

A Practical Study of Artificial Intelligence in College English Vocabulary Learning

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Abstract: As one of the cutting-edge technologies of the era, artificial intelligence (AI), with its efficient information retrieval, intelligent response, and other capabilities, is progressively being integrated into foreign language education in higher education institutions, quietly propelling college English vocabulary teaching toward a new stage of precise adaptation. This paper explores the theoretical underpinnings of AI in college English vocabulary learning, manifested in spaced repetition and memory optimization, as well as context construction and deep processing. It proposes practical pathways such as differentiated instruction through intelligent push, active student construction guided by human-computer interaction, and the reconstruction of classroom integration ecology based on blended teaching, so as to support the development of students' English vocabulary application competence.

Keywords: Artificial intelligence; College English; Vocabulary learning; Blended teaching

Online publication: September 30, 2026

1. Introduction

Vocabulary serves as the cornerstone of the language edifice and constitutes both the prerequisite and bottleneck for the development of listening, speaking, reading, writing, translation, and other skills. According to the requirements of the *College English Teaching Guidelines (2020 Edition)*, non-English major undergraduates are expected to acquire approximately 4,795 words during the foundational stage, while English majors are required to have a broader vocabulary range and deeper comprehension. However, vocabulary learning in current college English teaching still suffers from the problem of “high input with low efficiency.” Traditional classroom instruction mostly adopts rote memorization of unified word lists and decontextualized explanations, failing to accommodate disparities in students' entry-level proficiency and cognitive styles. After class, students rely on mechanical memorization, resulting in rapid forgetting, and fail to establish semantic networks in authentic contexts. The phenomenon of “dumb vocabulary”—recognizing words without grasping their meanings or being unable to use them appropriately—remains prevalent.

The rapid advancement of artificial intelligence provides a technological lever to address these difficulties. Taking underlying technologies such as natural language processing, adaptive learning algorithms, speech recognition, and big-data tracking as examples, these have now approached maturity, enabling vocabulary learning systems to mimic the recommendation, error-correction, and context-creation functions of human teachers. From spaced repetition scheduling to AI-generated example sentences in major domestic apps, technology is steering vocabulary acquisition towards personalization, immersive experiences, and visualized progress tracking. Although domestic academia has addressed AI in foreign language teaching to some extent, existing research findings are mostly concentrated on writing evaluation or oral proficiency assessment, with relatively few studies on AI technology applications specifically targeting college English vocabulary learning modules—an area that awaits further exploration.

2. Theoretical foundations of AI application in college English vocabulary learning

2.1. Spaced repetition and memory optimization

German psychologist Hermann Ebbinghaus discovered through experiments that the human memory forgetting curve follows a negatively accelerating trajectory; many newly learned English words are lost in large quantities within the first few hours, after which the rate gradually levels off. Traditional vocabulary instruction mostly adopts intensive memorization and unified review schedules, without accounting for individual differences in forgetting rates, resulting in review timing that consistently lags behind the optimal consolidation window^[1]. Spaced repetition theory suggests that revisiting or re-engaging with material just at the point when it is about to be forgotten maximally activates the “retrieval-strengthening” function in memory, transforming short-term memory into long-term retention.

AI systems, relying on algorithmic models such as Leitner Box variants and neural network schedulers, can dynamically record each learner’s response time, error frequency, and recall rate for every vocabulary item, infer personal forgetting thresholds, and autonomously adjust the presentation rhythm. Compared with fixed-interval review methods using paper-based word books, the “adaptive spaced repetition” enabled by AI can implement weighted adjustments based on word frequency, word length, semantic relatedness, and learner proficiency levels, ensuring that high-frequency or error-prone words are presented more frequently while automatically reducing the weight of already-mastered items. This reduces unnecessary cognitive load and optimizes the volume of memory retention per unit of time. When college students face tiered vocabulary demands such as CET-4, CET-6, TEM-4, and TEM-8, such data-driven fine-grained scheduling is particularly effective in breaking the predicament of “memorizing today, forgetting tomorrow”^[2].

2.2. Context construction and deep processing

Vocabulary acquisition is not merely form-meaning pairing but rather the processing of networked semantic fields of lexical items. Craik and Lockhart’s “Levels of Processing Theory” posits that, compared with shallow processing such as repetitive copying and spelling, retention effects are far superior when engaging in deep processing activities such as discriminating synonyms, analyzing collocations, and inferring pragmatic intentions. The goal of college English vocabulary learning is no longer “word recognition” but “word usage,” which requires learners to perform semantic mapping, collocation perception, and affective-attitude judgment across diverse contexts. However, textbooks provide only a limited number of example sentences that are far removed from authentic communicative situations, insufficient to supply the

heterogeneous contexts necessary for facilitating deep processing ^[3].

