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The Effect of AI-Powered Adaptive Tools on Vocabulary Acquisition among University Students: A Systematic Review

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ABSTRACT

Recently, the use of AI technologies in education has rapidly developed and yielded crucial outcomes in different tasks, and it has become an effective educational approach that provides flexible and personalized learning experiences (Chu et al. 23). In the context of English as a Foreign or Second Language, educational technologies may provide new opportunities for supporting university students' vocabulary acquisition, although their effectiveness varies across learning contexts. This systematic review explores how AI-powered adaptive platforms affect vocabulary acquisition among EFL/ESL university students, uncovering specific tools, AI features, outcomes, and challenges. Following a systematic review protocol, empirical studies indexed in Scopus, Web of Science, and ERIC were screened according to predefined inclusion and exclusion criteria. This review included 29 empirical studies published between 2024 and 2026. The findings show that there is an increase in research on AI-based vocabulary acquisition, especially in Asian countries. ChatGPT emerged as the most frequently used AI tool, and the reviewed studies reported that the use of AI enhances vocabulary acquisition by providing personalized learning, immediate feedback, and contextualized content. However, the quality appraisal identified some methodological limitations across the evidence base, and a number of challenges associated with AI use were also identified, suggesting that teacher guidance remains crucial to ensure the effective use of AI-powered tools in vocabulary acquisition.

KEYWORDS

Artificial Intelligence

Adaptive Learning

Vocabulary Acquisition

University Students

Introduction

In recent years, the development of educational technologies has led to a growing interest in the application of artificial intelligence in the field of education among the public, policymakers, and academia (Chu et al. 22). AI in education includes a range of technologies, such as machine learning, Natural Language Processing (NLP), and generative AI. These technologies support the development of e-learning platforms that use various adaptive learning techniques, including intelligent tutoring systems, learning analytics, and personalized learning paths. These systems provide contextualized content, immediate feedback, and personalized learning in a flexible way (Gligorea et al.).

Research in the field of second language acquisition has underscored the significance of vocabulary knowledge in overall language proficiency. In fact, it is considered a foundational aspect of language learning and crucial for effective communication and comprehension in a

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second or foreign language context (Nation). However, many students still experience a number of challenges related to vocabulary learning, such as struggling with the meaning of words and their pronunciation (Behforouz et al., "Effect of AI-Based Instruction" 2). After the emergence of AI as an effective educational tool, it has become increasingly used among language learners who aim to improve their vocabulary, grammar, writing, reading and speaking skills (Maghsoudi 53). As a result, a growing number of studies have investigated the effectiveness of AI-powered tools on vocabulary acquisition.

This systematic review is grounded in sociocultural theory and cognitive load theory. The Sociocultural Theory (SCT) views learning as mediated by tools that provide support within the learner's zone of proximal development (Vygotsky), while the Cognitive Load Theory (CLT) explains why such support matters for learning new material (Sweller). Together, these frameworks hold that AI may serve as a scaffold that reduces the extraneous load since it offers help to acquire new information through assistance until it is not needed anymore (Koka et al.; Abdelhalim and Alsehibany). In this review, these theories serve as interpretive lenses for organizing and synthesizing the reported features and learning outcomes. From an SCT perspective, the coding focused on features that reflect interaction, scaffolding and feedback to see how AI-based platforms may facilitate vocabulary learning through mediated interaction. From a CLT perspective, the coding considered features related to the presentation of vocabulary items, personalization and the potential reduction of extraneous cognitive demands.

Although previous systematic reviews focused on the use of AI-based platforms in language learning generally, there are few reviews that addressed their effect on vocabulary learning (Yang; X. Chen). Also, they did not specifically synthesize which adaptive mechanisms affect vocabulary acquisition in higher education. To address this gap, the present review asks:

RQ1: What are the demographic and methodological characteristics of research on AI-based vocabulary learning among university students?

RQ2: What is the effect of AI-powered tools on L2 vocabulary acquisition among EFL university students compared to traditional learning methods?

RQ3: Which AI tools and adaptive features are associated with positive vocabulary acquisition outcomes?

Literature Review

Artificial Intelligence (AI) in Education

The field of AI is mainly responsible for using computers to study and mimic human intelligence and the associated thinking abilities. In other words, AI attempts to enable machines to observe and learn from humans and solve problems from the existing problem-solving techniques in addition to developing new solutions through experience (Kaliraj and Devi 5). Artificial Intelligence in Education (AIED) encompasses a number of AI-based tools and technologies that support learning and teaching, including AI-driven, personalized instructional and dialogue systems, learning analytics, game-based learning, chatbots, and AI-powered adaptive learning that enables students to become autonomous learners. Additionally, it includes mobile-assisted learning outside the classroom and real-time feedback (Holmes et al. 82).

The field of AIED is informed by other domains and based on theories from various disciplines, such as AI, cognitive science, and education. Simultaneously, it creates its own research questions that address the nature of knowledge, the way students can learn, and the most effective and suitable teaching practices. In this regard, AIED tools embody particular learning theories, such as Vygotsky's "zone of proximal development." That said, some AIED researchers have questioned the foundations of those theories, using AI and data analysis

techniques to explore the hidden processes of learning (Holmes et al. 82). In essence, AIED successfully combines two primary strands: creating AI-powered tools to improve learning, and leveraging these tools to better grasp learning, and how it actually occurs and to determine which learning methods are more effective in either AI-supported or non-AI-supported classrooms (83).

Adaptive learning is a pedagogical approach that makes use of technology to adjust to each student's specific needs and progress. It offers personalized learning, which is supported by machine learning algorithms, and it adapts the content and the learning pace to the learner's performance and level. Therefore, adaptive learning fosters learning gains and enhances engagement. In the context of e-learning, adaptive learning is understood as addressing students' needs through the use of intelligent systems that personalize the learning experience, such as the content, activities, and assessment. Its main objective is to adapt the learning process in real time according to the learner's progress and level. This goal is achieved by the constant analysis of the learner's data and progress tracking. Consequently, as adaptive learning is becoming a popular option for teachers and educators, they need to be trained to efficiently use AI-powered platforms (Gligorea et al.).

