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Developing Academic Vocabulary through Computer-Assisted Language Learning: A Cognitive-Linguistic Approach

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Abstract

Developing academic vocabulary remains a significant challenge for learners of English as a foreign language, particularly in academic writing. This study addressed the following research question: How much can a cognitively grounded, technology-enhanced instructional approach improve academic vocabulary development among postgraduate learners? It examined the effectiveness of Computer-Assisted Language Learning, supported by cognitive-linguistic principles, in developing academic vocabulary. Its significance lies in integrating cognitive linguistics, academic vocabulary research, and technology-enhanced language learning into a cohesive instructional framework. An explanatory sequential mixed-methods design was used. The study involved 60 postgraduate English as a foreign language learners, selected through purposive sampling and divided into experimental (n = 30) and control (n = 30) groups. Data were collected through academic vocabulary tests, collocational and phraseological competence assessments, academic writing tasks, questionnaires, interviews, and corpus analysis. Results showed that the experimental group significantly outperformed the control group in academic vocabulary knowledge, collocational and phraseological competence, and lexical richness in academic writing. Participants also

expressed positive views of technology-supported learning environments, noting increased engagement, independence, and confidence in academic writing. The study concludes that combining cognitive-linguistic principles with Computer-Assisted Language Learning offers an effective strategy for developing academic vocabulary. Future research should explore the long-term impacts of these interventions across various educational settings and learner groups.
Keywords: Academic vocabulary, Artificial Intelligence, Cognitive Linguistics, Computer-Assisted Language Learning, Phraseological Competence
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Introduction

Academic vocabulary is essential to academic literacy and shapes students' ability to produce effective academic writing. Recent studies show that academic discourse includes not only individual words but also phrases, collocations, and recurring patterns that promote coherence and enhance discipline-specific knowledge. Resources such as the Academic Word List (AWL) (Coxhead, 2000) and the Academic Vocabulary List (AVL) (Gardner & Davies, 2014) help identify words commonly used across various fields. However, participating in academic discourse involves more than knowing isolated words; it also depends on the ability to use phrases and vocabulary appropriately within specific contexts.

Despite its importance, English as a Foreign Language (EFL) learners often struggle with academic vocabulary. Studies show that students typically have difficulty using vocabulary effectively, maintaining collocational accuracy, and applying academic phrases correctly. These challenges can negatively affect the quality of their writing (AlMarwani, 2020). Differences across disciplines compound these difficulties because different fields use distinct vocabulary and phrases. Traditional vocabulary instruction often emphasizes memorizing individual words rather than using language in context, which limits learners' ability to develop deeper vocabulary skills.

Recent advances in Computer-Assisted Language Learning (CALL) and artificial intelligence (AI) offer new approaches to teaching academic vocabulary. CALL environments provide access to real-world language data, concordancers, AI writing tools, and feedback systems that support contextual vocabulary learning. Research indicates that these technologies can increase learner engagement, promote independent learning, and improve language development (Crompton & Burke, 2023; Kasneci et al., 2023). However, evidence on how effectively these tools enhance academic vocabulary, collocational skills, and phrase knowledge remains limited.

This study is grounded in Cognitive Linguistics, particularly Usage-Based Theory, Construction Grammar, Conceptual Metaphor Theory, Schema Theory, and Categorization Theory. These theories view language learning as recognizing patterns, conceptualizing ideas, categorizing information, and using language meaningfully. From this perspective, vocabulary learning involves forming connections between form and meaning through repeated exposure to authentic language patterns rather than mere memorization. CALL environments effectively support these processes by providing learners with opportunities to interact with language in various contexts and to receive immediate feedback.

While previous research has examined either CALL technology or cognitive approaches to language learning, there has been limited focus on how these cognitive strategies work together

within CALL instruction to influence academic vocabulary development. Therefore, this study aims to explore how a cognitive-linguistic, CALL-based approach can enhance EFL learners' vocabulary knowledge, collocational skills, phraseological understanding, and academic writing.

The study is important because it integrates cognitive-linguistic theory, corpus-based vocabulary methods, and modern CALL technologies into a unified instructional framework. The findings will advance the field of AI-assisted language learning and offer practical insights for teaching academic writing in higher education.

