.9
	Non-Saudi	3	2.1
Educational Level	Freshman (Level 1–2)	50	34.5
	Sophomore (Level 3–4)	37	25.5
	Junior (Level 5–6)	37	25.5
	Senior (Level 7–8)	21	14.5

Table 1. Demographic Characteristics of the Participants (N = 145).

N = total number of participants. All participants were female and majored in English Langage and Translation.

4. 2 AI Tools and Purposes of Usage

ChatGPT emerged as the most dominant tool, utilized by the vast majority of the sample (n = 129, 89.0%). Google Translate ranked second with nearly two-thirds of the participants using it (n = 95, 65.5%). Other tools showed moderate to low usage rates. Gemini was used by approximately one-quarter of the participants (n = 37, 25.5%), closely followed by the writing assistant Grammarly (n = 35, 24.1%). Language learning platforms like Duolingo (n = 22, 15.2%) and paraphrasing tools like QuillBot (n = 13, 9.0%) were the least frequently cited tools in this study. Figure 1 illustrates the popularity of specific AI-powered tools among the participants.

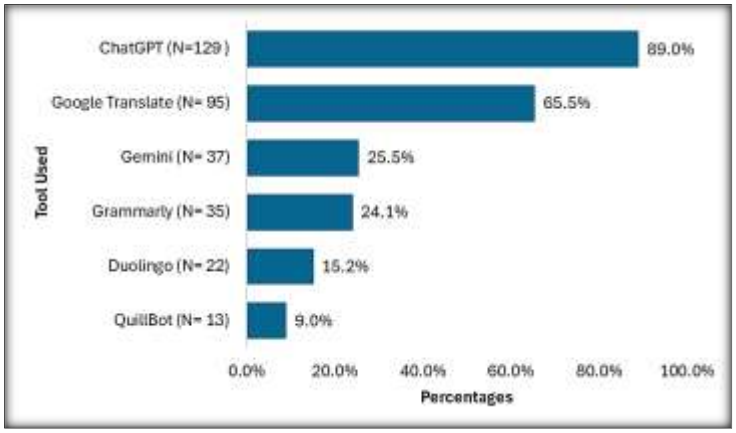

Figure 1. Percentage of AI-Powered Tools Used by Participants (N = 145)

Figure 2 details the specific English language skills that participants aim to improve through AI technology. The primary application of AI tools was for Translation (71.7% (n = 104)). Writing Skills followed as the second most common objective (n = 87, 60.0%). Crucially for the scope of this study, Learning Vocabulary was the third most cited purpose, reported by more than half of the participants (n = 81, 55.9%). Fewer participants utilized AI for structural and oral skills, with Grammar (n = 50, 34.5%) and Pronunciation (n = 43, 29.7%) being the least common purposes.

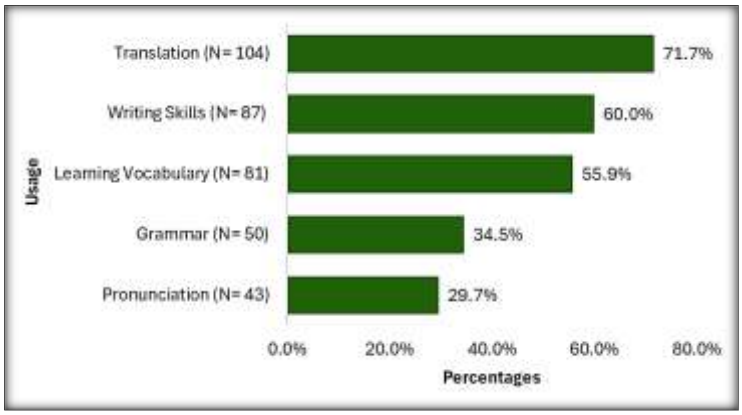

Figure 2. Purposes of Using AI-Powered Tools for English Language Skills (N = 145)