AI-Based Vocabulary Acquisition

AI plays a significant role in improving the teaching-learning process, helping teachers in creating better teaching strategies, and providing students with an adaptive and improved learning environment. To illustrate, AI can cater to students' different levels and abilities through diagnostic testing and thus create a personalized curriculum. In this way, it is possible to address the drawbacks of the traditional educational models that do not take into account the different educational backgrounds (Kaliraj and Devi 13-14). Similarly, AI is also improving vocabulary instruction by providing personalized, real-time, and context-specific practice opportunities (Maghsoudi 56). Unlike traditional vocabulary teaching methods that rely heavily on memorization, AI tools are based on contextual analysis and scenario-based activities, allowing learners to use vocabulary in practical and authentic environments (Huang et al.).

Another distinction is worth noting: traditional EFL vocabulary acquisition often entails using specific vocabulary exercises, such as fill-in-the-blanks, matching, and sentence creation. Repeated testing and practice are deemed essential tools for evaluating learning outcomes. However, learners differ in their language proficiency, learning abilities and styles, and learning needs. Thus, a unified teaching plan and content would not be suitable and efficient for all students. As a solution, using AI in EFL vocabulary teaching provides educators with an analysis of learners' data, such as performance, accuracy and the time spent on tasks, in order to identify their linguistic strengths and weaknesses, resulting in a comprehensive assessment of their abilities. Based on these data, teachers can design personalized learning materials that meet students' needs. Besides monitoring learners' progress, AI systems can analyze behavioral data to support instruction (Wang et al. 131894).

Yet, limited attention has been given to synthesizing the effect of AI-based technologies on vocabulary learning, especially in the context of higher education. Thus, the present systematic review addresses this gap by examining the use of AI-powered and adaptive tools for EFL/ESL vocabulary learning and synthesizing their reported features, adaptive mechanisms, and effects on vocabulary-related outcomes.

Methodology

This review is based on PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines (Page et al.), using a systematic approach that involves a structured search strategy, study selection, which involved applying inclusion and exclusion criteria, and data synthesis. First, the search string was developed based on the study questions, and three databases were selected to yield a suitable literature search. Second, inclusion and exclusion criteria were also established based on the three study questions, and they guided the selection of appropriate articles and conference papers and the exclusion of irrelevant studies. Finally, the methodological quality of the included studies was appraised, and the results were coded from these studies to answer the research questions and address gaps and limitations. All these stages of the review process were conducted by a single reviewer.

Search Strategy

To conduct this systematic review, three databases were used: Scopus, Web of Science, and ERIC. These databases were selected based on their frequent use in other systematic reviews in the same research area (Yan et al.; Simonnet et al.). Indeed, Web of Science (WoS) and Scopus are considered the most reliable databases that are widely used as the most comprehensive data sources for academic publications (Pranckutė 1). In the educational field, the Educational Resources Information Center (ERIC) is regarded as the leading subject-specific database (Fitzgerald 30).

In April 2026, the search was executed on the mentioned databases using the following Boolean search string: (“Artificial Intelligence” OR “AI” OR “Adaptive Learning” OR “Machine Learning”) AND (“Vocabulary Acquisition” OR “Vocabulary Learning”). This resulted in 790 records before removing duplicates. All the references from the three databases were exported to Rayyan, which is a web and mobile tool used for screening studies (Ouzzani et al.).

Study Selection

As shown in Figure 1, in the selection process, 210 duplicates were removed from the 790 studies identified through searches on the mentioned databases. Therefore, 580 studies were screened based on the inclusion and exclusion criteria. In the first screening, 580 papers’ titles and abstracts were screened. After that, the 40 papers included in the first screening were retrieved for full-text screening. Finally, 29 papers that met the inclusion and exclusion criteria were selected for this systematic review.

The PRISMA flowchart (Figure 1) illustrates the whole data extraction process. After retrieving the 40 papers, 11 studies were excluded during eligibility assessment for the following reasons: wrong target population (n=1), focusing on a different intervention type (n=4), absence of empirical data (n=4), and not focusing on vocabulary acquisition as a dependent variable (n=2).

