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RESEARCH ARTICLE

AI-Assisted Vocabulary Learning: Enhancing English Vocabulary Acquisition among Undergraduate Learners – A Conceptual Review

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Abstract:

Vocabulary knowledge is a fundamental component of successful English language learning because it enables learners to understand, express, and communicate ideas effectively. For undergraduate learners studying English as a Foreign Language (EFL), developing an adequate vocabulary is often challenging because of limited exposure to English, insufficient opportunities for meaningful practice, difficulties in remembering new words, and uncertainty regarding appropriate usage. Recent developments in Artificial Intelligence (AI) have introduced new possibilities for vocabulary instruction through intelligent tutoring systems, adaptive learning applications, conversational chatbots, generative AI tools, automated feedback systems, and personalized language-learning platforms. These technologies can provide learners with contextualized vocabulary, personalized exercises, immediate feedback, pronunciation support, spaced practice, examples, synonyms, antonyms, and interactive activities. This conceptual review examines the role of AI-assisted vocabulary learning in enhancing English vocabulary acquisition among undergraduate learners. It discusses how AI can support vocabulary breadth and depth, contextual learning, retention, pronunciation, collocation, learner autonomy, motivation, and individualized instruction. At the same time, the paper examines challenges such as inaccurate AI-generated information, inappropriate word suggestions, overdependence on technology, privacy concerns, unequal access, reduced teacher involvement, and the risk of superficial vocabulary learning. The review proposes a human-AI collaborative model in which AI provides personalized practice and feedback while teachers guide learners in contextual, communicative, and critical vocabulary use. The paper concludes that AI-assisted vocabulary learning can significantly enrich undergraduate English education when it is integrated with systematic vocabulary instruction, meaningful communication, human feedback, and responsible AI literacy.

Keywords: Artificial Intelligence, vocabulary learning, EFL learners, undergraduate students, AI-assisted language learning, vocabulary acquisition, generative AI, learner autonomy

1. Introduction

Vocabulary knowledge is one of the most important foundations of English language proficiency. Learners require sufficient vocabulary to understand academic texts, participate in conversations, write effectively, interpret information, and communicate their ideas accurately. Grammar provides the structural framework of language, but vocabulary provides many of the essential elements through which meaning is expressed. For undergraduate learners, vocabulary development is particularly important because higher education increasingly requires students to engage with English-language textbooks, research articles, online resources, technical documentation, presentations, and professional communication. Students are also

expected to use specialized and academic vocabulary appropriate to their disciplines.

However, vocabulary acquisition is a complex and gradual process. Learners need to encounter words repeatedly, understand their meanings in different contexts, recognize their grammatical patterns, understand collocations, pronounce them correctly, and eventually use them productively. Memorizing word lists alone may not result in effective vocabulary use. Traditional vocabulary teaching commonly includes word lists, dictionaries, flashcards, reading activities, classroom exercises, and teacher explanations. These methods remain valuable, but they may not always provide sufficient individualized practice. Teachers working with large groups may find it difficult to identify the specific vocabulary needs of every learner.

Artificial Intelligence has introduced new opportunities for addressing these limitations. AI-powered language-learning systems can analyse learner performance, generate vocabulary exercises, provide contextual examples, and adapt activities to individual needs. Generative AI tools can also create conversations and writing activities incorporating target vocabulary. This conceptual review examines how AI-assisted vocabulary learning can support undergraduate learners and identifies the opportunities and challenges involved in its integration into English language education.

2. Concept of AI-Assisted Vocabulary Learning

AI-assisted vocabulary learning refers to the use of Artificial Intelligence technologies to support the acquisition, practice, retention, and application of vocabulary.

AI-based vocabulary systems may include:

- intelligent tutoring systems;
- adaptive vocabulary applications;
- AI chatbots;
- generative AI platforms;
- speech-recognition systems;
- automated writing tools;
- personalized vocabulary platforms;
- AI-supported digital dictionaries.

These technologies can provide different forms of assistance.

For example, when a learner encounters an unfamiliar word, an AI system may provide its meaning, pronunciation, synonyms, antonyms, example sentences, collocations, and contextual usage.