4. 3 Perceived Usefulness of AI Tools

Participants' perceptions regarding the usefulness of various AI-powered tools in improving their English vocabulary are presented in Table 2. The tools are ranked based on their Relative Importance Index (RII) and Mean scores. The results demonstrate that ChatGPT was perceived as the most useful tool for vocabulary enhancement, ranking first with the highest mean score (M = 4.57, SD = 0.648) and an RII of 0.914. This indicates a very high level of satisfaction with its utility. Google Translate followed in the second rank (M = 4.15, SD = 0.825, RII = 0.830). Grammarly was ranked third (M = 4.03, SD = 0.923, RII = 0.806). Gemini and QuillBot occupied the fourth and fifth positions, with mean scores of 3.95 (RII = 0.790) and 3.850 (RII = 0.770), respectively. Conversely, Duolingo was ranked last among the evaluated tools (M = 3.36, SD = 1.255, RII = 0.672).

Table 2. Descriptive Statistics, Relative Importance Index (RII), and Ranking of Perceived Usefulness of AI Tools for Vocabulary Learning.

AI Tool	M	SD	RII	Rank
ChatGPT	4.57	0.648	0.914	1
Google Translate	4.15	0.825	0.830	2
Grammarly	4.03	0.923	0.806	3
Gemini (Google's AI)	3.95	0.911	0.790	4
QuillBot	3.85	1.144	0.770	5
Duolingo	3.36	1.255	0.672	6

Note. M = Mean; SD = Standard Deviation. The scale ranged from 1 (Not Useful) to 5 (Very Useful). The Relative Importance Index (RII) was calculated by this formula: (Mean/5).

4. 4 The Informal Digital Learning of English (IDLE) Scale

First, the reliability analysis for the 19-item Informal Digital Learning of English (IDLE) scale was determined. The calculated Cronbach's Alpha coefficient was .926. This indicates that the instrument possesses excellent internal consistency and reliability. Table 3 shows the descriptive statistics for the items of the IDLE scale, ranked by their mean scores and Relative Importance Index (RII). The overall responses reflect a highly positive attitude toward the use of AI in informal digital learning (Total mean score = 4.13, RII = .826). The highest-ranked item was the accessibility of tools ("I can easily find the right AI-powered tools that I need to improve my English vocabulary"), with a mean of 4.56 and an RII of 0.912. The second highest-ranked item was the reverse-coded statement regarding difficulty (M = 4.55, RII = 0.910), indicating that participants strongly disagreed that AI made vocabulary learning difficult; conversely, they found it user-friendly. Participants also reported high agreement that AI enhances their understanding of learning materials (M = 4.43, Rank 3) and improves their vocabulary learning (M = 4.39, Rank 4).

Items related to engagement, enjoyment, and motivation also received high ratings, all scoring above 4.10. This confirms that AI contributes to a more engaging and motivated learning experience. The lowest-ranked items were related to the intensity of time spent and peer collaboration. The frequency of spending "3 hours a day" on learning or browsing (M = 3.50 and M = 3.21, respectively) received the lowest scores.

Table 3. Descriptive Statistics, Relative Importance Index (RII), and Ranking of IDLE Scale Items.

IDLE Scale Item	M	SD	RII	Rank
I can easily find the right AI-powered tools that I need to improve my English vocabulary.	4.56	0.716	0.912	1
AI-powered tools have made learning English vocabulary difficult for me. (**Reverse Coded**)	4.55	0.824	0.91	2
I use AI-powered tools to enhance my understanding of English language learning materials.	4.43	0.685	0.886	3
Using AI-powered tools has helped me to improve my English vocabulary learning.	4.39	0.835	0.878	4
I use AI-powered tools to find personalized English learning materials and experiences.	4.35	0.804	0.87	5
I have used AI-powered tools to practice English reading and writing outside the classroom.	4.34	0.891	0.868	6
I find English learning tasks more engaging when I use AI-powered tools.	4.26	0.972	0.852	7
I use AI-powered tools to synthesize and select reliable online resources and information in English.	4.23	0.948	0.846	8
AI-powered tools have made learning English vocabulary more enjoyable for me.	4.23	1.007	0.846	9
I use AI-powered tools to keep myself motivated to learn English vocabulary.	4.17	1.023	0.834	10
I am satisfied with how I have used AI-powered tools to support me in achieving my English vocabulary learning goals.	4.12	1.124	0.824	11