The aim of the study is to examine the effectiveness of a cognitive approach to CALL instruction in developing academic vocabulary among postgraduate EFL learners.

The study has several goals: (1) to identify academic vocabulary and phrase patterns common in student writing; (2) to develop CALL-based activities grounded in cognitive principles; (3) to measure the program's impact on learners' vocabulary knowledge, collocational skills, and phrase knowledge; (4) to assess changes in the quality of academic writing; and (5) to explore learners' opinions about CALL and AI tools for vocabulary learning.

The study seeks to answer these research questions:

1. Does taking part in a cognitive CALL program significantly improve learners' vocabulary knowledge?
2. To what extent does the program enhance learners' collocational and phrase knowledge?
3. Does the CALL approach improve vocabulary richness and appropriate academic vocabulary use in writing?
4. Are there significant differences between the experimental and control groups in post-test results for vocabulary development?
5. How do learners perceive the effectiveness of CALL and AI tools for academic vocabulary learning?

Literature Review

Academic vocabulary is widely recognized as a key component of academic literacy and success in higher education. Corpus-based research has been instrumental in identifying lexical features typical of academic discourse. The Academic Word List (AWL), created by Coxhead (2000), and the Academic Vocabulary List (AVL), proposed by Gardner and Davies (2014), have become influential tools for describing vocabulary that frequently appears across academic disciplines.

Contemporary research highlights phraseological competence as a key component of academic language skills. Learners need to understand academic vocabulary and use it accurately within common phrases and patterns specific to their field. Studies indicate that effective academic writing depends on integrating vocabulary, grammar, and discourse structures. This integration enhances lexico-syntactic competence (Strochenko et al., 2025). However, English as a Foreign Language (EFL) learners often struggle to use vocabulary effectively, master accurate collocations, and apply field-specific variations. These challenges can lead to less sophisticated academic writing (AlMarwani, 2020).

An important theory in vocabulary studies is Nation's Vocabulary Learning Framework. This framework defines vocabulary knowledge as encompassing form, meaning, and use. Each aspect includes both receptive and productive dimensions (Nation, 2013). The distinction between the breadth and depth of vocabulary knowledge has also received significant attention. Breadth refers to the number of words known, while depth concerns the quality of that knowledge. Depth

includes collocations, semantic associations, phraseological patterns, and context appropriateness (Qian, 2002). These ideas suggest that effective academic vocabulary teaching should focus on meaningful, contextual language use rather than merely memorizing isolated words.

Cognitive Linguistics offers a robust theoretical foundation for understanding how we acquire vocabulary. Unlike traditional views that treat vocabulary as discrete units, Cognitive Linguistics regards language as a system of symbolic constructions rooted in human cognition and experience (Langacker, 2008). Several cognitive theories are closely linked to the learning of academic vocabulary.

Usage-Based Theory holds that we learn language through repeated exposure to authentic language use and gradually recognize patterns (Bybee, 2010). From this perspective, vocabulary acquisition improves with frequent encounters with words and phrases in meaningful contexts. Construction Grammar holds that language consists of form-meaning pairings, or constructions, learned through repeated use (Goldberg, 2006). Academic lexical bundles and recurring phrases can therefore be viewed as constructions that become ingrained through practice and exposure.

Conceptual Metaphor Theory highlights the role of metaphorical thinking in learning abstract academic language (Lakoff & Johnson, 1980). Many academic ideas are expressed through metaphors, such as knowledge as construction, argument as war, or research as a journey. Understanding these conceptual connections promotes a deeper grasp of academic vocabulary and improves vocabulary retention.

Schema Theory and Categorization Theory further clarify how learners organize and retain vocabulary. Schemas provide mental frameworks that link new words to existing knowledge, while categorization helps learners group words by semantic and conceptual similarities (Taylor, 2003). Conceptual mapping activities, semantic networks, and categorization tasks therefore support vocabulary development by strengthening mental connections and promoting long-term memory.