AI can therefore move vocabulary learning from simple memorization toward more interactive and contextualized learning.

3. Vocabulary Breadth and Depth

Vocabulary knowledge involves both breadth and depth.

Vocabulary breadth refers to the number of words a learner knows, while **vocabulary depth** refers to how well the learner understands a word.

Knowing the word “significant,” for example, involves more than knowing its basic meaning. A learner should understand:

- its pronunciation;
- grammatical behaviour;
- synonyms;
- antonyms;

- common collocations;
- formal and informal uses;
- meanings in different contexts.

AI can support both dimensions.

For vocabulary breadth, AI can generate lists of words related to a particular topic.

For vocabulary depth, it can provide contextual explanations and examples.

This makes AI potentially useful for both vocabulary expansion and deeper lexical knowledge.

4. Contextualized Vocabulary Learning

One of the major advantages of AI-assisted vocabulary learning is contextualization.

Learners often have difficulty understanding how a word is used when they learn it in isolation. AI can generate sentences and dialogues based on specific contexts.

For example, the word "conduct" can have different meanings depending on context:

- conduct research;
- conduct an interview;
- conduct a meeting;
- electrical conductivity.

An AI system can explain these differences and create examples appropriate to the learner's academic field.Contextual learning allows students to connect vocabulary with situations rather than memorizing isolated definitions.

5. Personalized Vocabulary Instruction

Undergraduate learners differ considerably in vocabulary proficiency. Some may have strong general English vocabulary but limited academic vocabulary, while others may struggle with basic vocabulary.

AI systems can potentially personalize vocabulary learning by analysing learner responses.

A system may identify that a learner repeatedly struggles with:

- academic verbs;
- prepositions;
- technical terms;
- phrasal verbs;
- collocations.

It can then generate additional practice activities targeting these areas.

Personalization can make vocabulary instruction more efficient because students spend more time practising vocabulary that requires improvement.

6. AI and Vocabulary Retention

Learning a word once does not guarantee long-term retention. Repeated exposure and retrieval are essential.

AI can support repeated practice through adaptive review.

For example, a vocabulary platform may provide a word repeatedly when the learner demonstrates difficulty and reduce its frequency when the learner demonstrates mastery.

AI-generated quizzes can include:

- multiple-choice questions;
- sentence completion;
- matching;
- word formation;

- translation;
- contextual usage;
- short-answer activities.

Such repeated retrieval can strengthen vocabulary retention.

7. Spaced Learning and Retrieval Practice

Vocabulary acquisition benefits from encountering words at appropriate intervals.

AI-based systems can help automate spaced practice by identifying words that need additional review.

For example:

Day 1: Introduce new words

Day 2: Recognition activity

Day 4: Sentence completion

Day 7: Contextual quiz

Day 14: Productive writing or speaking activity

This type of systematic practice may improve long-term retention compared with one-time vocabulary exercises.

AI can also adapt the difficulty according to learner performance.

8. Vocabulary and Pronunciation

Vocabulary knowledge is closely connected with pronunciation. Learners may recognize a written word but have difficulty pronouncing it correctly.

Speech-enabled AI systems can provide pronunciation models and allow learners to practise words repeatedly.

AI can potentially support:

- individual sounds;
- syllable stress;
- word stress;
- pronunciation patterns;
- connected speech.

For undergraduate learners preparing for professional communication, accurate and intelligible pronunciation of technical and academic vocabulary is particularly valuable.

However, pronunciation feedback should be treated as guidance rather than absolute judgment because speech-recognition systems may be influenced by accents, microphones, and background noise.

9. AI and Collocation Learning

Knowing individual words is not sufficient for fluent English use. Learners also need to know which words commonly occur together.

Examples include:

- make a decision;
- conduct research;
- strong argument;
- significant impact;
- heavy traffic.

AI can generate collocation examples and explain common combinations.

Learners can also ask AI to identify natural collocations for a particular word.

This can help undergraduate students produce more natural academic and professional English.

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10. AI for Academic Vocabulary

Academic vocabulary is particularly important for university learners.

