

Innovation and Optimization Approaches of College English Vocabulary Teaching Enabled by Generative Artificial Intelligence

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Abstract: Drawing on the Input and Output Hypotheses, this study aims to address the persistent challenges of surface-level processing, homogenization and decontextualization in traditional college English vocabulary teaching and enhance students' pragmatic competence. To this end, by integrating the features of generative artificial intelligence (Gen AI), it explores the synergies between Gen AI and college English vocabulary teaching. To overcome the limitations of current vocabulary teaching, the study leverages Gen AI for dynamic context generation, personalized adaptation and real-time error correction. It then constructs innovative teaching models to facilitate deep vocabulary acquisition and establishes an optimization system for stage-based teaching processes, human-AI collaborative teaching and dynamic vocabulary assessment, thereby forming a new paradigm that unifies teaching, learning and assessment. The findings provide guidance for the digital and intelligent transformation of college English vocabulary teaching and offer empirical evidence for further research on the integration of Gen AI into foreign language instruction.

Keywords: Generative Artificial Intelligence; College English Vocabulary Teaching; Innovation and Optimization Approaches

Introduction

In the context of digital transformation in higher education, the integration of emerging technologies into college English teaching has become an important direction for educational reform. However, current vocabulary teaching is confronted with a contradiction between time constraints and the requirement for in-depth vocabulary acquisition. Traditional teaching models fail to accommodate students' individual needs, resulting in unsatisfactory teaching outcomes that call for immediate improvement. Research on language acquisition suggests that vocabulary competence depends on a continuous cycle of comprehensible input and effective output. Generative artificial intelligence (Gen AI) is well-positioned to support such a cycle, as its capacity for dynamic generation and immediate feedback offers a new technological approach to addressing the aforementioned teaching challenges. Therefore, this study focuses on the core issue of vocabulary teaching that is enabled by Gen AI. It analyzes the current status and theoretical demands, explores effective ways to integrate this technology with teaching, develops innovative teaching models and proposes systematic optimization approaches, with the aim of providing practical implications for foreign language teaching reform.

1. Current Challenges and Theoretical Foundations of College English Vocabulary Teaching

1.1 Major Obstacles to Students' Deep Vocabulary Acquisition

In vocabulary learning, college students often resort to mechanical repetition, memorizing words by reading or copying. Such surface-level processing limits their ability to grasp deeper lexical features. As a result, even students with a considerable vocabulary frequently make errors in actual language use, for they lack a thorough understanding of polysemy, stylistic nuances and collocations. This issue becomes particularly salient when dealing with high-frequency collocations. Students can often recognize these expressions but cannot actively retrieve or flexibly use them in authentic contexts, which hinders the transformation of their vocabulary knowledge into a long-term linguistic repertoire. Moreover, due to the lack of effective review strategies and authentic contexts, new words learned by students are easily forgotten once outside the classroom, making it difficult for them to move from

comprehension to application. The root cause of this problem lies in the overly simplistic way students process vocabulary. They tend to establish only a simple one-to-one correspondence between English words and their Chinese equivalents while overlooking the multidimensional relationships among form, meaning and function. This partial processing directly impedes advanced vocabulary acquisition, leading to comprehension errors or inappropriate expressions when students are faced with complex texts, as they cannot accurately grasp word usage.

1.2 Inherent Limitations of Traditional Classroom Vocabulary Teaching

Current college English vocabulary teaching continues to center on teacher explanation and student memorization. Teachers often present new vocabulary items in groups and then require students to reinforce these words through decontextualized exercises such as multiple-choice questions and translation tasks. This practice separates vocabulary from authentic communication contexts, such that students acquire only static Chinese equivalents rather than the dynamic usage of words in real-life communication. Teachers are constrained by limited class time and large class sizes, which makes it difficult for them to provide differentiated guidance to students at different proficiency levels. Most exercises remain confined to simple repetition and fail to reveal the collocation patterns and pragmatic functions of vocabulary. This situation directly undermines students' performance in productive tasks such as speaking, writing and translation. They have little access to authentic and diverse language materials, struggle to distinguish synonyms and easily confused words and can hardly retrieve and flexibly apply newly learned vocabulary. Over time, the vocabulary input provided in traditional classrooms falls short of both the quantity and quality required for intermediate and advanced language production. Vocabulary learning eventually becomes a tedious process of rote memorization.