I have used AI-powered tools to practice English speaking and listening outside the classroom.	4.11	1.131	0.822	12
Using AI-powered tools has made my English vocabulary learning less effective. (**Reverse Coded**)	4.11	1.208	0.822	13
I have been actively using AI-powered tools outside of the classroom to improve my vocabulary knowledge.	4.08	1.14	0.816	14
In the last 6 months, I have used AI-powered tools to browse authentic English content or participate in authentic activities.	4.06	1.197	0.812	15
I have used AI-enhanced knowledge-sharing platforms to view English content and participate in English-related activities.	4.06	1.094	0.812	16
I work together with my peers on English vocabulary learning activities that involve using AI-powered tools or resources.	3.62	1.231	0.724	17
In the last 6 months, I have spent an average of 3 hours a day using AI-powered tools to learn English outside of class.	3.50	1.137	0.700	18
In the past 6 months, I have spent an average of 3 hours per day using AI-powered tools to browse content or participate in activities in English.	3.21	1.18	0.642	19
Total IDLE mean score	**4.13**	**0.658**	**0.826**	

M = Mean; SD = Standard Deviation. Scale ranged from 1 (Completely Disagree) to 5 (Completely Agree). Reverse-coded items indicate that a higher score reflects a positive disagreement with a negative statement (i.e., the tool was not difficult or ineffective). Relative Importance Index (RII) was calculated as RII = Mean/5

4. 5 Participants' Vocabulary Proficiency

Participants' current level of English vocabulary knowledge was measured by the Oxford Online Placement Test (OOPT). The largest subgroup of participants (n = 50, 34.5%) was classified at the B2 (Upper-Intermediate) level. This was followed by the A2 (Elementary) level (n = 42, 29.0%) and the B1 (Intermediate) level (n = 39, 26.9%). Only a small minority of the participants (n = 14, 9.7%) fell into the A1 (Beginner) category. The participants achieved an overall mean score of 25.38 with a standard deviation of 8.571. Table 4 presents the results of the Oxford Online Placement Test (OOPT).

Table 4. Distribution of Participants According to CEFR Vocabulary Levels

CEFR Level	Description	N	%
B2	Upper-Intermediate	50	34.5
A2	Elementary	42	29
B1	Intermediate	39	26.9
A1	Beginner	14	9.7
OOPT Vocabulary Score	Mean ± SD	25.4 ± 8.57	
	Min-Max	8.0 – 38.0	

CEFR = Common European Framework of Reference for Languages. The OOPT score reflects the vocabulary proficiency level.

4. 6 The relation between IDLE Scores and OOPT Vocabulary Scores

As presented in Figure 3, there was a statistically significant positive correlation between the participants' engagement in AI-mediated informal digital learning (IDLE Total Score) and their vocabulary proficiency (OOPT Vocabulary Score) ($r = .214$, $p = .029$). R^2 is .053, which implies that AI usage explains approximately 5.3% of the variance in vocabulary knowledge. The simple linear regression model yielded the following equation:

$$\text{Vocabulary Score } (y) = 3.06 * \text{IDLE Score } (x)$$

This equation indicates that for every 1-point increase in the IDLE score, the vocabulary score is predicted to increase by 3.06 points.

