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EXPLORING THE RELATIONSHIP BETWEEN CHATGPT USE AND VOCABULARY MASTERY AMONG INDONESIAN EFL SECONDARY SCHOOL STUDENTS

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ABSTRACT

The rapid development of artificial intelligence (AI) has expanded opportunities for English as a Foreign Language (EFL) learning, particularly through ChatGPT as an accessible language-learning tool. Although previous studies have reported generally positive perceptions of ChatGPT among language learners, empirical evidence concerning its relationship with measurable language proficiency remains limited. This study examined the relationship between ChatGPT use and vocabulary mastery among eleventh-grade students at MAN 1 Kota Palu, Indonesia. Using a quantitative correlational design, the study involved 54 students selected through purposive sampling. Data were collected using a 20-item ChatGPT Usage Questionnaire measuring frequency of use and perceived usefulness, along with a 30-item Vocabulary Mastery Test assessing lexical knowledge. The data were analyzed using descriptive statistics, the Kolmogorov–Smirnov normality test, and Pearson's product-moment correlation. The findings showed that students generally reported moderate to high levels of ChatGPT use and perceived it as useful for vocabulary learning. However, the correlation analysis revealed a negligible positive and statistically nonsignificant relationship between ChatGPT use and vocabulary mastery (r = .020, p = .886). These findings suggest that frequent use and positive perceptions of ChatGPT do not necessarily correspond to higher vocabulary achievement. Other learner-related and contextual factors, which were not directly examined in this study, may contribute to differences in vocabulary mastery. Therefore, ChatGPT may be more appropriately viewed as a supplementary resource whose educational value depends on how it is used and integrated into meaningful language-learning activities.

Keywords: Artificial Intelligence, ChatGPT, EFL Learners, Technology-Assisted Language Learning, Vocabulary Mastery

INTRODUCTION

The rapid development of digital technology has profoundly transformed educational practices worldwide, particularly in the field of English as a Foreign Language (EFL). Over the past decade, digital learning environments have expanded learners' access to educational resources, enabling more flexible, interactive, and independent learning experiences. The integration of digital technologies into language education has also

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contributed to a shift from conventional teacher-centered approaches toward more learner-centered practices, in which students actively engage with various learning resources beyond the classroom. As digital technologies continue to evolve, language learners increasingly rely on online platforms, mobile applications, and artificial intelligence (AI)-powered tools to support different aspects of language acquisition, including vocabulary development.

Among recent technological developments, generative artificial intelligence has attracted considerable attention because of its capacity to produce human-like responses, provide immediate feedback, and facilitate interactive learning. ChatGPT, developed as a conversational AI system, has become particularly prominent in educational contexts due to its accessibility and ability to respond to diverse learning needs. In language education, learners can use ChatGPT to obtain explanations of unfamiliar words, identify synonyms and antonyms, generate example sentences, clarify contextual meanings, practice written communication, and receive immediate linguistic feedback. These features have led researchers and educators to consider ChatGPT a potentially valuable resource for supporting language learning and learner autonomy (Kasneci et al., 2023; Kohnke et al., 2023; Lo et al., 2024).

The increasing adoption of ChatGPT has generated growing scholarly interest in its pedagogical possibilities and limitations. Research suggests that generative AI can provide personalized explanations, immediate responses, interactive practice, and flexible access to information, thereby creating new opportunities for language learning (Kasneci et al., 2023; Kohnke et al., 2023). At the same time, researchers have emphasized that the educational value of ChatGPT depends substantially on how learners interact with the technology, the quality of their prompts, their ability to critically evaluate AI-generated information, and the pedagogical contexts in which the tool is used (Farrokhnia et al., 2024; Han, 2024). Therefore, the availability and frequent use of ChatGPT should not automatically be assumed to produce measurable improvements in language proficiency.

Vocabulary mastery is particularly relevant in this context because lexical knowledge constitutes a fundamental component of second-language proficiency. An adequate vocabulary enables learners to comprehend spoken and written texts, express ideas effectively, and participate more confidently in communication. Conversely, insufficient lexical knowledge may constrain learners' performance across reading, writing, listening, and speaking. Vocabulary development is therefore a central concern in EFL learning, particularly in contexts where learners have limited opportunities for authentic exposure to English outside formal classroom instruction. Technology-mediated learning has increasingly been explored as a means of providing learners with greater access to lexical input, contextualized examples, repetition, and independent practice (Elgort, 2018; Golonka et al., 2014).