Several influential theories of vocabulary learning complement the cognitive-linguistic perspective. Schmidt's (1990) Noticing Hypothesis holds that conscious attention to linguistic forms is essential for acquisition. Similarly, Laufer and Hulstijn's (2001) Involvement Load Hypothesis maintains that vocabulary retention depends on the degree of cognitive engagement required by learning tasks. Lexical Chunk Theory focuses on the acquisition of multiword units rather than isolated words (Lewis, 1993), while Input Processing Theory holds that learners acquire language more effectively when they attend to meaningful input before explicit form-focused instruction (VanPatten, 2015). Together, these theories underscore the importance of attention, cognitive engagement, conceptualization, and phraseological learning in vocabulary development.

Computer-Assisted Language Learning (CALL) has become one of the most influential approaches to teaching vocabulary. CALL environments provide learners with access to authentic language data, concordancers, corpora, and interactive activities that support context-based vocabulary learning. Research consistently shows that corpus-based learning promotes pattern recognition, collocation awareness, and phraseological skills by exposing learners to real-world language use (Boulton & Cobb, 2017).

The effectiveness of CALL can be explained by cognitive-linguistic principles. Corpus tools support noticing and pattern recognition, concordancing supports conceptual mapping between form and meaning, and interactive activities aid categorization and the development of lexical networks. As a result, CALL environments closely align with Usage-Based Theory, Construction Grammar, and the Noticing Hypothesis. Despite these benefits, previous research has

mainly focused on technological features rather than the cognitive processes underlying vocabulary learning.

Recent advances in Artificial Intelligence have greatly expanded the possibilities of CALL. AI-powered writing tools, intelligent tutoring systems, and conversational agents provide learners with adaptive feedback, personalized suggestions, and opportunities for independent practice (Crompton & Burke, 2023). Research shows that AI can enhance lexical choices, improve textual coherence, and boost the quality of academic writing, while also increasing learner engagement and motivation (Kasneci et al., 2023).

Recent studies in Scopus- and Web of Science-indexed journals show that AI-assisted learning environments support self-regulated learning and facilitate vocabulary development when pedagogically guided (Delcker et al., 2024; AlMashagbeh et al., 2025; Granström & Oppi, 2025). Research in AWEJ also reports positive effects of generative AI tools on language learning and learner motivation, while emphasizing the need for critical AI literacy and responsible use (Bekdaş, 2025).

From a cognitive-linguistic perspective, AI tools have specific potential to support conceptual mapping, categorization, noticing, and phraseological learning. AI-generated feedback can help learners focus on collocations, lexical bundles, and discipline-specific vocabulary patterns, thereby supporting deeper lexical processing. However, concerns remain about overreliance on automated feedback, superficial processing, and academic integrity issues (Kasneci et al., 2023).

The literature indicates that research on academic vocabulary development, cognitive-linguistic theories of language learning, CALL technologies, and AI-assisted instruction has been extensive. However, these areas have largely been examined separately. Most existing studies focus either on the technological advantages of CALL and AI tools or on theoretical explanations of vocabulary acquisition. There is relatively little empirical research on how cognitive-linguistic principles such as conceptual mapping, categorization, metaphorical thinking, noticing, and phraseological learning can be systematically integrated into CALL environments to enhance measurable aspects of academic vocabulary growth. Additionally, limited attention has been given to how this integration affects academic vocabulary knowledge, collocational skills, phraseological skills, and academic writing performance among postgraduate EFL learners. This study aims to address that gap by exploring the effectiveness of a cognitively grounded, CALL-based model for developing academic vocabulary.

Methodology

Research Design

The study used a sequential mixed-methods design, combining quantitative and qualitative approaches to clarify academic vocabulary development in a cognitively informed CALL environment. The quantitative phase evaluated the instructional intervention's effectiveness using pre- and post-tests. The qualitative phase examined learners' perceptions and experiences with CALL and AI-assisted vocabulary learning. The independent variable was the cognitively informed CALL-based instructional model, and the dependent variables included academic vocabulary knowledge, collocation skills, phraseological skills, lexical richness in academic writing, and students' views on the learning process.