1.3 Implications of Input and Output Hypotheses for Vocabulary Pedagogy

Krashen's Input Hypothesis suggests that language acquisition depends on sufficient comprehensible input and that vocabulary internalization requires repeated meaningful encounters with target words^[1]. Therefore, vocabulary teaching should not be limited to a one-time presentation of word lists. Instead, teachers can adopt multimodal activities to ensure recurring exposure to target vocabulary across different contexts. Swain's Output Hypothesis further argues that input alone is insufficient for accurate and fluent language use. Output activities can prompt learners to shift their focus from semantic processing to syntactic and morphological features, thereby enabling them to better internalize collocations and lexical constraints^[2]. Thus, students must actively retrieve vocabulary in language production, filling gaps in their linguistic output through trial and error. Ideal vocabulary teaching should establish a virtuous cycle in which input and output reinforce each other. On the input side, rich contextual cues should be provided. On the output side, tasks such as information-gap activities or topic-based writing should be designed to help students polish their vocabulary use and receive timely feedback. This pedagogical framework also facilitates the integration of Gen AI. Relying on large-scale pre-trained corpora, Gen AI can generate diverse and authentic language materials on demand, thereby overcoming the limitations of outdated and monotonous materials in traditional textbooks. At the same time, it offers students opportunities for autonomous practice and delivers instant feedback.

2. Synergies between Gen AI and Vocabulary Teaching

2.1 Integration of Dynamic Context and Semantic Understanding

The key to semantic understanding lies in moving beyond reliance on dictionary definitions and embedding vocabulary in authentic discourse, where students can deduce their specific functions. Nevertheless, as traditional teaching is constrained by relatively fixed textbook content and limited classroom time, the language materials it provides tend to be narrow in scope and lack diversity. This hinders students from fully grasping the specific usages and pragmatic nuances of the same word across different communicative contexts. Gen AI presents a promising solution. It can instantly generate diverse corpora that contain target vocabulary in contexts tailored to students' language proficiency and interests. Such dynamic corpora reduce students' excessive dependence on static definitions. Consistent exposure to ample authentic examples enables students to gradually grasp collocation rules and pragmatic constraints in language use. Meanwhile, teachers can systematically incorporate such corpora into pre-class assignments and lead-in activities, guiding students through

progressively deeper contextual experiences, enabling them to move from imprecise inference to accurate application. This process shifts students' vocabulary learning from decontextualized memorization to deep contextual understanding, effectively addressing the problems of outdated teaching resources and insufficient personalization.

2.2 Application of Personalized Vocabulary Lists and Forgetting Curve

In traditional classroom teaching, students typically follow fixed vocabulary review schedules. However, this uniform pace often fails to align with each student's forgetting curve due to individual differences in vocabulary mastery. Gen AI addresses this issue by analyzing students' comprehension and production errors during human-AI interactions to pinpoint their vocabulary weaknesses. It then dynamically adjusts the focus of subsequent review sessions. Drawing on the principles of the forgetting curve, Gen AI intelligently controls the frequency and spacing of exposure to target vocabulary, thereby overcoming the constraints of a uniform teaching pace. In practice, teachers need only provide a basic vocabulary set. Gen AI can then design a personalized review path for each student, naturally integrating vocabulary that needs reinforcement into subsequent tasks or assignments. This intelligent scheduling approach transforms frequent vocabulary review from a task that relies on students' self-discipline into an organic component of daily practice, achieving precise alignment between vocabulary exercises and the optimal timing and frequency. Hence, this method not only effectively slows memory decay but also facilitates the consolidation and transfer of vocabulary from short-term to long-term memory^[3].

2.3 Interactive Practice of Collocations and Pragmatic Functions

Proficiency in collocations and adherence to pragmatic norms are critical to enhancing college students' English output. In practice, however, students frequently misuse collocations and make pragmatic errors in both written and spoken English. This problem primarily arises from a lack of immersive practice and timely error feedback, which hinders students from using vocabulary properly in authentic communicative contexts. To address this issue, Gen AI, with its natural language interaction features, can function as an intelligent platform that creates simulated environments for practice, thereby overcoming the limitations of conventional teaching methods. Such a platform encourages students to engage in conversations instead of passive memorization, enabling them to apply target vocabulary in real communicative scenarios. It identifies and corrects various linguistic errors, including incorrect verb-object collocations, misused fixed expressions and inappropriate stylistic choices. Through repeated interactive practice and dynamic feedback, students gradually reduce native language interference and acquire idiomatic English expressions. Meanwhile, by drawing on learning data from these interactive drills, teachers can identify common error patterns and provide targeted instruction on collocation rules and pragmatic contexts. This approach effectively helps students bridge the gap between theoretical vocabulary knowledge and practical language application^[4].