Students encounter specialized expressions in:

- textbooks;
- research papers;
- lectures;
- assignments;
- presentations;
- project reports.

AI can help learners identify academic vocabulary within texts and explain its meaning.

For example, an AI system can analyse a paragraph and identify words related to academic functions such as:

- analyse;
- evaluate;
- demonstrate;
- indicate;
- establish;
- investigate;
- significant;
- consequently.

Students can then practise using these words in their own sentences.

11. AI and Technical Vocabulary

Undergraduate students from engineering, science, medicine, management, and other disciplines require discipline-specific vocabulary.

AI can generate vocabulary exercises according to academic specialization.

For example, engineering students can practise terms related to:

- programming;
- networking;
- artificial intelligence;
- electronics;
- mechanical systems.

Management students can practise vocabulary related to:

- marketing;
- finance;
- human resources;
- entrepreneurship;
- business communication.

This domain-specific personalization can make vocabulary learning more relevant to students' academic and professional needs.

12. AI Chatbots and Vocabulary Practice

AI-powered chatbots can integrate vocabulary learning with communication.

Instead of simply memorizing a word, students can use it in conversation.

For example, after learning the word “innovation,” the learner can engage in a conversation about

technological innovation.

The chatbot can ask:

"What recent technological innovation has changed the way students learn?"

The student must then retrieve and use appropriate vocabulary.

This moves vocabulary learning from recognition to productive use.

13. Generative AI and Vocabulary Learning

Generative AI can create vocabulary materials rapidly.

Students can request:

- vocabulary lists;
- example sentences;
- dialogues;
- quizzes;
- fill-in-the-blank exercises;
- vocabulary games;
- short stories;
- discussion questions.

The same vocabulary can be presented in multiple contexts.

For example, a student learning the word "sustainable" can encounter it in an environmental discussion, an academic paragraph, a business conversation, and a presentation.

Such variation can strengthen understanding.

However, AI-generated examples should be checked for accuracy and appropriateness.

14. Learner Autonomy

AI-assisted vocabulary learning can promote learner autonomy by allowing students to take greater responsibility for their learning.

Students can independently:

- identify unfamiliar words;
- ask for explanations;
- create personalized vocabulary lists;
- generate quizzes;
- practise pronunciation;
- use words in conversations;
- review previously learned vocabulary.

This is especially valuable for undergraduate students who need to continue developing English beyond formal classroom instruction.

15. Motivation and Engagement

Vocabulary learning is sometimes perceived as repetitive.

AI can make vocabulary activities more interactive by introducing games, conversations, personalized challenges, and immediate feedback.

Students may be more willing to practise when they can choose topics related to their interests.

For example, students interested in technology can learn vocabulary through AI-generated discussions about emerging technologies.

The interactive nature of AI may therefore increase engagement.

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However, motivation should be supported by meaningful learning objectives rather than technology novelty alone.

16. Challenges of AI-Assisted Vocabulary Learning

Despite its potential, AI-assisted vocabulary learning has several limitations.

16.1 Inaccurate Information

AI systems may occasionally provide incorrect definitions, examples, or explanations.

16.2 Contextual Errors

A suggested synonym may not be appropriate in every context.

16.3 Overdependence

Learners may depend on AI rather than developing independent dictionary and contextual analysis skills.

16.4 Superficial Learning

Rapidly generated vocabulary lists may encourage memorization without meaningful application.

16.5 Privacy

Students may enter personal or academic information into AI systems.

16.6 Digital Inequality

Access to reliable devices and advanced AI services may differ among learners.

16.7 Reduced Teacher Interaction

Excessive reliance on AI could reduce opportunities for teacher-guided vocabulary instruction.

These challenges demonstrate the importance of responsible implementation.

17. Role of Teachers

Teachers remain essential in AI-assisted vocabulary education.

Teachers can:

- identify learning objectives;
- select appropriate vocabulary;
- evaluate AI-generated materials;
- explain cultural and contextual differences;
- design communicative activities;
- assess students' productive vocabulary;
- monitor progress.

AI should support rather than replace teacher expertise.