ChatGPT may offer several affordances for vocabulary learning. Learners can request definitions, translations, synonyms, antonyms, example sentences, contextual explanations, and customized exercises according to their individual needs. Unlike static dictionaries or conventional vocabulary applications, ChatGPT allows learners to engage in interactive exchanges and request further clarification when an initial explanation is insufficient. This

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flexibility may support independent learning and provide learners with opportunities to encounter vocabulary in multiple contexts. Previous research has consequently highlighted the potential of ChatGPT and other AI-based tools to support vocabulary learning and language development (Abdelhalim & Alsehibany, 2025; Galuh et al., 2025; Karataş et al., 2024).

Despite this pedagogical potential, the relationship between the use of ChatGPT and measurable language-learning outcomes remains insufficiently understood. Much of the emerging research on ChatGPT in EFL and ESL education has concentrated on learners' perceptions, acceptance, experiences, and attitudes toward the technology (Baig & Yadegaridehkordi, 2024; Kohnke et al., 2023; Lo et al., 2024). These studies generally indicate that learners appreciate ChatGPT for its accessibility, immediate responses, personalized explanations, and support for independent learning. Similarly, studies such as Kurniadi et al. (2025), Karolina et al. (2025), and Tusino et al. (2025) revealed predominantly favorable perceptions of ChatGPT among EFL learners, although they offered limited evidence concerning its direct relationship with measurable learning outcomes. Thus, while learners often regard ChatGPT as advantageous, empirical evidence connecting its use to actual vocabulary mastery remains limited.

The limited availability of empirical evidence is particularly evident in the Indonesian EFL context. As digital technologies become increasingly accessible, Indonesian students have begun integrating AI-powered applications into their learning practices. Previous studies have explored digital literacy, technology integration, and AI adoption among Indonesian EFL learners and teachers (Kurniawati et al., 2018; Pertiwi, 2022; Wafa & Sulistyaningsih, 2025). Other studies have investigated students' perceptions of ChatGPT and its role in supporting language-learning activities (Kurniadi & Satria, 2025; Tusino et al., 2025). However, few studies have specifically examined whether students who use ChatGPT more frequently actually demonstrate higher levels of vocabulary mastery. Furthermore, research conducted in Indonesian secondary-school settings remains limited, as most existing studies focus on university students or pre-service teachers. This situation highlights the need for further research examining the relationship between ChatGPT use and vocabulary-learning outcomes among Indonesian EFL learners at different educational levels.

Another important consideration is the complex nature of vocabulary development itself. Although technological tools may facilitate learning opportunities, vocabulary acquisition can be associated with numerous interacting learner-related and contextual factors, including motivation, reading habits, prior vocabulary knowledge, exposure to language input, self-regulated learning behaviors, and digital literacy competencies (Bandura, 1977; Benson, 2011; Ryan & Deci, 2020). These theoretical considerations suggest that increased use of a technological tool should not automatically be expected to correspond to higher vocabulary achievement. Rather, the potential educational benefits of ChatGPT may depend on how purposefully learners engage with the technology and how its affordances interact with broader learning processes. Importantly, these additional factors were not directly measured in the present study and are therefore considered theoretical explanations rather than variables empirically tested in the analysis.

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This distinction between technology acceptance and measurable learning outcomes represents an important area for empirical investigation. Students may frequently use ChatGPT and perceive it as useful for obtaining definitions, generating examples, or completing language-related tasks, yet positive perceptions and frequent use do not necessarily demonstrate improved lexical proficiency. Examining the relationship between students' reported ChatGPT use and objectively assessed vocabulary mastery can therefore provide a more evidence-based understanding of the role of generative AI in language learning.

Against this background, the present study examines the relationship between students' use of ChatGPT and their vocabulary mastery among eleventh-grade students at MAN 1 Kota Palu, Indonesia. The study addresses both an empirical gap, concerning the limited evidence linking ChatGPT use with objectively assessed vocabulary proficiency, and a contextual gap, concerning the underrepresentation of Indonesian secondary-school learners in existing generative AI research. Unlike studies focusing primarily on students' perceptions or attitudes toward ChatGPT, this study combines self-reported data on ChatGPT use with a direct assessment of vocabulary mastery. In doing so, it seeks to contribute empirical evidence regarding whether students' engagement with ChatGPT corresponds to measurable differences in vocabulary achievement.