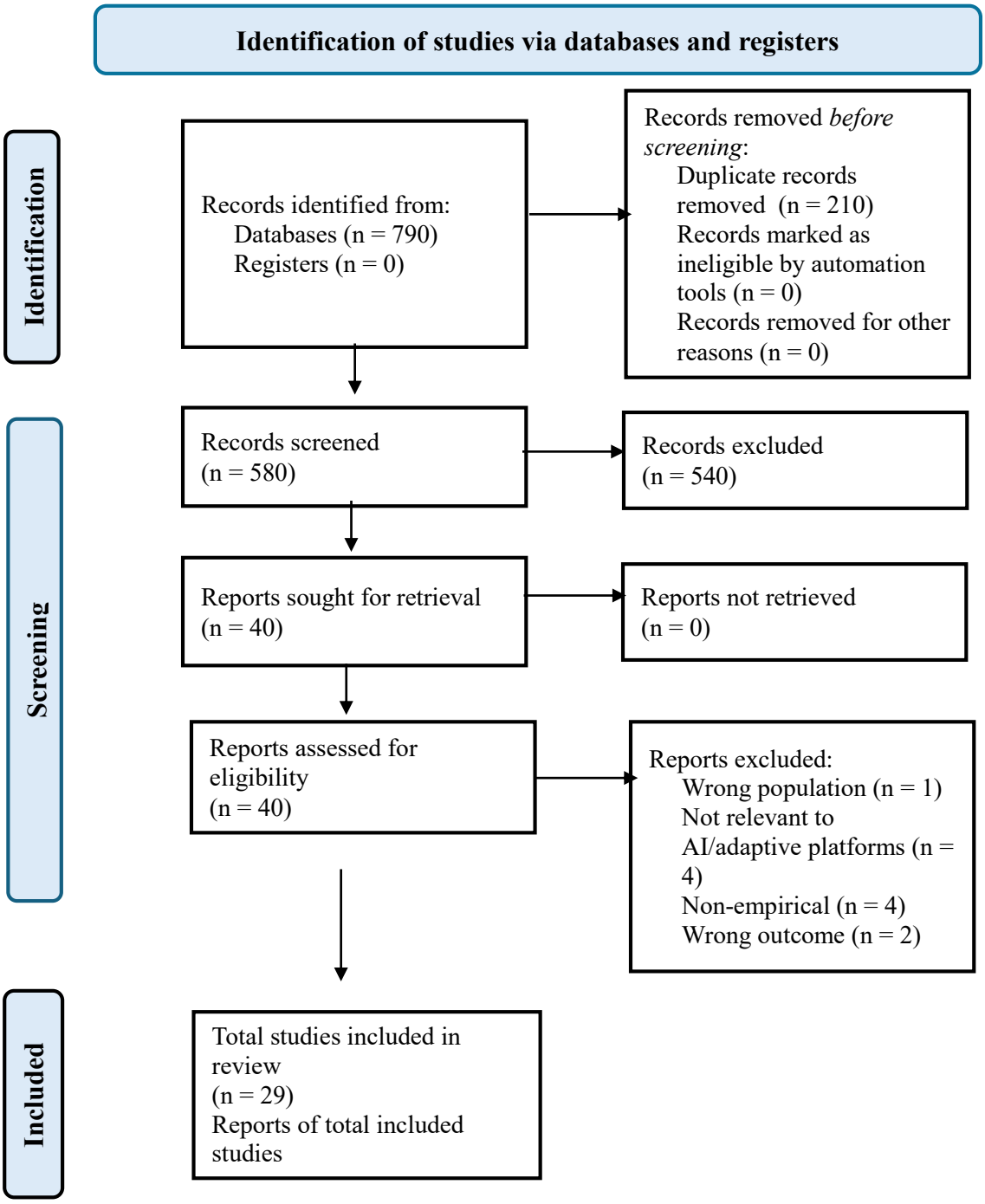


Fig. 1. PRISMA Flow Diagram

Inclusion and Exclusion Criteria

These criteria were defined using the PICOS framework (Figure 2), which includes population, intervention, comparison, outcomes, and study design.

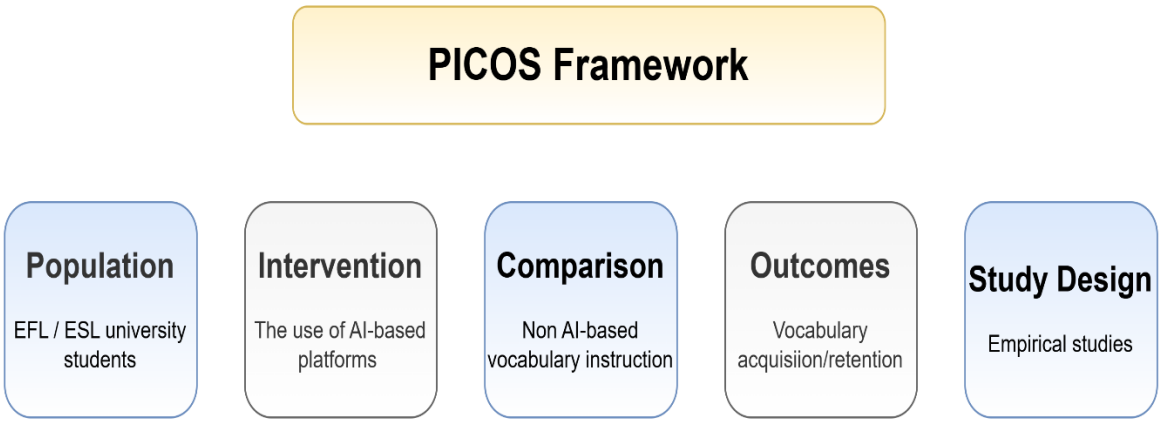


Fig. 2. PICOS Framework

Inclusion Criteria

Journal articles and conference papers which adhere to the following inclusion criteria were included. To begin with, the study must address university students (undergraduate or graduate students) who are learning English as a second or foreign language, must be written in English, and must evaluate specific AI technologies used for vocabulary acquisition. Additionally, the study must measure specific outcomes related to vocabulary acquisition, such as word retention, receptive and productive knowledge, or vocabulary depth and breadth. More importantly, the study must be published in the last five years (between 2022 and 2026).

Exclusion Criteria

Book chapters, systematic reviews, meta-analyses and non-empirical studies are excluded. Studies must not focus only on traditional Computer-Assisted Language Learning (CALL) or Mobile-Assisted Language Learning tools without AI features. Moreover, they must not target primary or secondary education since this study focuses only on higher education. Finally, studies that measure general language proficiency without providing specific vocabulary outcomes are also excluded.

Data Extraction and Analysis

A data extraction and coding process was conducted to systematically organize information from the selected studies. Data were extracted using a predefined coding Excel sheet developed by the researcher. Each study was coded according to publication details, number of participants and their characteristics (age and level), country, the AI tools used, research design, study context, treatment period, vocabulary dimension, number of target words, and outcomes. Through the coding process, themes were identified and a thematic analysis was employed to analyze the findings of the selected studies. Reflexive thematic analysis was used to identify, analyze and report the existing themes. As Braun and Clarke (79) stated, this type of analysis aims to organize data and represent it in a detailed way, and find themes that are related to the effect of AI-based platforms on vocabulary acquisition.

Quality Appraisal

Methodological quality appraisal was done by the first author, using the Mixed Methods Appraisal Tool (MMAT), which is designed for systematic reviews that include qualitative, quantitative and mixed methods studies. The tool includes two initial screening questions, and then the appropriate five MMAT criteria are applied according to each study's research design (qualitative research, randomized controlled trials, non-randomized studies, quantitative descriptive studies, or mixed methods studies). Each criterion was assessed as "Yes", "No", or "Can't Tell". Since it is not advised to calculate an overall quality score, the appraisal findings were used to find methodological strengths and limitations across the included studies (Hong et al. 1).

After using the MMAT, the appraisal revealed that there is variation across the methodological criteria and study designs. Overall, most studies met several of the MMAT criteria. However, there were some recurring methodological limitations, particularly regarding sample representativeness, instrument validity and reliability, and control of confounding variables. To exemplify, most studies drew from a single institution, which limits generalizability. Also, in the non-randomized studies, confounder control is absent, so the vocabulary outcomes might be affected by variables other than the AI tools used. Additionally, some studies do not provide information on the validity and reliability of instruments, such as Cronbach's alpha or the use of standardized instruments. Also, blinding is essentially absent in most experimental studies, with only Shobeiry and Namaziandost reporting blinded instructor delivery status. Detailed data extraction and study-level MMAT appraisal results are provided in the supplementary materials.