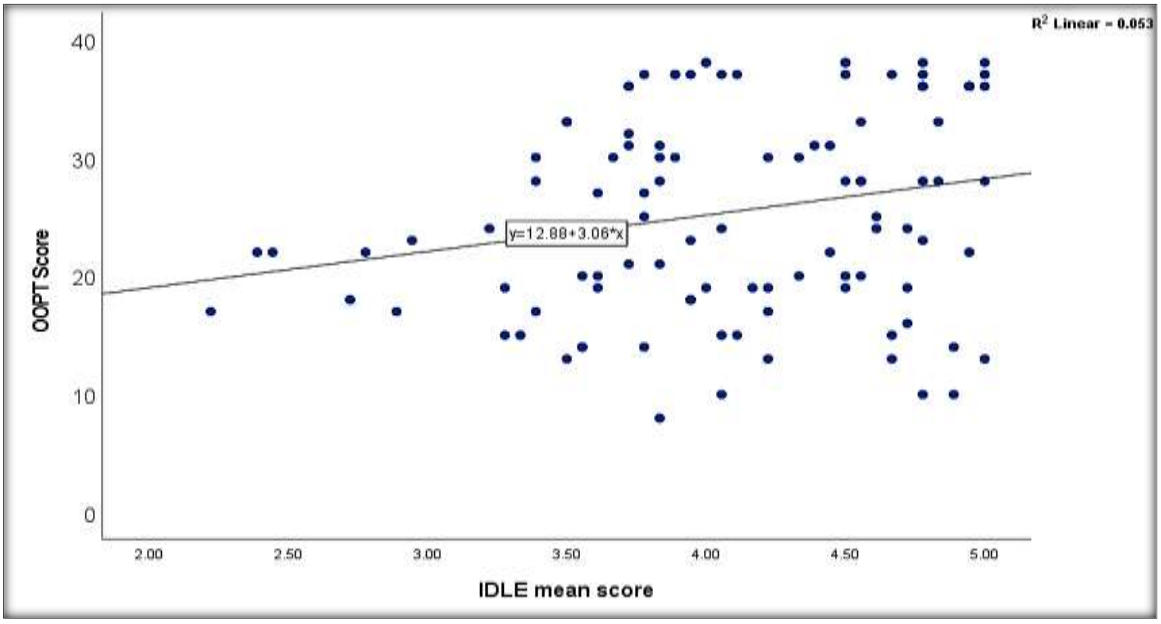

Figure 3. Scatter Plot Illustrating the Linear Relationship Between IDLE Scores and OOPT Vocabulary Scores. Pearson's Differences in Vocabulary Proficiency Based on Demographic Variables correlation analysis indicated a statistically significant positive relationship ($r = .230$, $p < .05$). The straight line represents the linear regression fit.

4. 7 Differences in Vocabulary Proficiency Based on Demographic Characteristics

Table 5 examines whether demographic characteristics (age and educational level) influenced vocabulary proficiency. Regarding Age, the analysis revealed a statistically significant difference between the two age groups ($t = -2.139$, $p = .035$). Participants aged over 20 achieved significantly higher vocabulary scores ($M = 27.64$, $SD = 8.047$) compared to the younger group aged 18–20 ($M = 24.07$, $SD = 8.559$). Conversely, regarding Educational Level, no statistically significant differences were found among the four academic levels ($F = 1.304$, $p = .277$).

Table 5. Comparison of OOPT Vocabulary Scores According to Age and Educational Level

Variable	Group	M	SD	Test Value	p
Age [1]	18 – 20	24.07	8.559	t=−2.139	**0.035***
	> 20	27.64	8.047		
Educational Level [2]	Freshman (Level 1–2)	23.81	8.425	F=1.304	0.277
	Sophomore (Level 3–4)	27.5	9.426		
	Junior (Level 5–6)	25.48	7.329		
	Senior (Level 7–8)	28.08	10.04		

M = Mean; SD = Standard Deviation. 1, the P-value is calculated by an Independent Samples t-test. 2, the P-value is calculated by a One-Way ANOVA. * Sig. at p< 0.05.