Accordingly, this study addresses the following research question: Is there a statistically significant relationship between students' use of ChatGPT and their vocabulary mastery? By answering this question, the study seeks to contribute to a more nuanced understanding of the role of generative AI in EFL vocabulary learning and provide practical insights for educators regarding the extent to which students' independent engagement with ChatGPT corresponds to measurable vocabulary proficiency.

METHODS

Research Design

This study employed a quantitative correlational research design to examine the relationship between students' use of ChatGPT and their vocabulary mastery. A correlational design was considered appropriate because the study aimed to determine the strength and direction of the relationship between two naturally occurring variables without manipulating either variable or introducing an experimental treatment. In this study, students' ChatGPT use was treated as the first variable, while vocabulary mastery was treated as the second variable. The study therefore focused on determining whether variation in students' reported engagement with ChatGPT was statistically associated with variation in their vocabulary test performance.

The use of a correlational design was consistent with the study's objective of investigating an association rather than establishing a causal relationship. Consequently, the findings were interpreted in terms of the strength, direction, and statistical significance of the relationship between the two variables and were not intended to demonstrate that ChatGPT use directly caused changes in students' vocabulary mastery.

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Research Setting and Participants

The study was conducted at MAN 1 Kota Palu, a secondary school located in Palu, Central Sulawesi, Indonesia. The participants were eleventh-grade students enrolled during the 2024/2025 academic year. A total of 54 students participated in the study and were selected through purposive sampling.

Purposive sampling was used because the participants were required to meet criteria relevant to the objectives of the study. Specifically, the selected students had previous experience using ChatGPT and were familiar with its application for English language-learning activities. This criterion was important because the study sought to examine the relationship between students' actual engagement with ChatGPT and their vocabulary mastery. Students without previous experience using ChatGPT would therefore not have been able to provide meaningful responses to the ChatGPT Usage Questionnaire.

The selected participants represented eleventh-grade students who had access to digital technologies and experience using ChatGPT as part of their independent or academic learning activities. Participation was voluntary, and all participants were informed about the purpose and procedures of the study before data collection. Informed consent was obtained from all participants, and the confidentiality of their responses was maintained throughout the research process.

Research Instruments

Two instruments were used to collect the data: a ChatGPT Usage Questionnaire and a Vocabulary Mastery Test. The questionnaire was used to obtain information about students' engagement with ChatGPT in vocabulary learning, whereas the vocabulary test was administered to provide an objective measure of their lexical knowledge.

ChatGPT Usage Questionnaire

The ChatGPT Usage Questionnaire consisted of 20 items covering two related dimensions: frequency of ChatGPT use and perceived usefulness of ChatGPT for vocabulary learning. For the primary analysis, responses across these two dimensions were combined to represent students' overall engagement with ChatGPT for vocabulary-learning purposes. Accordingly, the term *ChatGPT use* in this study refers broadly to students' reported engagement with the technology, encompassing both how frequently they used ChatGPT and how useful they perceived it to be for supporting vocabulary learning. Responses were recorded on a five-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree), with higher overall scores indicating greater engagement with ChatGPT for vocabulary learning.

Before administration, the questionnaire underwent content validation by two experts in English education, who evaluated the clarity, relevance, and appropriateness of the items. Revisions were subsequently made based on their recommendations to improve the quality and suitability of the instrument. A pilot test was then conducted to examine the questionnaire's internal consistency. The reliability analysis indicated a Cronbach's alpha coefficient above the acceptable threshold of .70, demonstrating adequate internal consistency for the purposes of this study.

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Vocabulary Mastery Test

Students' vocabulary mastery was assessed using a 30-item multiple-choice test designed to measure several aspects of lexical knowledge, including word definitions, synonyms, antonyms, contextual use, and vocabulary identification. The test items were adapted from English learning materials for senior high school students and aligned with the learning objectives specified in the national curriculum.

The test underwent content validation by experts in English language education and experienced classroom teachers to ensure that the items were appropriate for the participants' educational level and relevant to the intended vocabulary constructs. An item analysis was also conducted to identify unclear, excessively difficult, or otherwise problematic items. Based on the validation and item-analysis procedures, necessary revisions were made before the final administration of the test. The final version was considered to demonstrate satisfactory validity and reliability for assessing students' vocabulary mastery. Scores ranged from 0 to 100, with higher scores indicating greater vocabulary mastery.

Data Collection Procedures

Data collection was conducted during the second semester of the 2024/2025 academic year. Before collecting the data, permission was obtained from the school administration and English teachers. The students were informed about the objectives of the study and the procedures involved, and participation was entirely voluntary.