Participants

The study involved 60 postgraduate EFL students enrolled in academic writing courses at a Ukrainian university. Participants were selected via purposive sampling to ensure comparable English proficiency (B2–C1 according to the CEFR) and prior experience with academic writing tasks. The sample included 38 female and 22 male students, aged 21 to 28 years (M = 24.3 years). Participants came from various academic disciplines, including Linguistics (n = 18), Law (n = 16), Education (n = 12), International Relations (n = 8), and Economics (n = 6). All participants were native Ukrainian speakers learning English as a foreign language. The sample was divided into an experimental group (n = 30) and a control group (n = 30). The experimental group received instruction through CALL-based tools designed according to cognitive-linguistic principles, while the control group followed a traditional vocabulary instruction approach using textbooks and teacher-led activities.

Research Instruments

Several tools were used to collect both quantitative and qualitative data. First, an Academic Vocabulary Test was administered before and after the intervention to assess receptive and productive academic vocabulary knowledge. The test included items from the Academic Vocabulary List (AVL), academic lexical bundles, and discipline-specific vocabulary. Second, a Collocational and Phraseological Competence Test evaluated learners' ability to recognize and produce academic collocations, lexical bundles, and common phraseological patterns. Third, participants completed an Academic Writing Task, writing a short argumentative essay. These essays were analyzed for lexical richness, lexical diversity, collocational accuracy, phraseological competence, and the correct use of academic vocabulary. To explore learners' experiences, a structured questionnaire with Likert-scale and open-ended questions was administered after the intervention. Additionally, semi-structured interviews with ten volunteer participants from the experimental group provided further qualitative insights. System logs from corpus platforms, AI writing tools, and vocabulary learning applications were also collected to assess learners' engagement with CALL tools.

Research Procedures

The intervention lasted eight weeks. During the first week, all participants completed the pre-test instruments, including the Academic Vocabulary Test, the Collocational and Phraseological Competence Test, and the Academic Writing Task. Throughout the intervention, the experimental group used corpus-based platforms, AI writing assistants, and interactive vocabulary-learning applications. Instructional activities followed cognitive-linguistic principles and included concordance analysis, conceptual mapping, semantic categorization, collocation matching, lexical bundle identification, and guided academic writing tasks. The focus was on recognizing patterns, expanding metaphors related to academic concepts, and applying discipline-specific vocabulary. The control group engaged in traditional vocabulary-learning activities, such as definition matching, translation exercises, vocabulary lists, and sentence-level practice without CALL tools. At the end of the intervention, all participants completed the post-tests. Following this, a questionnaire was administered, and semi-structured interviews were conducted with selected participants from the experimental group.

Data Analysis

Quantitative data were analyzed using descriptive and inferential statistics. Means, standard deviations, and percentage increases were computed for all measures. Paired-samples t-tests assessed within-group changes from pre-test to post-test, and independent-samples t-tests compared the performance of the experimental and control groups. Statistical significance was set at $p < .05$. The analysis focused on five key outcomes: academic vocabulary knowledge, collocational competence, phraseological competence, lexical richness in academic writing, and overall academic vocabulary performance. Qualitative data from interviews and open-ended questionnaire responses were analyzed thematically. The goal was to identify recurring themes related to learner engagement, perceived usefulness of CALL tools, AI-assisted feedback, vocabulary learning strategies, and challenges encountered during the intervention.

Ethical Considerations

Participation in the study was voluntary. All participants were informed of the study's purpose and provided informed consent before data collection. Anonymity and confidentiality were maintained throughout the study, and participants retained the right to withdraw at any time without penalty.

Results

Table 1 presents the descriptive statistics for the pre-test and post-test measures in both groups.