4. 8 Differences in Vocabulary Proficiency Based on AI Usage Patterns

Table 6 determines whether vocabulary proficiency differed significantly based on how and which AI tools participants used. Regarding the purposes of usage, the analysis revealed no statistically significant differences in OOPT scores between students who used AI for specific skills (Writing, Vocabulary, Pronunciation, Grammar, or Translation) and those who did not ($p > .05$ for all categories). In contrast, regarding the specific AI tools used, a significant disparity was found related to ChatGPT. Participants who reported using ChatGPT achieved significantly higher vocabulary scores ($M = 26.19$, $SD = 8.58$) compared to those who did not use the tool ($M = 20.53$, $SD = 6.958$); $t = -2.810$, $p = .010$. No significant differences were observed for other tools such as Grammarly, Duolingo, Google Translate, or Gemini. Notably, users of QuillBot achieved a considerably high mean score ($M = 29.90$), but due to the small sample size of users ($n = 10$), the difference approached but did not reach significance ($p = .079$).

Table 6. Independent Samples t-test Comparing OOPT Vocabulary Scores Based on AI Usage Purposes and Tools

Variable	Group	M	SD	t	p
Purpose of Usage					
Writing Skills	Yes	26.63	8.761	-1.619	0.109
	No	23.92	8.194		
Learning Vocabulary	Yes	26.32	9.097	-1.347	0.181
	No	24.09	7.712		
Pronunciation	Yes	26.89	8.959	-1.067	0.288
	No	24.84	8.426		
Grammar	Yes	26.11	8.098	-0.625	0.534
	No	25	8.835		
Translation	Yes	24.62	8.766	1.242	0.217
	No	26.81	8.116		
AI Tools Used					
ChatGPT	Yes	26.19	8.58	-2.81	**0.010***
	No	20.53	6.958		
Grammarly	Yes	26.32	8.352	-0.579	0.564
	No	25.12	8.662		
Duolingo	Yes	24.95	9.715	0.239	0.811
	No	25.47	8.355		
Google Translate	Yes	25.26	8.555	0.190	0.85
	No	25.6	8.722		
Gemini	Yes	24.18	9.333	0.734	0.465
	No	25.7	8.387		
QuillBot	Yes	29.9	7.951	-1.774	0.079
	No	24.89	8.533		

M = Mean; SD = Standard Deviation; t = t-test statistic. * Sig. at p< 0.05.

4. 9 Predictors of Vocabulary Knowledge

To identify the key predictors of participants' vocabulary knowledge (OOPT Score), a multiple linear regression analysis was conducted. The model included four independent variables: Age, usage of ChatGPT, usage of QuillBot, and the total score of Informal Digital Learning of English (IDLE) (Table 7). Before interpreting the model, the assumptions of multicollinearity were checked. The collinearity diagnostics indicated that there were no significant issues among the predictor variables, with Tolerance values ranging from .912 to .969 (all well above .10) and Variance Inflation Factor (VIF) values ranging from 1.032 to 1.096 (all well below 10).

The multiple regression model was statistically significant, $F(4, 99) = 4.309$, $p = .003$, indicating that the combination of these four predictors predicts vocabulary proficiency. The model explained 14.8% of the variance in vocabulary scores ($R^2 = .148$). Three of the four predictors made a statistically significant unique contribution to the model. ChatGPT Usage was the strongest predictor ($\beta = .224$, $p = .020$). Holding other variables constant, students who used ChatGPT scored 5.43 points higher ($B = 5.427$) on the vocabulary test than those who did not. Informal digital learning (IDLE) remained a significant predictor ($\beta = .217$, p

= .025). For every 1-point increase in the average IDLE score, vocabulary scores increased by approximately 2.89 points (B = 2.889), after adjusting for other variables. The usage of QuillBot also emerged as a significant positive predictor (β = .214, p = .027), associated with an increase of roughly 6.20 points (B = 6.197) in vocabulary scores. In contrast, age was represented non-significant in this multivariate model (p = .228).