The data collection process consisted of two stages. First, participants completed the ChatGPT Usage Questionnaire in a classroom setting. Approximately 15–20 minutes were allocated for completion, and students were encouraged to provide honest responses based on their actual experiences of using ChatGPT for English language learning.

Second, the participants completed the Vocabulary Mastery Test under supervised classroom conditions. The same general testing procedures were applied to all participants to maintain consistency in test administration. The students' questionnaire responses and vocabulary test scores were subsequently compiled, coded, and prepared for statistical analysis.

Data Analysis

The collected data were analyzed using descriptive and inferential statistics. Descriptive statistics were first used to summarize students' ChatGPT use and vocabulary mastery. These analyses included measures of central tendency and variability, as appropriate, to provide an overview of the participants' questionnaire responses and vocabulary test performance.

Before conducting the correlation analysis, the distribution of the data was examined using the Kolmogorov–Smirnov normality test. The normality test was conducted to determine whether the data satisfied the distributional assumption required for parametric correlation analysis. Based on the normality results reported in the study, Pearson's product-moment correlation was subsequently employed to examine the strength, direction,

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and statistical significance of the relationship between students' ChatGPT use and vocabulary mastery.

The correlation coefficient (*r*) was interpreted according to its magnitude and direction, while statistical significance was evaluated at the .05 level. A *p*-value below .05 was considered statistically significant, whereas a *p*-value above .05 indicated insufficient evidence to reject the null hypothesis.

Ethical Considerations

Ethical principles were observed throughout the research process. Permission to conduct the study was obtained from the relevant school authorities before data collection. Participants were informed about the purpose of the study, the voluntary nature of their participation, and their right to withdraw without penalty. Their responses were treated confidentially and used exclusively for research purposes.

RESULTS

This section presents the findings concerning students' engagement with ChatGPT for vocabulary learning, their vocabulary mastery, the distribution of the data, and the relationship between the two main variables. The results are organized into four parts: descriptive statistics of ChatGPT use and vocabulary mastery, students' vocabulary mastery, assumption testing, and correlation and hypothesis testing.

Students' Use of ChatGPT for Vocabulary Learning

Table 1 presents the descriptive statistics for students' overall ChatGPT use and vocabulary mastery. In this study, *ChatGPT use* refers to students' overall reported engagement with ChatGPT for vocabulary-learning purposes, encompassing both frequency of use and perceived usefulness.

Table 1. Descriptive statistics of the variables

Variable	N	Minimum	Maximum	Mean
ChatGPT Use	54	30	70	50.94
Vocabulary Mastery	54	42	99	85.33

As shown in Table 1, the ChatGPT-use scores ranged from 30 to 70, with a mean score of 50.94. Considering that the questionnaire measured students' frequency of ChatGPT use and their perceptions of its usefulness for vocabulary learning, the findings indicate generally positive engagement with the technology. The variation in scores also shows that students differed in the extent to which they used and perceived the usefulness of ChatGPT for vocabulary-learning purposes.

Analysis of the frequency-of-use dimension showed that students commonly reported using ChatGPT to learn new vocabulary, obtain word meanings, generate example sentences, and assist with English assignments. Students also reported using ChatGPT when encountering unfamiliar vocabulary and seeking immediate explanations. These findings

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indicate that ChatGPT was incorporated into various vocabulary-related learning activities among the participants.

The perceived-usefulness dimension similarly showed generally positive responses. Students reported that ChatGPT helped them understand vocabulary more quickly, provided examples of word use, and made vocabulary learning more practical. Many participants also perceived ChatGPT as helpful for supporting independent learning beyond the classroom. Nevertheless, the variation in overall questionnaire scores indicates that students' patterns of engagement were not uniform, with some reporting greater use and stronger perceptions of usefulness than others.

Students' Vocabulary Mastery

Students' vocabulary mastery was assessed using a 30-item multiple-choice test covering word definitions, synonyms, antonyms, contextual use, and vocabulary identification. As presented in Table 1, vocabulary scores ranged from 42 to 99, with a mean score of 85.33. These results indicate that the participants generally demonstrated relatively high vocabulary achievement, although individual performance varied considerably across the sample.

The difference between the minimum and maximum scores shows substantial variation in students' vocabulary mastery. While many students obtained relatively high scores, others demonstrated lower levels of performance. This variability provided an appropriate basis for examining whether differences in vocabulary achievement were statistically associated with students' reported engagement with ChatGPT.