3. Innovations in Vocabulary Teaching Models Driven by Gen AI

3.1 An Output-Oriented Reinforcement Model for Immersive Conversational Scenarios

This output-oriented reinforcement model, designed for immersive conversational vocabulary learning, provides a training framework based on simulated interactive contexts. Its core aim is to shift students from passive vocabulary recognition to active lexical production. Leveraging the real-time interactive capabilities of Gen AI, the model creates situated learning environments that support students in applying vocabulary during interpersonal communication. In teaching practice, teachers first select a communicative topic and a core set of target vocabulary. They then guide students to engage in multi-turn dialogues with Gen AI, which seamlessly incorporates the key vocabulary into the conversation, prompting students to retrieve the target words and construct sentences in real time. Additionally, teachers can design graded task sequences that embed vocabulary use into a step-by-step interactive process, helping students build a network of lexical associations. Moreover, Gen AI can provide a range of synonyms and generate varied communicative scenarios, guiding students to distinguish subtle semantic differences and contextual usage rules. Practice in diverse scenarios enhances students' exposure to target vocabulary, enabling them to move beyond rote memorization toward systematic and semantic understanding^[5].

3.2 A Training Model for In-Depth Polysemy Analysis and Collocation Differentiation

This training model focuses on the cognitive processing of in-depth vocabulary knowledge, addressing fragmented senses of polysemous words and rigid collocation patterns. In practice, teachers can follow these steps with the help of Gen AI. First, for a polysemous word, Gen AI produces representative example sentences that illustrate each of its core meanings. By comparing these sentences across contexts, students are guided to discern how the same word form performs distinct syntactic functions. To strengthen semantic connections, teachers can instruct Gen AI to generate a coherent passage that embeds multiple meanings of a target word, guiding students to trace the word's functional shifts at the discourse level. Second, for collocations, Gen AI provides target words and potential collocations for students to assess. It then explains why certain collocations are semantically preferred and why others are pragmatically flawed. On this basis, teachers can design tasks such as paragraph cloze exercises, where students select appropriate collocations for specific contexts. Gen AI then offers instant feedback on their choices and visualizes the distribution of high-frequency collocations. Taken together, these procedures synthesize discrete vocabulary knowledge into a coherent framework, thereby compensating for the lack of deep cognitive processing typically observed in solely output-oriented vocabulary practice^[6].

3.3 An Integrated Model for Real-Time Error Correction and Hierarchical Feedback

This model addresses delayed feedback prevalent in traditional classrooms. Powered by Gen AI, it embeds a real-time feedback mechanism throughout vocabulary practice. Specifically, Gen AI analyzes students' sentences or paragraphs in real time, accurately identifies vocabulary errors and provides the correct forms. It further explains the causes of these errors, contrasts the incorrect usages with the standard ones and clarifies their semantic and functional distinctions. Students then make immediate corrections and resubmit their work, thereby consolidating their learning through a continuous cycle of output, feedback and revision. Gen AI also records each correction to track every student's learning trajectory. Moreover, Gen AI dynamically adjusts feedback intensity based on individual error frequency. For example, it automatically provides additional example sentences and explanations for vocabulary items that are frequently misused. Accordingly, the model enables teachers to efficiently identify common errors in the classroom through backend data and then deliver targeted in-class instruction, focusing limited time on shared difficulties. This approach seamlessly combines class-wide error remediation with personalized support for individual weaknesses, greatly enhancing the precision of vocabulary instruction.