Overall, the results suggest that actively engaging in informal digital learning and specifically utilizing AI tools like ChatGPT and QuillBot are significant independent predictors of higher vocabulary proficiency among Saudi EFL learners.

Table 7. Multiple Regression Analysis Predicting OOPT Vocabulary Scores

Predictor	B	SE	β	t	p
Constant	5.76	5.621	—	1.025	0.308
Tool Used: QuillBot	6.197	2.756	0.214	2.248	**0.027***
Tool Used: ChatGPT	5.427	2.288	0.224	2.372	**0.020***
IDLE Total Score	2.889	1.265	0.217	2.284	**0.025***
Age	1.758	1.451	0.118	1.212	0.228

R^2 = .148; Adjusted R^2 = .114; F(4, 99) = 4.309, p = .003. B = Unstandardized coefficient; SE = Standard error; beta = Standardized coefficient. * Sig. at p< 0.05.

5. Disscussion

The purpose of this study was to examine the relationship between students' use of AI-powered tools and their English vocabulary proficiency, as measured by the Oxford Online Placement Test (OOPT). The findings reveal that there is a statistically significant positive correlation between the participants' engagement in AI-mediated informal digital learning of English (IDLE Total Score) and their vocabulary proficiency (OOPT Vocabulary Score). This suggests that learners who showed greater involvement in using AI tools for informal learning generally obtained higher scores on the OOPT, indicating stronger English vocabulary knowledge. Since, engaging in AI-mediated informal digital learning positively affects the vocabulary knowledge of Saudi EFL learners, H1 is supported. The results are consistent with earlier studies that highlight positive linguistic outcomes of AI-mediated informal learning (Liu et al., 2025a; Zhou et al., 2025). Earlier research emphasized affective outcomes such as motivation (Fang, 2025; Wang et al., 2025) whereas the current study contributes objective evidence of vocabulary development through AI-IDLE.

The findings further demonstrated that not all AI tools have the same influence on vocabulary achievement. Learners who used ChatGPT demonstrated better vocabulary performance than those who did not use it. This finding aligns with previous studies that demonstrated the effectiveness of ChatGPT for vocabulary learning (Aldowsari & Aljebreen, 2024; Abdelhalim & Alsehibany, 2025; Alsagoor et al., 2025). Unlike instructional intervention studies, this research indicates that informal AI use can also support vocabulary development. In line with Alghamdi (2025) and Alhamam (2025) who observed that Saudi EFL learners mainly rely on AI tools for translation and writing rather than explicit vocabulary learning. Qualitative findings revealed that students mainly used AI tools for translation, then for writing development, whereas vocabulary learning was the third most common objective. Although learners primarily used AI tools for translation and writing, indirect vocabulary exposure contributed to improved vocabulary knowledge.

6. Conclusion

This study investigates the relationship between AI-mediated informal digital learning of English and vocabulary proficiency among Saudi EFL learners. The findings indicates that greater engagement in AI-mediated informal learning is associated with higher vocabulary proficiency among Saudi EFL learners. Although learners mainly used AI tools for translation and writing, indirect exposure through AI use contributed to vocabulary development. These findings extend AI-IDLE research by offering objective evidence of vocabulary outcomes in informal learning contexts and demonstrating the educational value of AI tools beyond the classroom. Despite its contributions, this study included only female participants, which may limit the generalizability of the results. Future studies should adopt longitudinal designs, include male and female participants, and explore the long-term impact of specific AI tools on vocabulary development.