Assumption Testing

Before conducting the correlation analysis, the normality of the data was examined using the Kolmogorov–Smirnov test. Table 2 presents the normality-test results for the two dimensions of the ChatGPT Usage Questionnaire.

Table 2. Results of the Kolmogorov–Smirnov normality test

Variable	N	Mean	SD	Sig.
Frequency of ChatGPT Use	54	24.81	5.80	.200
Benefit of ChatGPT Use	54	26.13	5.00	.067

The significance value for the frequency-of-use dimension was .200, while that for perceived usefulness was .067. Since both values exceeded the .05 significance level, the distributions of these dimensions were considered approximately normal. Based on these results, the data were considered suitable for subsequent parametric analysis.

The descriptive statistics further indicate that the mean score for perceived usefulness (M = 26.13, SD = 5.00) was slightly higher than that for frequency of use (M = 24.81, SD = 5.80). This pattern suggests that students tended to report relatively positive perceptions of ChatGPT's usefulness even when their actual frequency of use varied. However, whether

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such engagement was associated with vocabulary achievement required further examination through correlation analysis.

Relationship between ChatGPT Use and Vocabulary Mastery

Pearson's product-moment correlation was conducted to examine the relationship between students' overall engagement with ChatGPT and their vocabulary mastery. The results are presented in Table 3.

Table 3. Pearson Product-Moment correlation analysis

Variables	r	Sig. (2-tailed)	N
ChatGPT Use and Vocabulary Mastery	.020	.886	54

The analysis yielded a correlation coefficient of $r = .020$, indicating a negligible positive relationship between students' overall engagement with ChatGPT and their vocabulary mastery. The significance value was $p = .886$, which was considerably higher than the predetermined alpha level of .05. Therefore, the relationship between the two variables was not statistically significant.

These findings indicate that greater overall engagement with ChatGPT was not associated with higher vocabulary scores among the participants in this study. More specifically, students reporting higher levels of ChatGPT engagement, encompassing both frequency of use and perceived usefulness, did not necessarily demonstrate higher vocabulary mastery than students reporting lower levels of engagement. The near-zero correlation coefficient indicates that there was virtually no linear association between the two variables in this sample.

Hypothesis Testing

The study proposed the following hypotheses:

H_0: There is no significant relationship between students' use of ChatGPT and their vocabulary mastery.

H_1: There is a significant relationship between students' use of ChatGPT and their vocabulary mastery.

The Pearson correlation analysis yielded $r = .020$ and $p = .886$. Since the significance value exceeded the .05 threshold, the study **failed to reject the null hypothesis (H_0)**. Therefore, there was insufficient statistical evidence to conclude that students' overall engagement with ChatGPT was significantly related to their vocabulary mastery among the eleventh-grade students participating in this study.

Overall, the results reveal a clear distinction between students' reported engagement with ChatGPT and their objectively assessed vocabulary achievement. Although students generally reported positive engagement with ChatGPT and recognized its usefulness for vocabulary-related activities, these patterns were not associated with statistically measurable differences in vocabulary test performance. The implications of this finding and

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possible explanations for the absence of a significant relationship are discussed in the following section.

DISCUSSION

This study examined the relationship between students' engagement with ChatGPT and their vocabulary mastery among eleventh-grade students at MAN 1 Kota Palu. The findings revealed that students generally demonstrated positive engagement with ChatGPT for vocabulary-learning purposes. They reported using the technology to obtain word definitions, identify synonyms and antonyms, generate example sentences, clarify unfamiliar vocabulary, and support English assignments. Students also generally perceived ChatGPT as a useful and accessible resource that could facilitate independent learning. However, despite these positive patterns of engagement, the correlation analysis revealed a negligible and statistically nonsignificant relationship between overall ChatGPT engagement and vocabulary mastery (r = .020, p = .886). Thus, students who reported greater engagement with ChatGPT did not necessarily demonstrate higher vocabulary scores than those reporting lower levels of engagement.

The positive perceptions identified in this study are consistent with the growing body of research highlighting the pedagogical potential of ChatGPT in language education. Previous studies have shown that ChatGPT can provide immediate feedback, personalized explanations, interactive language practice, and convenient access to learning resources, all of which may enhance students' learning experiences (Kasneci et al., 2023; Kohnke et al., 2023; Lo et al., 2024). Similarly, studies conducted in EFL contexts have reported generally favorable attitudes toward ChatGPT because of its accessibility, responsiveness, and capacity to support independent language-learning activities (Baig & Yadegaridehkordi, 2024; Kurniadi & Satria, 2025; Tusino et al., 2025). The present findings reinforce this pattern by showing that secondary-school EFL learners also recognize ChatGPT as a potentially useful resource for vocabulary-related activities.