Table 1. *Descriptive statistics for academic vocabulary development*

Measure	Group	Pre-test M (SD)	Post-test M (SD)	Gain (%)
Academic Vocabulary Knowledge (100)	Experimental (n = 30)	61.4 (8.2)	83.7 (6.9)	+36.3
	Control (n = 30)	60.8 (7.9)	69.5 (7.4)	+14.3
Collocational Competence (50)	Experimental	28.3 (5.1)	41.8 (4.7)	+47.7
	Control	27.9 (5.4)	33.4 (5.2)	+19.7
Phraseological Competence (50)	Experimental	26.7 (4.8)	40.5 (4.9)	+51.7
	Control	27.1 (4.6)	32.8 (5.0)	+21.0
Lexical Richness in Writing (%)	Experimental	58.9 (6.7)	78.6 (5.8)	+33.4
	Control	59.4 (6.4)	66.8 (6.1)	+12.5

The results are presented in relation to the research questions and are based on the analysis of both quantitative and qualitative data collected from the experimental and control groups. For RQ1, the corpus-based analysis of student academic texts revealed recurring lexical features characteristic of academic discourse. The mini-corpus showed a high frequency of nominalizations (e.g., development, analysis, acquisition), abstract nouns (e.g., framework, approach, process), and lexical bundles (e.g., the results of the study, it should be noted that, in the context of). Collocational patterns indicated a preference for verb–noun combinations typical of academic style, such as conduct research, provide evidence, and play a role. These findings confirm that academic vocabulary is not limited to isolated words but involves patterned, context-dependent usage. Therefore, the corpus analysis provided the linguistic foundation for the instructional materials and assessment tools used in the intervention.

Addressing RQ2, incorporating cognitive-linguistic principles into the experimental group led to notable improvements in learners' academic vocabulary knowledge, collocational skills, and phraseological abilities. As shown in Table 1, the experimental group's average score on the

Academic Vocabulary Test rose from 61.4 to 83.7 points, while the control group's score increased from 60.8 to 69.5 points. Paired-samples t-tests revealed statistically significant gains for the experimental group in academic vocabulary knowledge ($t = 9.84$, $p < .001$), collocational ability ($t = 10.27$, $p < .001$), and phraseological skill ($t = 11.13$, $p < .001$). These findings suggest that activities involving conceptual mapping, categorization, pattern recognition, and contextualized language use improved lexical processing and supported longer-lasting vocabulary retention. A more detailed analysis of test components showed that learners in the experimental group achieved especially strong gains in productive vocabulary knowledge. They performed significantly better on tasks requiring context-based lexical selection, paraphrasing, sentence completion, and the production of academic collocations. In contrast, progress in the control group was more evident in receptive vocabulary tasks, indicating that traditional instruction was less effective at promoting active vocabulary use.

Regarding RQ3, the analysis of academic writing tasks revealed significant improvements in lexical richness and the appropriate use of academic vocabulary. Post-test essays from the experimental group showed a broader range of AVL items, more frequent use of lexical bundles, and more discipline-appropriate phraseological patterns. Lexical diversity increased substantially, while collocational errors and incorrect word choices decreased. Independent-samples t-tests showed significant differences between the groups in lexical richness at post-test ($t = 4.96$, $p < .001$). The results also indicated qualitative enhancements in writing performance. Texts produced by students in the experimental group demonstrated greater stylistic appropriateness, stronger cohesion, and more advanced academic phraseology. Compared with the control group, their essays featured more varied vocabulary, a higher frequency of academic lexical bundles, and more precise use of discipline-specific expressions. These improvements contributed to the overall quality and coherence of their academic texts.

For RQ4, the analysis of CALL tool use and learning activities showed that digitally enriched environments supported by cognitive insights provided significant benefits for vocabulary acquisition. System logs and task completion data indicated high engagement with corpus-based platforms, concordancers, and AI-powered writing tools. Learners often explored authentic examples of word use, analyzed collocational patterns, and adjusted lexical choices based on AI feedback. Questionnaire results further confirmed these findings. About 87% of participants reported that CALL tools enhanced their understanding of academic vocabulary in context, while 83% reported that AI feedback helped them improve their lexical choices and writing quality. Additionally, 79% of respondents noted that corpus-based activities increased their awareness of collocations and phrase patterns.

The findings on RQ5 highlighted the overall effectiveness of the cognitively grounded CALL-based approach. Post-test comparisons showed that the experimental group significantly outperformed the control group across all measured variables. The largest gains were in phraseological competence (+51.7%), followed by collocational competence (+47.7%) and academic vocabulary knowledge (+36.3%). These results indicate that learners not only expanded their vocabulary but also developed a more advanced ability to use words appropriately in real academic contexts. Qualitative findings further supported the quantitative results and offered deeper insights into the learning process. Three main themes emerged from the interview data: increased awareness of lexical patterns, improved learner independence, and greater confidence in academic writing. Participants consistently reported that tools such as concordance analysis, semantic categorization, lexical bundle identification, and AI-assisted feedback helped them

understand how academic vocabulary functions in real discourse, rather than viewing it as a list of separate words.