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References

[1] Abdelhalim, S. M., & Alsehibany, R. A. (2025). Integrating ChatGPT for vocabulary learning and retention: A classroom-based study of Saudi EFL learners. *Language Learning & Technology, 29*(1), 1–24. https://doi.org/10.64152/10125/73635
[2] Aldowsari, B. I., & Aljebreen, S. G. (2024). The impact of using a ChatGPT-based application to enhance Saudi students' EFL vocabulary learning. *International Journal of Language and Literary Studies, 6*(4), 380–397. http://doi.org/10.36892/ijlls.v6i4.1955
[3] Alghamdi, N. (2025). Utilizing artificial intelligence (AI) for vocabulary learning by Saudi EFL students: Perspectives, practices, and challenges. *Forum for Linguistic Studies, 7*(9), 15–28. https://doi.org/10.30564/fls.v7i9.10870
[4] Alhamam, A.A. (2025). Investigating the role of AI tool interactions in enhancing English language acquisition among Saudi college students. *Arab World English Journal, 16*(3): 426-440 DOI: https://dx.doi.org/10.24093/awej/vol16no3.26
[5] Alsagoor, J., Shukri Albakri, G., Alaudan, R., & Alyami, R. H. (2025). Exploring the impact of ChatGPT on vocabulary acquisition in EFL learners: A mixed-methods study on AI-assisted language learning. *Forum for Linguistic Studies*, *7*(9), 1173–1185. https://doi.org/10.30564/fls.v7i9.10257
[6] Altamimi, D.H.F. (2025). Unlocking potential: Saudi EFL male students' perspectives on AI tools for enhancing English writing proficiency. *Arab World English Journal*, Special Issue on Artificial Intelligence: 40-58. https://dx.doi.org/10.24093/awej/AI.3
[7] Apriani, E., Cardoso, L., Obaid, A. J., Muthmainnah, Wijayanti, E., Esmianti, F.,et al. (2024). Impact of AI-powered chatbots on EFL students' writing skills, self-efficacy, and self-regulation: A mixed-methods study. *Global Education Research Review, 1*, 57–72.doi: 10.71380/GERR-08-2024-8
[8] Alotaibi, N. S., & Alshehri, A. H. (2023). Prospers and Obstacles in Using Artificial Intelligence in Saudi Arabia Higher Education Potential https://doi.org/10.3390/su151310723 of AI-Based Learning Outcomes. *Sustainability, 15*(13), 10723
[9] Benson P (2011) Language learning and teaching beyond the classroom: An introduction to the f ield. In: Benson P and Reinders H (eds) *Beyond the Language Classroom* (pp. 7–16). Palgrave Macmillan.
[10] Dörnyei, Z., & Csizér, K. (2012). How to design and analyze surveys in second language acquisition research. In A. Mackey & S. M. Gass (Eds.), *Research methods in second language acquisition: A practical guide* (pp. 74–94). Wiley-Blackwell. https://doi.org/10.1002/9781444347340.ch5
[11] Friedrich, P. 2020. When Englishes go digital. *World Englishes 39*, 67–78. https://doi.org/10.1111/weng.12446
[12] Indrayani, N, Cahyono, B. Y., Mukminatien, N., & Ivone, F.M. (2024). Exploring informal digital language learning: How learning frequency counts. *Journal of Languages and Language Teaching,12*(3), 1392-1404. DOI: https://doi.org/10.33394/jollt.v%vi%i.11366
[13] Ismail, I. S. & Shafie, N. H. (2019) English informal language learning through social networking sites among Malaysian university students. *Asian Journal of University Education, 15*(3). . https://doi.org/10.24191/ajue.v15i3.7800
[14] Kumar, R., Singh, A., Kassar, A. S. A., Humaida, M. I., Joshi, S., & Sharma, M. (2025). Leveraging artificial intelligence to achieve sustainable public healthcare services in Saudi Arabia: A systematic literature review of critical success factors. Computer Modeling in Engineering & Sciences, 142(2), 1289–1349. https://doi.org/10.32604/cmes.2025.059152
[15] Lee, J. S. (2019a). Informal digital learning of English and second language vocabulary outcomes: Can quantity conquer quality? *British Journal of Educational Technology, 50*(2), 767–778. https://doi.org/10.1111/bjet.12599
[16] Lee, J. S. (2021). *Informal digital learning of English: Research to practice*. Routledge.
[17] Lee, J. S., Xie, Q., & Lee, K. (2021). Informal digital learning of English and L2 willingness to communicate: Roles of emotions, gender, and educational stage. *Journal of Multilingual and Multicultural Development,* 1–17. https://doi.org/10.1080/01434632.2021.1918699
[18] Liu, G. L., Darvin, R., & Ma, C. (2024). Exploring AI-mediated informal digital learning of English (AI-IDLE): A mixed-method investigation of Chinese EFL learners' AI adoption and experiences. *Computer Assisted Language Learning*, *38*(7), 1632–1660. https://doi.org/10.1080/09588221.2024.2310288
[19] Liu, G. L., Soyoof, A., Lee, J. S., & Zhang, L. J. (2025b). Informal digital learning of English in Asian EFL contexts: A thematic review. *RELC Journal*. https://doi.org/10.1177/00336882251332309
[20] Liu, G.L., Zou, M.M., Soyoof, A. and Chiu, M.M. (2025c). Untangling the relationship between AI-mediated informal digital learning of English (AI-IDLE), foreign language enjoyment and the ideal L2 self. *European Journal of Education, 60*(1), e12846. https://doi.org/10.1111/ejed.12846
[21] Mohammed, G. M. S., & Ali, J. K. M. (2021). Informal digital learning of English vocabulary: Saudi EFL learners' attitudes and practices. *Arab World English Journal, Special Issue 7*, 345–358. https://doi.org/10.24093/awej/call7.24