In vocabulary learning specifically, ChatGPT offers several affordances that may explain students' positive perceptions. Learners can request definitions, translations, synonyms, antonyms, contextualized examples, and further clarification according to their individual needs. Unlike static dictionaries or conventional vocabulary resources, ChatGPT enables interactive exchanges in which learners can refine their questions and request additional examples. Previous studies have similarly suggested that AI-supported tools may facilitate vocabulary learning by providing personalized assistance and immediate access to lexical information (Abdelhalim & Alsehibany, 2025; Galuh et al., 2025; Karataş et al., 2024). From this perspective, the favorable responses reported by participants in the present study are consistent with the broader pedagogical affordances associated with generative AI.

Nevertheless, the principal finding of this study is that positive engagement with ChatGPT did not correspond to higher vocabulary mastery. The correlation coefficient of r = .020 indicates virtually no linear relationship between the two variables, while the significance value of p = .886 confirms that the observed association was not statistically significant. This finding is important because it highlights a distinction between learners' engagement with or perceptions of educational technology and their objectively measured

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learning outcomes. Students may value a technological tool, use it regularly, and perceive it as helpful without necessarily demonstrating higher achievement as measured by a vocabulary test.

One possible explanation is that the frequency of technology use does not necessarily reflect the quality or depth of learning engagement. Students may use ChatGPT for various purposes, ranging from actively exploring vocabulary and requesting contextualized explanations to simply obtaining quick answers for assignments. These different patterns of use may produce substantially different learning experiences even when students report similar levels of overall engagement. Previous research has emphasized that the educational effectiveness of ChatGPT depends not merely on access or frequency of use but also on the quality of prompts, learners' critical evaluation of AI-generated responses, and the pedagogical purposes for which the technology is employed (Farrokhnia et al., 2024; Han, 2024). Therefore, the absence of a significant correlation in the present study may reflect differences in how students interacted with ChatGPT rather than simply how frequently they accessed it.

The finding may also be understood in relation to the multidimensional nature of vocabulary development. Vocabulary mastery is not typically determined by a single technological resource but develops through repeated exposure, meaningful use, reading, classroom instruction, interaction, retrieval practice, and various forms of intentional and incidental learning. Technology may facilitate some of these processes, but its presence alone cannot guarantee vocabulary acquisition. As previous research on technology-assisted language learning has demonstrated, technological resources can create valuable learning opportunities, but actual outcomes depend substantially on how learners engage with those opportunities (Elgort, 2018; Golonka et al., 2014).

Another possible explanation concerns learner-related factors that may influence how effectively students benefit from AI-assisted learning. Motivation, self-regulated learning, learner autonomy, prior knowledge, digital literacy, and language exposure may shape students' ability to transform access to technological resources into meaningful learning outcomes. Theoretical perspectives on motivation and learner agency suggest that students differ in their willingness to initiate learning activities, sustain effort, monitor their understanding, and independently select appropriate learning strategies (Bandura, 1977; Benson, 2011; Ryan & Deci, 2020). In the context of ChatGPT use, some students may actively explore unfamiliar words, compare meanings, request additional examples, and apply new vocabulary in meaningful contexts, whereas others may interact with the technology more superficially.

However, these factors should be interpreted cautiously in relation to the present findings. Motivation, self-regulation, learner autonomy, digital literacy, prior vocabulary knowledge, and language exposure were not directly measured in this study. Therefore, they cannot be regarded as empirically established explanations for the nonsignificant correlation. Rather, they represent theoretically plausible factors that may help explain why students with similar levels of reported ChatGPT engagement can demonstrate different vocabulary outcomes. Future research could directly measure these variables to determine

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whether they moderate or mediate the relationship between AI-assisted learning and vocabulary achievement.

The distinction between frequency of use and perceived usefulness also deserves particular attention. The ChatGPT Usage Questionnaire in this study covered both dimensions and combined them into an overall measure of students' engagement with ChatGPT for vocabulary learning. However, frequency and perceived usefulness represent related but conceptually distinct aspects of technology engagement. A student may perceive ChatGPT as highly useful without using it frequently, while another may use it regularly without necessarily engaging in learning activities that promote vocabulary retention. The descriptive results of this study showed that students' mean perceived-usefulness score (M = 26.13, SD = 5.00) was slightly higher than their mean frequency-of-use score (M = 24.81, SD = 5.80), suggesting that positive perceptions of the technology did not always correspond directly to greater frequency of use.