Results

RQ1: What Are the Demographic and Methodological Characteristics of Research on AI-Based Vocabulary Learning among University Students?

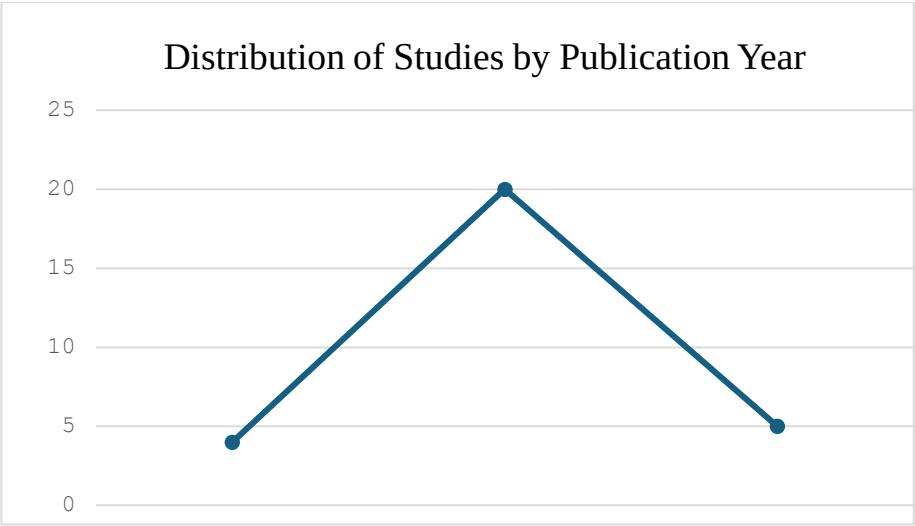


Fig. 3. Frequency of Publication Years

Figure 3 illustrates the distribution of included studies by publication year.

As shown above, all of the selected studies were published between 2024 and 2026, and the largest number of studies (n=20) was published in 2025, followed by 2026 (n=5) and 2024 (n=4). This indicates that researchers have become increasingly interested in the use of AI-powered tools for vocabulary acquisition over the last three years.

Figure 4 shows the geographical distribution of the included studies according to the participants' countries.

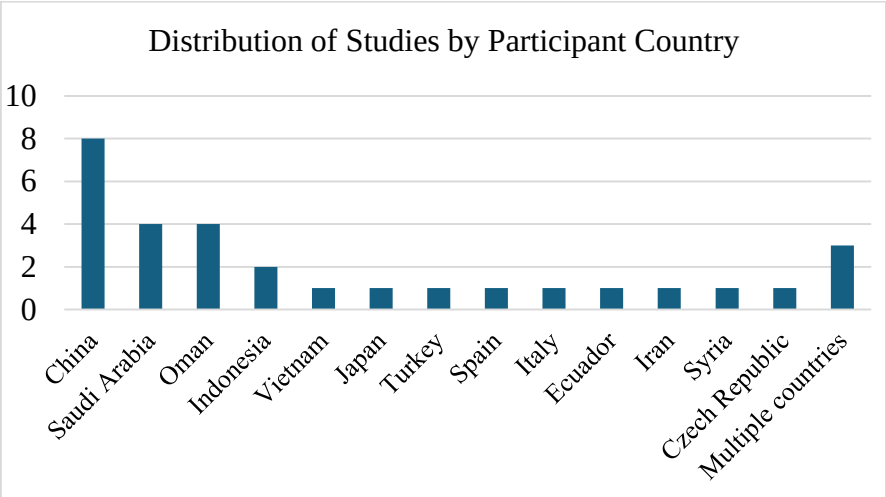


Fig. 4. Participants' Countries

Figure 4 illustrates the geographical distribution of the included studies according to participants' countries. The highest number (n=8) of studies was conducted in China, followed by Saudi Arabia (n=4) and Oman (n=4). Other studies were conducted in Vietnam, Japan, Turkey and several additional countries. Overall, this suggests that research on AI-based vocabulary learning is centered in Asian and Middle Eastern educational contexts.

Table 1 summarizes the research methodology employed across the included studies.

Table 1
Research Methodology

Research Methodology	Frequency
Mixed methods	17
Quantitative	12

The methodological landscape, as shown in Table 1, is dominated by the use of mixed-methods approaches (n=17) and quantitative studies (n=12), which can be divided into surveys, quasi-experimental, and comparative experimental studies. Mixed methods studies were based on

quantitative and qualitative methods, such as quasi-experiments, surveys, observation, learning-platform data and interviews. For instance, Abdelhalim and Alsehibany used a quasi-experimental pre- and post-test design followed by semi-structured interviews, whereas Jácome Paredes et al. combined closed-ended and open-ended questions in an online survey to explore students' experiences. Concerning quantitative studies, Kheder utilized a questionnaire to determine the participants' perspectives towards the use of AI in vocabulary learning while Ng et al. employed a quasi-experimental design to investigate the effect of Copilot AI on vocabulary development.

The included studies involved undergraduate university students whose ages ranged from 18 to 34 years, where reported. Sample sizes ranged from 31 to 600 participants with an average sample size of 121.27. In terms of language proficiency, most participants had a pre-intermediate or intermediate level in English. Still, a few studies included learners at other levels, such as A1 and C1.

RQ2: What Is the Effect of AI-Powered Tools on L2 Vocabulary Acquisition among EFL University Students?

The number of target vocabulary items ranged from 20 to 100 words with an average of 58.77 words. The treatment period ranged from three to sixteen weeks, with most experiments lasting for four weeks (Behforouz and Al Ghaithi; Namaziandost and Çakmak; Morgana and Poli; Koka et al.; Ng et al.). Among the studies that specified which dimensions of vocabulary knowledge are tackled, receptive and productive vocabulary were the most frequently investigated, while fewer studies focused on vocabulary depth. To exemplify, Abdelhalim and Alsehibany, Y. Chen, and Hao et al. examined the effect of AI-based tools on receptive and productive vocabulary, whereas Morgana and Poli focused on spoken academic collocations as an indicator of vocabulary depth.