Many learners also highlighted the importance of AI-powered feedback for identifying lexical errors and offering better alternatives. Several participants reported becoming more independent in exploring vocabulary beyond assigned tasks, often using corpora and AI tools to check collocations, analyze contextual usage, and test different lexical options. These results indicate that the CALL-based environment encouraged self-regulated learning and increased learner engagement. At the same time, the qualitative data revealed some challenges with AI-assisted learning. Some participants admitted they relied too heavily on automated suggestions without thoroughly checking whether they were linguistically correct. Others had occasional difficulty understanding AI-generated feedback, especially when explanations lacked sufficient detail. These findings emphasize the need to add pedagogical guidance and build learners' critical AI literacy to ensure technology supports, rather than replaces, mental effort.

Overall, the combined quantitative and qualitative results strongly demonstrate that the cognitively grounded CALL-based approach is highly effective in fostering meaningful and lasting academic vocabulary development. The approach not only enhances measurable outcomes, such as academic vocabulary knowledge, collocational skills, phraseological capabilities, and lexical diversity in writing, but also positively affects learners' confidence, independence, and engagement. Therefore, the findings support integrating cognitive-linguistic principles with CALL and AI technologies as an effective framework for teaching academic vocabulary in EFL settings.

Discussion

The findings of this study confirm that academic vocabulary development can be significantly improved through the use of CALL tools within a cognitive-linguistic framework. First, the results showed that the cognitively grounded CALL-based intervention significantly enhanced learners' academic vocabulary knowledge, collocational skills, phraseological competence, and lexical richness in academic writing. Second, the intervention supported more accurate and contextually appropriate use of academic vocabulary, indicating that learners gained not only breadth of vocabulary but also deeper vocabulary knowledge. Third, participants viewed CALL and AI-assisted environments positively, and these tools promoted engagement, autonomous learning, and vocabulary retention. Finally, statistically significant differences between the experimental and control groups confirmed the effectiveness of incorporating cognitive-linguistic principles into technology-enhanced vocabulary instruction.

The intervention's effectiveness can be explained by the cognitive-linguistic mechanisms embedded in the instructional design. Conceptual mapping activities encouraged learners to establish meaningful relationships among lexical items, concepts, and discourse functions. Rather than memorizing isolated words, learners organized vocabulary into interconnected semantic networks, which facilitated deeper processing and easier retrieval. Categorization tasks further supported lexical retention by helping learners group academic vocabulary according to semantic, disciplinary, and functional similarities. This organization of lexical knowledge aligns with Schema Theory and Categorization Theory, which view learning as the development and refinement of cognitive structures that support long-term memory and efficient retrieval.

Second, the observed improvement in learners' academic vocabulary skills supports earlier claims about the challenges of academic writing identified by AlMarwani (2020). While that study highlights learners' difficulties with formal vocabulary and stylistic appropriateness, the current

research shows that these challenges can be reduced through cognitively focused CALL instruction. Specifically, the use of conceptual mapping and contextualized practice appears to close the gap between knowing a word and using it correctly in discourse.

The results also align with broader research on artificial intelligence in education. For example, Crompton and Burke (2023) argue that AI technologies boost learner engagement and support personalized learning experiences. The high engagement levels and positive learner perceptions in the experimental group confirm this. Similarly, the findings align with Kasneci et al. (2023), who highlight both the opportunities and challenges of using AI tools like ChatGPT in educational settings. While learners in this study benefited from immediate feedback and adaptive support, concerns about overreliance and superficial processing were also raised, emphasizing the need for pedagogical guidance.