This distinction may also help explain why the overall measure of ChatGPT engagement showed almost no relationship with vocabulary mastery. Combining frequency of use and perceived usefulness into a single composite measure provides a broad indication of students' engagement, but it may not fully capture the specific ways in which each dimension relates to learning achievement. Future studies may therefore benefit from examining frequency of use, perceived usefulness, quality of interaction, learning purpose, and prompting strategies as separate dimensions. Such an approach could provide a more nuanced understanding of which forms of engagement with ChatGPT, if any, are most closely associated with vocabulary development.

The findings also differ from studies reporting positive effects of AI-supported interventions on language learning outcomes. Experimental and quasi-experimental research has shown that structured AI-assisted learning activities may improve vocabulary development or other aspects of language proficiency when learners receive guided tasks, systematic practice, and pedagogical support (Abdelhalim & Alsehibany, 2025; Galuh et al., 2025; Karataş et al., 2024). The difference between those findings and the present study may be partly explained by research design. The current study examined students' naturally occurring engagement with ChatGPT rather than implementing a structured instructional intervention. Consequently, students differed in how frequently, purposefully, and systematically they used the technology.

This difference between independent use and pedagogically structured use is important. The educational potential of ChatGPT may be greater when its use is incorporated into carefully designed learning activities that require students to actively process, retrieve, compare, and apply new vocabulary. In contrast, unguided use may involve highly variable learning behaviors and may not consistently promote long-term vocabulary retention. Thus, the nonsignificant relationship found in this study should not be interpreted as evidence that ChatGPT is ineffective for vocabulary learning. Instead, it indicates that students' overall reported engagement with ChatGPT, as measured in this study, was not sufficient to explain individual differences in vocabulary achievement.

The Indonesian secondary-school context also adds significance to these findings. Previous research in Indonesia has examined digital literacy, technology integration, and AI

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adoption among EFL learners and educators (Kurniawati et al., 2018; Pertiwi, 2022; Wafa & Sulistyaningsih, 2025), while more recent studies have explored students' perceptions of ChatGPT and its potential role in language learning (Kurniadi & Satria, 2025; Tusino et al., 2025). However, relatively limited empirical attention has been given to whether students' engagement with ChatGPT corresponds to objectively measured language achievement, particularly among secondary-school learners. The present study therefore contributes evidence showing that favorable engagement with generative AI should not automatically be equated with higher vocabulary proficiency.

From a pedagogical perspective, the findings suggest that teachers should consider ChatGPT as a supplementary resource rather than assume that frequent independent use will automatically improve vocabulary mastery. Students may benefit from explicit guidance on how to use ChatGPT for meaningful vocabulary learning, such as requesting contextualized examples, comparing word meanings, generating retrieval-practice activities, creating personalized exercises, and applying newly learned vocabulary in sentences or communicative tasks. Teacher guidance may help learners move beyond obtaining immediate answers toward more active and reflective engagement with lexical knowledge.

More broadly, the findings support a cautious and evidence-based approach to the integration of generative AI in EFL education. The pedagogical value of ChatGPT may lie not simply in whether students use it, but in how, why, and for what learning purposes they use it. Frequency and positive perceptions alone may provide an incomplete picture of AI-assisted learning. Future research should therefore examine the quality of learner–AI interaction, prompting strategies, duration and purpose of use, self-regulatory behaviors, digital literacy, and opportunities to apply newly encountered vocabulary. Longitudinal and experimental designs may also provide stronger evidence regarding whether structured and sustained use of ChatGPT contributes to vocabulary development over time.

Overall, the findings demonstrate a meaningful distinction between students' positive engagement with ChatGPT and their measurable vocabulary achievement. Although participants generally regarded ChatGPT as accessible, practical, and useful for vocabulary-related activities, greater overall engagement with the technology was not associated with higher vocabulary mastery. This finding does not diminish the potential educational value of ChatGPT; rather, it suggests that its effectiveness may depend on the quality, purpose, and pedagogical structure of its use. ChatGPT may therefore be most beneficial when integrated thoughtfully into broader language-learning practices rather than treated as an independent determinant of vocabulary achievement.