Table 2 summarizes the vocabulary, affective, and self-regulation outcomes reported across the included studies. Since individual studies could report multiple outcomes, the outcome categories are not mutually exclusive. Thus, frequencies do not sum to the total number of included studies.

Table 2
Reported Outcomes

Outcome Category	Reported outcome	Frequency
Vocabulary Outcomes	Increased vocabulary acquisition	11
	Increased productive vocabulary	6
	Increased receptive vocabulary	4
	Long-term vocabulary retention	5
	Short-term vocabulary learning	2
	Incidental vocabulary learning	2
	Increased engagement	7

Outcome Category	Reported outcome	Frequency
Affective Outcomes	Motivation	2
Self-regulation Outcomes	Autonomy	4
	Metacognitive strategy use	2

Most of the selected studies reported that the use of AI-powered tools yielded positive vocabulary outcomes, particularly in improving productive and receptive vocabulary knowledge (n=10), and increasing long-term vocabulary retention (n=5) while other studies (n=11) did not specify which dimensions are positively affected. Additionally, AI-supported vocabulary learning also led to boosting engagement (n=7) and motivation (n=2) and enhancing self-regulated learning, especially autonomy (n=4) and metacognitive strategy use (n=2). Overall, the findings suggest that the use of AI by university students improves not only vocabulary acquisition but also students' affective factors and self-regulation skills.

RQ3: Which AI Tools and Adaptive Features Are Associated with Positive Vocabulary Acquisition Outcomes?

Table 3 reports the AI-based tool used in each of the included studies.

Table 3
Frequency of the Used AI Tools

AI Tool	Frequency
ChatGPT	11
Quizlet	2
Duolingo	2
Rosetta Stone	1
Conversational Bot	1
AVAR-RL Model	1
Copilot	1
UNIPUS AIGC Platform	1
Kimi	1
QuillBot	1

AI Tool	Frequency
AI Chatbot "Doubao"	1
WhatsApp Bot	1
Kahoot	1
Grok 5	1
ELSA Speak	1
Hedra AI	1
Not reported	1

Table 3 shows the distribution of the used AI tools among undergraduate students. As illustrated, ChatGPT was the most widely used, reported in 11 studies, followed by Quizlet (n=2) and Duolingo (n=2). The remaining tools, including Rosetta Stone, Copilot, QuillBot, and other Generative AI tools and chatbot systems were each reported in a single study. This shows that ChatGPT dominates vocabulary learning research among university students.

Table 4 presents the adaptive AI features that enhance vocabulary learning. The most commonly reported features involved feedback, personalization and contextualized learning. Feedback was provided through immediate and real-time responses, while personalization enabled students to learn vocabulary according to their individual needs. Other studies, especially the ones using AI chatbots, employed conversational interactions to enable students to engage in dialogues. Additional features included progress tracking, speech recognition, gamification, spaced repetition and content generation.

Table 4
Reported AI Features

AI Feature	Examples from Included Studies
Feedback	Real-time feedback, adaptive feedback
Personalization	Personalized content, learning style adaptation
Contextualized learning	Context-specific input, visual stories, real-life situations
Interactive learning	Discussion activities, interactive dialogue, conversation support
Monitoring	Progress tracking
Speech-based features	Speech detection and recognition
Spaced repetition	Vocabulary review

AI Feature	Examples from Included Studies
Gamification	Gamified features such as quizzes
Content generation	Generating example sentences, authentic content

Discussion

The Rapid Growth of AI-Based Vocabulary Learning Research

This review focused on studies published between 2022 and 2026. However, no eligible studies were found for 2022 or 2023. The findings revealed that there is an increase in publications related to AI-based vocabulary learning among university students in 2025, whereas fewer studies were identified in 2026 since the year is still ongoing during this review's data collection process. Thus, the use of AI in vocabulary acquisition is becoming a key area of research within educational technology. This growth might be attributed to the broader and effective integration of AI into higher education (Abdelhalim and Alsehibany 2) and to the fact that a growing number of researchers are leveraging AI tools to tackle language education problems, such as vocabulary acquisition (Zhang and Huang, qtd. in Hao et al. 4). Despite this rapid growth of research, most studies were conducted in Asian countries, particularly in China. This finding aligns with a previous review conducted by Yan et al., which also indicated the strong concentration of publications in Asia, implying that other regions, such as Africa, do not benefit from the needed infrastructure and funding.

Dominance of ChatGPT

The results indicate that ChatGPT is the most frequently used AI tool. Several researchers, such as Alsagoor et al., Sawaguchi, Jalambo et al., Behforouz and Al Ghaithi, and Poláková and Ivenz, employed ChatGPT in their studies as it has reshaped AIED since its appearance in 2022. This tool allows learners to get real-time feedback, contextualized examples, and personalized content that matches their level. Therefore, it makes learning more flexible and accessible (Poláková and Ivenz 291).

The dominance of ChatGPT may be also explained by the shift from old rule-based chatbots which were only producing pre-programmed answers to large language models, which provide human-like responses. Although there are many AI language learning tools, ChatGPT is distinguished by its flexibility and accessibility (Karataş et al., qtd. in Abdelhalim and Alsehibany 2). These findings align with prior research which demonstrated that ChatGPT was the most used AI chatbot since it helps learners identify and correct errors, provides feedback, and fosters grammatical and semantic accuracy (Kheder 141).

AI Improves Vocabulary Outcomes

This review's findings highlight the positive impact of AI-powered tools on vocabulary acquisition among EFL university students. All included studies reported that there was a significant improvement in vocabulary gains after the use of AI, either in or outside the classroom, compared to the use of traditional approaches. These positive effects can be attributed to AI features that allow students to learn while having access to immediate feedback, personalized content, and contextualized examples.

Several studies that were published between 2024 and 2026 (Abdelhalim and Alsehibany; Y. Chen; Zhang and Huang; Koka et al.; Behforouz et al.) showed that AI-powered tools improved vocabulary through immediate, corrective and individualized feedback. In other words, they provide direct corrective learning and adaptation of exercise levels in real-time, which helps to close learning gaps and avoiding the fossilization of errors. Also, a number of studies (Zhang and Huang; Namaziandost and Çakmak; Shobeiry and Namaziandost) highlighted how AI-generated examples, storytelling activities and contextualized sentences improved students' vocabulary, unlike relying on learning isolated words.