[22] Nguyen, H. M. T., Nguyen, T. T., & Tran, C. D. (2024). ChatGPT as a tool for self-learning English among EFL learners: A multi-methods study. *System, 115*, 103528.
[23] https://doi.org/10.1016/j.system.2024.103528
[24] Rezai, A., Goodarzi, A., & Liu, G. L. (2025). A Comparative study of the effects of informal digital learning of English in extracurricular and extramural settings on reading comprehension: A multi-analysis study on Iranian university students. *Computer Assisted Language Learning*, 1–25. https://doi.org/10.1080/09588221.2025.2491708
[25] Rezai, A., Soyoof, A., & Reynolds, B. L. (2024). Informal digital learning of English and EFL teachers' job engagement: Exploring the mediating role of technological pedagogical content knowledge and digital competence. *System, 122*, 103276. https://doi.org/10.1016/j.system.2024.103276
[26] Rose, H., McKinley, J., & Galloway, N. (2021). Global Englishes and language teaching: A review of pedagogical research. *Language Teaching 54*, 157–189. https://doi.org/10.1017/S0261444820000518
[27] Soyoof, A., Reynolds, B. L., Vazquez-Calvo, B., & McLay, K. (2023). Informal digital learning of English (IDLE): A scoping review of what has been done and a look towards what is to come. *Computer Assisted Language Learning, 36*(4), 608–640. https://doi.org/10.1080/09588221.2021.1936562
[28] Yang, S., Xu, W., Liu, R., & Yu, Z. (2024). Influencing and moderating variables in informal digital learning of English through a structural equation model. *Computer Assisted Language Learning*. https://doi.org/10.1080/09588221.2023.2280645
[29] Zhang, Q., Nie, H., Fan, J., & Liu, H. (2025). Exploring the dynamics of artificial intelligence literacy on EFL learners' willingness to communicate. *Behavioral Sciences*, *15*(4), 523. https://doi.org/10.3390/bs15040523
[30] Zhang, Y., & Liu, G. X. (2022). Revisiting informal digital learning of English (IDLE): A structural equation modeling approach in a university EFL context. *Computer Assisted Language Learning*. Advance online publication. https://doi.org/10.1080/09588221.2022.2134424
[31] Zhou, Q., Hashim, H., & Sulaiman, N. A. (2025). Integrating AI chatbots in informal digital English learning: Impacts on listening competencies in Chinese higher education. *Education and Information Technologies.* https://doi.org/10.1007/s10639-025-13811-2