CONCLUSION

This study examined the relationship between students' engagement with ChatGPT and their vocabulary mastery among eleventh-grade EFL learners at MAN 1 Kota Palu, Indonesia. The findings showed that students generally demonstrated positive engagement with ChatGPT for vocabulary-learning purposes, using the technology to obtain word meanings, generate example sentences, clarify unfamiliar vocabulary, and support English-related learning activities. Students also generally perceived ChatGPT as a useful and accessible resource for independent vocabulary learning. However, Pearson's correlation

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analysis revealed a negligible and statistically nonsignificant relationship between students' overall engagement with ChatGPT and their vocabulary mastery (r = .020, p = .886). Therefore, students reporting greater engagement with ChatGPT did not necessarily demonstrate higher vocabulary achievement.

These findings highlight an important distinction between engagement with educational technology and objectively measured learning outcomes. Positive perceptions and frequent use of ChatGPT should not automatically be interpreted as evidence of higher vocabulary proficiency. The educational value of ChatGPT may depend not only on whether students use the technology but also on how purposefully and meaningfully they interact with it. Factors such as the quality of learner–AI interaction, the purposes for which ChatGPT is used, prompting strategies, opportunities for vocabulary retrieval and application, and the degree of pedagogical guidance may potentially shape its effectiveness for language learning. However, since these factors were not directly measured in the present study, they should be regarded as possible considerations rather than empirically established explanations for the findings.

The study contributes to the emerging literature on generative AI in EFL education by providing empirical evidence from an Indonesian secondary-school context, which remains comparatively underrepresented in existing research. While many previous studies have focused primarily on university students' perceptions, acceptance, or experiences of ChatGPT, the present study examined the relationship between students' reported engagement with ChatGPT and objectively assessed vocabulary mastery. The findings therefore contribute to a more nuanced understanding of AI-assisted language learning by demonstrating that favorable engagement with generative AI does not necessarily correspond to higher measurable vocabulary achievement.

From a pedagogical perspective, ChatGPT should be viewed as a supplementary learning resource rather than an independent determinant of vocabulary achievement. Teachers may help students use the technology more strategically by designing activities that require them to explore word meanings in context, compare synonyms and antonyms, generate and evaluate example sentences, practice vocabulary retrieval, and apply newly learned words in meaningful communicative tasks. Such guidance may help students move beyond simply obtaining immediate answers and toward deeper engagement with vocabulary knowledge. Therefore, the effective integration of ChatGPT into EFL instruction may require purposeful task design, learner guidance, and opportunities to actively process and use newly encountered vocabulary.

Several limitations should be acknowledged when interpreting the findings. First, the study involved a relatively small sample of 54 students from a single secondary school, which limits the generalizability of the findings to broader EFL populations. Second, the correlational design identifies statistical associations but does not establish causal relationships between ChatGPT engagement and vocabulary mastery. Third, students' engagement with ChatGPT was measured through self-reported questionnaire responses, which may not fully represent their actual patterns, duration, purposes, or quality of use. In addition, the operationalization of ChatGPT use combined frequency of use and perceived usefulness into an overall measure of engagement. Although these dimensions are related,

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they represent conceptually distinct aspects of technology use and may have different relationships with learning outcomes.

Future research should therefore examine these dimensions separately and investigate more specific aspects of learner–AI interaction, including frequency and duration of use, learning purposes, prompting strategies, quality of interaction, and the extent to which students actively retrieve and apply vocabulary encountered through ChatGPT. Studies involving larger and more diverse samples across multiple educational settings would also improve the generalizability of findings. Furthermore, longitudinal, experimental, or quasi-experimental research could provide stronger evidence regarding whether structured and sustained ChatGPT-assisted activities contribute to vocabulary development over time. Future studies may also directly examine potentially relevant learner-related factors, such as motivation, self-regulated learning, digital literacy, prior vocabulary knowledge, and language exposure, rather than treating them solely as theoretical explanations.

Overall, this study demonstrates that students' positive engagement with ChatGPT does not necessarily correspond to higher vocabulary mastery. The findings should not be interpreted as evidence that ChatGPT lacks educational value; rather, they indicate that the relationship between generative AI use and language-learning outcomes is more complex than frequency of use or positive perceptions alone can explain. ChatGPT may offer meaningful support for EFL vocabulary learning when used purposefully and integrated into well-designed learning activities, but its educational effectiveness ultimately depends on the nature and quality of learners' engagement with the technology.

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