Other studies focused on how personalized content improves word retention. AI-powered tools' interactive features can decrease the learners' cognitive load, mirroring Sweller's cognitive load theory, and boost their engagement with the tool, hence enhancing memory retention. Among the factors that affect word retention are the relevant contexts in which a word appears and the use of spaced repetition (Y. Chen; Koka et al.). It was also noted that adaptive learning systems' personalized review positively affects long-term retention (Xiang et al. 823).

Some studies (Abdelhalim and Alsehibany; Smith; Morgana and Poli) suggested that structured and guided use of AI-based tools yielded better vocabulary-related outcomes than solitary use. To illustrate, teacher scaffolding, controlled prompts, and peer interaction contribute to creating more memorable vocabulary learning experiences. This aligns with Vygotsky's sociocultural theory which holds that learners can achieve progress when they are exposed to structured external guidance before moving to autonomous mastery.

In sum, the findings indicate that the effectiveness of AI-powered tools in vocabulary acquisition among university students does not stem from only one feature or factor. Rather, it is the result of the combined effects of immediate feedback, personalization, contextualization, and guided teacher support.

Increased Engagement and Self-Regulation Skills

Beyond vocabulary gains, many studies (Behforouz et al.; Ahmed et al.) showed that AI also increases learner engagement and motivation. For instance, Zhang and Huang found that students in the experimental group demonstrated higher levels of classroom participation, asked more questions, especially targeting productive vocabulary knowledge, and engaged more actively in vocabulary tasks than those in traditional learning groups (11). Therefore, they focused more on communication, meaning construction, and monitoring their output. In the same vein, Koka et al. revealed that interactive and personalized learning promotes affective dimensions, such as increased motivation and autonomy and reduced boredom, leading to more positive effects on vocabulary acquisition (101). Collectively, these findings indicate that AI-powered tools foster a more engaging and learner-centered learning environment.

Challenges

Despite the reported benefits of AI-assisted vocabulary learning, there are still challenges that face the use of AI-powered tools. Students stated that they are not confident enough to use the acquired words in their everyday conversations, and some students faced difficulties while communicating with AI chatbots, such as increased anxiety levels. Therefore, teachers should concentrate on including interactive activities to retain students' motivation for a longer exposure period (Poláková and Ivenz; Jalambo et al.). Moreover, there are also concerns about the accuracy of answers, over-dependence on the tools, and insufficient training in using AI-

based tools, indicating that teacher guidance and digital literacy are needed for a better use of these tools (Alsagoor et al.; Ahmed et al.).

Additionally, some researchers note that although students exhibit high levels of engagement and motivation, autonomy alone may not guarantee long-term learning benefits. Ng et al. stated that the absence of teacher scaffolding and structured guidance limited long-term vocabulary retention (10). In this respect, Jalambo et al. mentioned that teachers should be aware of the novelty effect of AI-powered tools. Initial motivation disappears over time when the tools are not novel anymore; this is why it is important to deliberately implement chatbots in learning environments to attain better learning outcomes (14).

Limitations

A key limitation of this review is that study selection, data extraction and quality appraisal were conducted by a single reviewer rather than independently by two or more reviewers. The absence of an independent second assessment due to time constraints may have introduced some subjectivity into the appraisal and prevented the calculation of inter-rater reliability. This risk was partially mitigated by strictly following the MMAT user guide's definitions for each criterion. Still, future reviews would benefit from independent dual appraisal, as recommended in the MMAT guidance (Hong et al. 1).

Another limitation concerns the geographic distribution of the included studies. Most studies were conducted in China, Saudi Arabia, and Oman, with relatively limited representation of other geographical contexts. This concentration may constrain the generalizability of the findings to other EFL contexts, where educational systems and technological infrastructure are different. Hence, the findings should be interpreted with consideration of the contextual characteristics of the included studies' settings, and future research should focus on investigating the underrepresented areas.

Conclusion

This systematic review investigated the effectiveness of using AI-powered tools in vocabulary acquisition, with a focus on higher education. Its primary goal was to identify the most commonly used AI tools and features and their impact on vocabulary acquisition. After reviewing 29 studies which were published between 2024 and 2026, with no eligible studies identified for 2022 or 2023, the findings emphasize the potential of AI tools to enhance vocabulary acquisition among university students and increase their motivation and engagement while learning. This review also identified ChatGPT as the most frequently used AI tool and highlighted real-time feedback, personalization and contextualized learning as the most commonly associated AI features with positive vocabulary outcomes. However, the strength of this body of literature is limited by the reliance on single-institution samples in most of the included studies, limited confounder control and inadequate reporting of the reliability and validity of the instruments. Therefore, claims about the effect of AI tools on vocabulary learning should be interpreted with caution since these limitations may affect the generalizability of the findings.

Beyond its potential benefits, this review also highlights the challenges that students deal with when using AI while learning, including over-reliance on AI systems, decreased motivation after long-term usage, and lack of digital training. This underlines the importance of structured integration of AI into vocabulary instruction and implies that AI should be viewed as a complementary educational tool rather than a replacement for teachers. Taken together,

the findings of this review have implications for language teachers, higher education institutions, and students by encouraging the integration of AI into higher education through student-centered approaches. Future research should focus on the long-term effects of AI-based tools on vocabulary acquisition since most studies included in this systematic review lasted for four weeks. More importantly, future studies should address the mentioned challenges while integrating AI into vocabulary instruction.

Works Cited

Braun, Virginia, and Victoria Clarke. "Using Thematic Analysis in Psychology." *Qualitative Research in Psychology*, vol. 3, no. 2, 2006, pp. 77-101, https://doi.org/10.1191/1478088706qp063oa.

Chen, Xi. "Artificial Intelligence in EFL Vocabulary Learning: A Systematic Review of Higher Education Practices and Research Trends (2015-2025)." *Cogent Education*, vol. 13, no. 1, 2026, article 2667534, https://doi.org/10.1080/2331186X.2026.2667534.

Chu, Hui-Chun, et al. "Roles and Research Trends of Artificial Intelligence in Higher Education: A Systematic Review of the Top 50 Most-Cited Articles." *Australasian Journal of Educational Technology*, vol. 38, no. 3, 2022, pp. 22-42, https://doi.org/10.14742/ajet.7526.