For example, an AI system can generate ten example sentences, but the teacher can help students determine which examples are appropriate for academic writing.

18. Human-AI Collaborative Vocabulary Model

A practical model can involve five stages.

Stage 1: Vocabulary Introduction

The teacher introduces target words and explains their meanings.

Stage 2: AI Exploration

Students use AI to explore pronunciation, synonyms, collocations, and examples.

Stage 3: Controlled Practice

Students complete AI-generated quizzes and exercises.

Stage 4: Productive Application

Students use the vocabulary in speaking, writing, presentations, or discussions.

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Stage 5: Reflection and Assessment

Students reflect on their learning and complete teacher-guided assessment.

This model combines AI personalization with human pedagogical guidance.

19. Pedagogical Implications

AI-assisted vocabulary learning has important implications for undergraduate English education.

First, vocabulary instruction can become more personalized.

Second, teachers can use AI to rapidly create differentiated activities.

Third, students can practise vocabulary outside classroom hours.

Fourth, vocabulary can be integrated with speaking and writing rather than taught separately.

Fifth, AI can support continuous formative assessment.

However, vocabulary learning should remain connected to authentic communication. Knowing the definition of a word is not enough; students need to use it appropriately.

20. Recommendations

For Students

Students should:

- use AI to explore vocabulary deeply;
- verify AI-generated definitions;
- practise words in context;
- use new vocabulary in speaking and writing;
- maintain personal vocabulary records;
- avoid depending entirely on AI.

For Teachers

Teachers should:

- integrate AI into vocabulary activities;
- evaluate AI-generated materials;
- emphasize contextual learning;
- combine AI practice with communication;
- teach students how to verify AI information;
- assess productive vocabulary use.

For Institutions

Institutions should:

- provide AI literacy programmes;
- train English teachers;
- establish responsible AI policies;
- ensure equitable access;
- address data privacy.

21. Future Research Directions

Future research should examine the measurable effects of AI-assisted vocabulary learning among undergraduate students.

Studies can investigate:

- vocabulary breadth;
- vocabulary depth;

- retention;
- collocation knowledge;
- academic vocabulary;
- productive vocabulary;
- learner motivation;
- learner autonomy.

Researchers should conduct longitudinal studies to determine whether AI-assisted vocabulary learning produces durable gains.

Comparative studies could examine traditional vocabulary instruction, AI-assisted instruction, and blended human-AI instruction.

Further research is also needed to determine which AI activities are most effective. For example, vocabulary learning through AI-generated quizzes may produce different outcomes from conversational vocabulary practice.

22. Conclusion

Artificial Intelligence has created significant opportunities for improving vocabulary learning among undergraduate English language learners. AI-powered applications, adaptive platforms, conversational chatbots, speech-recognition systems, and generative AI tools can provide personalized vocabulary instruction, contextualized examples, pronunciation support, repeated practice, immediate feedback, and opportunities for productive use. The greatest potential of AI-assisted vocabulary learning lies in its ability to transform vocabulary from an isolated memorization activity into an interactive and personalized learning process. Learners can explore word meanings, pronunciation, collocations, synonyms, academic usage, and contextual differences while receiving immediate support.

However, AI should not be treated as an unquestionable authority. Incorrect information, inappropriate examples, contextual limitations, privacy concerns, unequal access, and learner overdependence are important challenges. Vocabulary learning also requires meaningful human interaction, teacher guidance, reading, speaking, writing, and authentic communication. A human-AI collaborative approach is therefore the most appropriate model. Teachers should establish vocabulary goals and provide pedagogical guidance, while AI can offer personalized practice, explanations, examples, and feedback. Students should critically evaluate AI-generated content and demonstrate their vocabulary knowledge through authentic communication.

Ultimately, the effectiveness of AI-assisted vocabulary learning depends not simply on the sophistication of the technology but on how thoughtfully it is integrated into language pedagogy. When AI is combined with teacher expertise, contextual learning, communicative practice, and learner reflection, it can become a powerful tool for expanding undergraduate learners' English vocabulary and strengthening their overall communicative competence.

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