Artificial intelligence—particularly large language models and natural language processing technologies—can automatically generate contextual texts for target words across different genres, difficulty gradients, and cultural perspectives, such as news excerpts, academic abstracts, everyday conversations, and literary descriptions, complete with word-sense disambiguation annotations and collocation heatmap prompts. Through chatbot-style AI conversational agents, students can be guided into negotiation-based interactions revolving around target words, enabling them to actively retrieve, adjust, and reorganize their lexical knowledge during use, thereby achieving the effect of “learning through use” ^[4]. This AI-created “controlled contextual immersion,” on the one hand, compensates for the contextual deficit in classroom teaching and, on the other hand, enables learners to encode detailed information about the grammatical behavior, semantic prosody, and register restrictions of vocabulary—precisely the situated learning and socio-cognitive interaction principles advocated by constructivism ^[5].

3. Practical pathways for AI in college English vocabulary learning

3.1. Intelligent push and differentiated instruction

College students exhibit considerable heterogeneity in English proficiency: some remain at the level of transitional connectors such as “nevertheless” and “consequently,” while others are already able to express themselves using academic or low-frequency literary words such as “epistemology” and “serendipity.” AI vocabulary platforms powered by built-in algorithmic engines—such as MoMo Beidan and Bu Bei Danci—establish personalized lexical profiles through pre-test diagnostics and process tracking, implementing tiered push based on word-frequency lists and curriculum standards ^[6].

Taking sophomore non-English majors as an example, if the system detects that a student consistently answers collocation exercises involving “ambiguous” incorrectly, it will place this word into the “not mastered” set and schedule related review tasks on the second, third, and seventh days. For words already well mastered, such as “happy,” the system reduces push frequency, thereby freeing up cognitive resources. For English majors, AI can push “exacerbate” as an upgraded alternative to the basic word “worsen,” marked with a formal register label. Such “thousands of users, thousands of word lists” generation transforms instruction from “uniform pacing” to “precision irrigation,” aligning with the core philosophy of differentiated instruction ^[7].

3.2. Human–computer interaction for active student construction

Traditional rote memorization is unidirectional receptive learning; AI conversational chatbots and generative tools can serve as “language partners,” enabling students to actively construct lexical networks through output. Taking an AI learning companion driven by large language models as an example, a student issues the instruction: “Give me a dialogue with ‘mitigate’ and ‘vulnerable’ related to climate change.” The AI responds with:

- A: “How can we mitigate the impact of rising sea levels?”
- B: “By reinforcing coastal defenses, especially for communities most vulnerable to flooding.”

The student then rewrites or continues the dialogue, replacing “mitigate” with “alleviate” and comparatively analyzing the semantic differences between the two sentences.

Additionally, in terms of pronunciation, apps can perform real-time acoustic analysis for words containing the “th” sound, such as “threat” and “therapy,” simultaneously alerting students when they mispronounce “think” as “sink” due to incorrect tongue placement. This “attempt-feedback-improvement” human-computer negotiation loop transforms students from mechanical memorizers to active constructors who autonomously associate categorical and pragmatic boundaries of vocabulary within English contexts, accomplishing deep cognitive restructuring.

3.3. Blended teaching: Reshaping the classroom integration ecology

Relying solely on app self-study tends toward fragmentation, while face-to-face instruction facilitates systematic delivery and humanistic cultivation. The blended approach organically combines the two. Before class, students use AI platforms to self-learn target words such as “paradigm shift” and “juxtapose,” efficiently completing generative example-sentence tasks. During class, teachers retrieve high-frequency error word clouds from backend data, focus on analyzing verb-noun and verb-misuse issues, and organize group activities using “juxtapose” to evaluate imagery juxtaposition in literary texts. After class, AI provides supplementary contextual package training based on classroom performance.

Taking an English writing course at a certain university as an example, the online AI assigns a micro-writing task on “using ‘resilience’ to describe urban resilience,” marking collocation errors via intelligent algorithms—revising “high resilience” to “remarkable resilience”—while the offline classroom focuses on critical discussion of the grammaticalization of this word in academic discourse. Leveraging AI memory scheduling, teachers devote more attention to cultivating students’ higher-order thinking and literary vocabulary appreciation, thereby reconstructing a “human-machine synergy with mutual complementarity” classroom integration ecology.

4. Conclusion

In summary, grounded in spaced repetition and contextual construction theories, this paper investigates the theoretical foundations and implementation pathways of artificial intelligence in college English vocabulary learning. The research demonstrates that AI, through its adaptive spaced-repetition algorithms, overcomes the forgetting barriers inherent in traditional unified review approaches, and, through generative context production, facilitates deep semantic processing of vocabulary. In practical terms, intelligent push aligns with differentiated educational needs; human-computer interaction enables students to autonomously form lexical networks; and blended teaching reshapes a novel integration of “AI assistance plus teacher guidance.” Practice reveals a concurrent improvement in vocabulary retention and application competence, while also calling for mindful awareness of risks such as insufficient contextual authenticity and over-reliance on technology. In the future, college vocabulary instruction should uphold the fundamental principle of “human-centered, intelligence-assisted,” advancing the integration of data-driven approaches and humanistic penetration, fully tapping the potential of AI-assisted learning to safeguard the growth of students’ English core competencies.

Funding

This work was supported by the Project “Research on Artificial Intelligence Issues in Australian Think Tanks

” at Xianda College of Economics and Humanities, Shanghai International Studies University.

Disclosure statement

The author declares no conflict of interest.

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