Fitzgerald, Sarah Rose, et al. "Selecting a Specialized Education Database for Literature Reviews and Evidence Synthesis Projects." *Research Synthesis Methods*, vol. 16, no. 1, 2025, pp. 30-41, https://doi.org/10.1017/rsm.2024.11.

Gligorea, Ilie, et al. "Adaptive Learning Using Artificial Intelligence in E-Learning: A Literature Review." *Education Sciences*, vol. 13, no. 12, 2023, article 1216, https://doi.org/10.3390/educsci13121216.

Holmes, Wayne, et al. *Artificial Intelligence in Education: Promises and Implications for Teaching and Learning*. Center for Curriculum Redesign, 2019.

Hong, Quan Nha, et al. *Mixed Methods Appraisal Tool (MMAT), Version 2018*. Registration of Copyright #1148552, Canadian Intellectual Property Office, Industry Canada, 2018.

Huang, Jianping, et al. "AVAIL: An AI-Driven Vocabulary Acquisition and Instructional Learning Framework." *Proceedings of the 2025 International Conference on Educational Technology and Artificial Intelligence*, ACM, 2025, pp. 134-37, https://doi.org/10.1145/3766557.3766581.

Kaliraj, P., and T. Devi, editors. *Artificial Intelligence Theory, Models, and Applications*. Auerbach Publications, 2021.

Maghsoudi, N. "Leveraging Artificial Intelligence for Vocabulary Development: Effects on Recall and Retention in English for Specific Purposes Contexts." *Curriculum Research*, vol. 6, no. 2, 2025, pp. 52-76, https://doi.org/10.71703/CURE.2025.1209154.

Nation, I. S. P. *Learning Vocabulary in Another Language*. Cambridge UP, 2001.

Ouzzani, Mourad, et al. "Rayyan—A Web and Mobile App for Systematic Reviews." *Systematic Reviews*, vol. 5, no. 1, 2016, article 210, https://doi.org/10.1186/s13643-016-0384-4.

Page, Matthew J., et al. "The PRISMA 2020 Statement: An Updated Guideline for Reporting Systematic Reviews." *BMJ*, vol. 372, 2021, article n71, https://doi.org/10.1136/bmj.n71.

Pranckutė, Raminta. "Web of Science (WoS) and Scopus: The Titans of Bibliographic Information in Today's Academic World." *Publications*, vol. 9, no. 1, 2021, article 12, https://doi.org/10.3390/publications9010012.

Simonnet, Enzo, et al. "A Systematic Literature Review of Technology-Assisted Vocabulary Learning." *Journal of Computer Assisted Learning*, vol. 41, no. 1, 2025, article e13096, https://doi.org/10.1111/jcal.13096.

Sweller, John. "Cognitive Load Theory, Learning Difficulty, and Instructional Design." *Learning and Instruction*, vol. 4, no. 4, 1994, pp. 295-312, https://doi.org/10.1016/0959-4752(94)90003-5.

Vygotsky, Lev S. *Mind in Society: The Development of Higher Psychological Processes*. Edited by Michael Cole et al., Harvard UP, 1978.

Yan, Weijian, et al. "Integrating Artificial Intelligence and Extended Reality in Language Education: A Systematic Literature Review (2017-2024)." *Education Sciences*, vol. 15, no. 8, 2025, article 1066, https://doi.org/10.3390/educsci15081066.

Yang, Ying. "AI-Supported L2 Vocabulary Acquisition: A Systematic Review from 2015 to 2023." *Education and Information Technologies*, vol. 30, no. 13, 2025, pp. 17995-18029, https://doi.org/10.1007/s10639-025-13417-8.

Studies Included in the Systematic Review

Abdelhalim, Safaa Mahmoud, and Raniya Alsehibany. "Integrating ChatGPT for Vocabulary Learning and Retention: A Classroom-Based Study of Saudi EFL Learners." *Language Learning & Technology*, vol. 29, no. 1, 2025, pp. 1-24, https://doi.org/10.64152/10125/73635.

Ahmed, Fawzi Eltayeb Yousuf, et al. "Saudi University EFL Students' Experiences with AI-Powered Games for Learning English Vocabulary." *Journal of Language Teaching and Research*, vol. 17, no. 2, 2026, pp. 704-14, https://doi.org/10.17507/jltr.1702.32.

Alsagoor, Jouri, et al. "Exploring the Impact of ChatGPT on Vocabulary Acquisition in EFL Learners: A Mixed-Methods Study on AI-Assisted Language Learning." *Forum for Linguistic Studies*, vol. 7, no. 9, 2025, pp. 1173-85, https://doi.org/10.30564/fls.v7i9.10257.

Behforouz, Behnam, and Ali Al Ghaithi. "Visual Language Learning: Exploring the Effects of Artificial Intelligence-Generated Animations on Vocabulary and Motivational Growth." *Technology in Language Teaching & Learning*, vol. 7, no. 4, 2025, article 103077, https://doi.org/10.29140/tltl.v7n4.103077.

Behforouz, Behnam, et al. "The Effect of AI-Based Instruction on Vocabulary Retention and Learner Motivation in Higher Education." *Technology in Language Teaching & Learning*, vol. 8, 2026, article 103599, https://doi.org/10.29140/tltl.2026.103599.

Behforouz, Behnam, et al. "Revolutionizing Vocabulary Acquisition through AI Chatbots." *International Journal of Learning, Teaching and Educational Research*, vol. 24, no. 7, 2025, pp. 1-22, https://doi.org/10.26803/ijlter.24.7.1.

Butarbutar, Ranta, et al. "Unlocking the Impact of AI-Assisted Online Interactive Learning Environment in English Language Learning." *Journal of Asia TEFL*, vol. 22, no. 4, 2025, pp. 646-62, https://doi.org/10.18823/asiatefl.2025.22.4.2.646.

Chen, Yuzhen. "A Comparative Study on the Effectiveness of AI Chatbots and Dictionary Apps for Lexical Tasks and Retention." *Lexikos*, vol. 35, 2025, https://doi.org/10.5788/35-1-2027.

Dai, Lili, and Fengming Wu. "An AI-Powered Conversational System for College Students Learning English as a Second Language." *Education and Information Technologies*, vol. 30, no. 16, 2025, pp. 23393-417, https://doi.org/10.1007/s10639-025-13640-3.