The results also underscore the importance of usage-based learning for acquiring academic vocabulary. Consistent with Usage-Based Theory (Bybee, 2010), repeated exposure to authentic examples via corpora, concordancers, and AI-assisted writing tools helped learners recognize recurring lexical and phrasal patterns. Frequent encounters with lexical bundles, collocations, and discipline-specific expressions strengthened these constructions in memory, leading to higher levels of productive vocabulary use. This finding explains why the experimental group showed greater improvements in phraseological competence and lexical richness than the control group.

Another key factor behind the observed improvement is the role of noticing and cognitive engagement. The concordance-based and AI-supported activities required learners to actively pay attention to lexical choices, collocations, and phraseological patterns in context. This supports Schmidt's (1990) Noticing Hypothesis, which suggests that conscious attention to linguistic forms is essential for acquisition. Moreover, the results align with the Involvement Load Hypothesis (Laufer & Hulstijn, 2001), as many of the instructional tasks demanded significant cognitive effort through analysis, comparison, categorization, and contextual use of vocabulary. This deeper engagement likely contributed to the higher retention rates seen in the experimental group.

The positive learner attitudes and high levels of engagement observed in this study are also supported by recent large-scale surveys of student interactions with AI tools (AlMashagbeh et al., 2025; Granström & Oppi, 2025). These studies suggest that students are generally receptive to AI-enhanced learning environments, particularly when such tools foster autonomy and provide immediate feedback. The present findings confirm that these factors play a crucial role in vocabulary development, as learners actively engaged with digital resources and took greater responsibility for their learning.

At the same time, the study contributes to the literature by addressing a gap identified in earlier research. While many studies focus on either technological affordances (Chu et al., 2022) or the linguistic features of academic discourse, fewer have integrated these perspectives into a single theoretical framework. This research demonstrates that a cognitive-linguistic approach can effectively bridge theory and practice, providing a solid foundation for designing CALL-based instruction.

However, the findings also highlight limitations and challenges. Consistent with concerns raised in the literature (Kasneci et al., 2023), some learners relied heavily on AI-generated suggestions without fully engaging in cognitive processing. This indicates that the effectiveness of CALL tools depends not only on their availability but also on developing learners' critical digital literacy and metacognitive awareness. The findings also support Lexical Chunk Theory (Lewis, 1993) and Construction Grammar (Goldberg, 2006). Significant gains in phraseological

competence suggest that learners benefited from acquiring common multiword units rather than isolated words. Exposure to academic lexical bundles and formulaic expressions helped students develop more fluent and contextually appropriate academic writing. This may explain the notable improvements observed in lexical richness, collocational accuracy, and overall writing quality.

In summary, the results of this study align with existing research and offer new insights into the role of cognitive-linguistic principles in CALL environments. The findings indicate that combining corpus-informed instruction, AI-supported tools, and cognitively grounded tasks is more effective for developing academic vocabulary than traditional methods alone.

Conclusion

This study examined the effectiveness of a cognitively based CALL approach for developing academic vocabulary among postgraduate EFL learners. The findings indicated that integrating cognitive-linguistic principles with CALL technologies led to significant improvements in academic vocabulary knowledge, collocation skills, phrase usage, and lexical richness in academic writing. Compared with traditional teaching methods, this approach helped learners use academic vocabulary more accurately, appropriately, and in context. From a theoretical perspective, this study enhances Cognitive Linguistics by providing evidence that conceptual mapping, categorization, pattern recognition, and learning through use aid in acquiring academic vocabulary. The results support the idea that vocabulary learning involves forming meaningful connections between forms and meanings and building conceptual networks, rather than simply memorizing isolated words.

The study also advances CALL research by demonstrating how cognitive-linguistic principles can be integrated into technology-driven vocabulary instruction. The findings indicate that corpus tools, AI writing assistants, and interactive vocabulary-learning environments are most effective when embedded in a learning framework that promotes noticing, contextual practice, and active learner engagement. From an instructional standpoint, the results suggest that integrating CALL technologies with cognitive-linguistic tasks can enhance academic writing instruction and support the development of strong academic literacy. However, the study was limited by the intervention's short duration and the specific participant group. Future research should examine the long-term effects of cognitively based CALL instruction across diverse educational settings and learner groups, as well as the impact of AI literacy and self-regulation strategies on academic vocabulary development.

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