4. Optimization Approaches for College English Vocabulary Teaching

4.1 Leveraging Gen AI for Coordinated Stage-based Vocabulary Training

Implementing a coordinated stage-based approach requires adherence to the cognitive principles of vocabulary acquisition. The teaching process can be divided into three sequential stages: pre-class, in-class and post-class. In the pre-class stage, teachers apply Gen AI to present vocabulary materials in diverse contexts aligned with unit teaching objectives. Students are guided to identify semantic differences and then mark difficult items independently. During the in-class stage, teachers address prevalent learning challenges identified from pre-class tasks and design targeted activities such as situational dialogues and collocation analysis. With the assistance of Gen AI, they generate supplementary materials and adaptive exercises in real time, enabling students to apply newly acquired vocabulary and correct mistakes in authentic communicative settings, thereby facilitating the transition from comprehension to productive use and accelerating vocabulary internalization. In the post-class stage, Gen AI automatically generates personalized review materials based on in-class interaction data. Vocabulary items that students have not yet mastered or tend to misuse are re-embedded into new contexts and reinforced through tasks such as micro-writing and guided dialogues. Thus, pre-class input builds initial understanding, in-class practice expands the semantic network and post-class review consolidates productive competence. These three stages form a closed loop centered on the target vocabulary. Teachers only need to set the vocabulary framework and difficulty parameters at the start of the semester. After that, Gen AI can assist with subsequent material generation and pathway adjustments. This closed-loop design not only frees up class time for learning strategy instruction and higher-order language training, but also reduces students' cognitive load during post-class review^[7].

4.2 Standardizing Gen AI for Human-AI Collaborative Classroom Teaching

In college English vocabulary teaching empowered by Gen AI, teachers must first carefully filter and calibrate its output. To this end, they should preset parameters such as vocabulary difficulty, language style and sentence structure to avoid obscure expressions and content inconsistent with teaching objectives. However, even with appropriate parameter settings, the example sentences and contexts generated by Gen AI may still fail to align with students' proficiency levels. In such cases, teachers must manually revise the output or adjust the prompts until the content is suitable for classroom teaching. Beyond initial parameter settings and output calibration, teachers should also regulate the frequency of human-AI interaction in classroom teaching to avoid excessive technological intervention. Specifically, Gen AI functions such as real-time feedback and context generation should serve students' productive practice, while vocabulary explanation and learning strategy guidance should remain teacher-led. This division of labor can harness the advantages of Gen AI while maintaining teachers' central role in pedagogical decision-making. Based on this, teachers should also tailor their application of Gen AI according to students' varying language proficiency levels. For students with weak foundational skills, teachers can direct Gen AI to simplify syntactic structures and provide essential semantic support. For more capable students, teachers may prompt Gen AI to generate more complex academic materials and design higher-order pragmatic tasks. Ultimately, by defining boundaries for technology use and specifying when to intervene, teachers can prevent Gen AI from replacing pedagogical judgment and ensure that its output serves vocabulary teaching goals, thereby helping establish a stable framework for human-AI collaboration.

4.3 Employing Gen AI for Data-Driven Dynamic Vocabulary Assessment

To establish a closed-loop dynamic monitoring system integrating teaching, learning and assessment, teachers can employ Gen AI platforms to develop personalized vocabulary portfolios for each student. The platform systematically gathers data on students' vocabulary usage across all learning stages. Based on the collected data, the platform regularly generates personalized diagnostic reports to pinpoint vocabulary items likely to be forgotten. In light of the diagnostic results, the platform activates an automatic intervention mechanism, increasing the frequency of problematic vocabulary items in subsequent contextual exercises and scheduling spaced repetition for memory consolidation. Furthermore, the platform visualizes the diagnosis and intervention process for students and delivers class-wide macro-level data analysis to teachers. Students can then adjust their learning priorities, while teachers refine their instructional feedback based on these data. Through this two-way feedback process, the dynamic assessment of vocabulary learning enabled by Gen AI integrates assessment data into instructional activities. This approach transforms delayed feedback on learning outcomes into real-time instructional interventions, allocating review resources tailored to individual student profiles. In this way, students at all proficiency levels can steadily enhance their vocabulary application within their respective zones of proximal development.

5. Conclusion

This study shows that Gen AI effectively empowers college English vocabulary teaching. It not only optimizes traditional practices in learning scenarios, practice activities and instructional feedback, but also transforms vocabulary learning from habitual memorization to a model that balances comprehension and application. With such technological support, students gain access to a wider range of language materials and receive targeted interventions that address their learning weaknesses, steadily improving both vocabulary acquisition efficiency and pragmatic competence. In practice, existing tools still exhibit minor inaccuracies in content generation. Besides, the collaboration between Gen AI and teachers, together with personalized instructional designs for students at different proficiency levels, requires further refinement. Future research and practice should focus on optimizing Gen AI algorithms in line with vocabulary acquisition patterns, diversifying their application contexts and modes, establishing a full-process dynamic evaluation system and exploring viable pathways for deeper integration into foreign language classrooms, thereby maximizing their educational potential.

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