Dandu, Ganesh, et al. "AI-Driven Language Learning: The Impact of Rosetta Stone on ESL Students' Speaking Proficiency and Self-Control." *Rupkatha Journal on*

Interdisciplinary Studies in Humanities, vol. 16, no. 4, 2024, https://doi.org/10.21659/rupkatha.v16n4.09.

Dinh, Cao-Tuong, et al. "Acceptance of AI Tools and Its Impact on Communication Strategies and Vocabulary Adaptation: Evidence from Vietnamese English Majors." *Acta Psychologica*, vol. 261, 2025, article 105911, https://doi.org/10.1016/j.actpsy.2025.105911.

Hao, Chun, et al. "AI Chatbot-Assisted Vocabulary Learning: Relationships with Self-Regulation, Motivation, and Performance among Chinese Private College Students." *Language Teaching Research*, 2025, https://doi.org/10.1177/13621688251352595.

Jácome Paredes, Vladimiro, et al. "AI-Powered Digital Tools for Vocabulary Retention in Foreign Language Learners: A Perception-Based Study." *Revista San Gregorio*, vol. 1, no. 62, 2025, pp. 79-84, https://doi.org/10.36097/rsan.v1i62.3579.

Jalambo, Mahmoud Omar, et al. "Effects of Self-Regulated Vocabulary Learning with Chatbots on Incidental and Collocational Vocabulary Learning and Foreign Language Learning Boredom." *Discover Education*, vol. 4, 2025, article 501, https://doi.org/10.1007/s44217-025-00977-7.

Kheder, Khalefa. "Using Artificial Intelligence in Learning Vocabulary by EFL Undergraduate Syrian Students." *Using AI Tools in Text Analysis, Simplification, Classification, and Synthesis*, edited by Nayef J. Jomaa, IGI Global, 2025, pp. 131-58, https://doi.org/10.4018/979-8-3693-9511-0.ch005.

Koka, Nisar Ahmad, et al. "Evaluating the Role of Artificial Intelligence (AI) in Enhancing Vocabulary Retention in Foreign Language Acquisition." *International Journal of Advanced and Applied Sciences*, vol. 13, no. 3, 2026, pp. 95-104, https://doi.org/10.21833/ijaas.2026.03.010.

Meng, Jing. "AVAR-RL: Adaptive Reinforcement Learning Approach for Personalized English Vocabulary Acquisition." *Discover Artificial Intelligence*, vol. 5, no. 1, 2025, article 317, https://doi.org/10.1007/s44163-025-00584-3.

Morgana, Valentina, and Francesca Poli. "Guided and Unguided GenAI Tasks for Learning Academic Spoken Collocations." *Journal of English for Academic Purposes*, vol. 80, 2026, article 101638, https://doi.org/10.1016/j.jeap.2026.101638.

Namaziandost, Ehsan, and Fidel Çakmak. "Impact of AI-Generated Storytelling vs. Gamified Learning on Vocabulary Retention and Engagement in CALL Environments." *Computers and Education: Artificial Intelligence*, vol. 9, 2025, article 100505, https://doi.org/10.1016/j.caeai.2025.100505.

Ng, Miew Luan, et al. "Digital Scaffolding as Learning Opportunities: Enhancing Vocabulary Knowledge through Copilot AI." *Educational Process: International Journal*, vol. 20, 2026, article e2026012, https://doi.org/10.22521/edupij.2026.20.12.

Poláková, Petra, and Petra Ivenz. "Investigating the Effectiveness of ChatGPT for Vocabulary Acquisition among University Students: A Pilot Study." *International Journal of Instruction*, vol. 19, no. 3, 2026, pp. 281-96, https://doi.org/10.29333/iji.2026.19315a.

Sawaguchi, Ryo. "ChatGPT as a Facilitator of Vocabulary Learning Strategy Use for Lexical Bundles across Different Difficulty Levels." *Vocabulary Learning and Instruction*, vol. 15, 2026, article 102978, https://doi.org/10.29140/vli.2026.102978.

Shobeiry, Maria, and Ehsan Namaziandost. "The Impact of AI-Mediated Gamified Flipped Learning on Adult English Language Learners' Vocabulary Learning and Motivation in Mobile-Assisted Language Learning Contexts." *Computer Assisted Language Learning*, 2026, https://doi.org/10.1080/09588221.2026.2625215.

Smith, Jorden. “Enhancing ESP Student Critical Thinking Skills and Vocabulary Acquisition through a GenAI-Based Project.” *Teaching English with Technology*, vol. 25, no. 2, 2025, https://doi.org/10.56297/vaca6841/ZDDD4208/HNVJ7828.

Wang, Yiyun, et al. “Empirical Assessment of AI-Powered Tools for Vocabulary Acquisition in EFL Instruction.” *IEEE Access*, vol. 12, 2024, pp. 131892-905, https://doi.org/10.1109/ACCESS.2024.3446657.

Waziana, Winia, et al. “Students’ Perceptions about the Impact of AI Chatbots on Their Vocabulary and Grammar in EFL Writing.” *Register Journal*, vol. 17, no. 2, 2024, pp. 352-82, https://doi.org/10.18326/register.v17i2.352-382.

Xiang, Lixia, et al. “Evaluating the Effectiveness of Adaptive Learning Systems in College-Level English Vocabulary and Grammar Acquisition.” *Proceedings of the 2025 2nd International Symposium on Artificial Intelligence for Education*, ACM, 2025, pp. 820-24, https://doi.org/10.1145/3775073.3775201.

Yu, Miao. “Optimizing EFL Vocabulary Acquisition: A Randomized Controlled Mixed-Methods Investigation of Artificial Intelligence-Driven Incidental, Contextual, and Multimodal Strategies.” *Education and Information Technologies*, vol. 31, no. 1, 2026, pp. 53-97, https://doi.org/10.1007/s10639-025-13803-2.

Zhang, Zhihui, and Xiaomeng Huang. “The Impact of Chatbots Based on Large Language Models on Second Language Vocabulary Acquisition.” *Heliyon*, vol. 10, no. 3, 2024, article e25370, https://doi.org/10.1016/j.heliyon.2024.e25370.