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Integrating Generative AI-Powered Tools for Vocabulary Instruction: Strategies for Indian ESL Learners – A Conceptual Analysis

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Abstract: Generative Artificial Intelligence (Gen AI) presents ground breaking possibilities for vocabulary learning in English as a Second Language (ESL) environments. Gen AI tools are changing the world at an incredibly fast pace. Gen AI tools have come to play an important role in AI technology in the education field. The availability of multiple Gen AI tools is augmenting the level of education in India, especially in the teaching of the English language. This research proposes a conceptual framework along with the theoretical underpinnings for integrating Gen AI tools for vocabulary acquisition and learning. This research also analyses the integration of some Gen AI-based tools, like intelligent chatbots, adaptive learning systems, and AI-generated content tools, into vocabulary learning for Indian ESL students. The study selects effective tools and recommends teaching strategies dealt with conceptual framework and tailored to Indian ESL students' requirements. This research assesses the pedagogical impact of such Gen AI-based tools in enhancing engagement, autonomy. The results of the current study seek to offer useful recommendations for researchers, teachers, different stakeholders to implement Gen AI-driven tools for language learning and thus contribute to the existing debate on AI and Gen AI-supported language learning in India.

Keywords: Generative Ai, Vocabulary Instruction, Esl Learners, Chatbots, Pedagogical Strategies.

1. Introduction

The history of learning English as a Second Language (ESL) in India is complicated and closely linked to the country's colonial past and its current role in the global economy. India's linguistic diversity, with more than 1,600 languages spoken throughout the country, fosters a unique setting for ESL education (Azam *et al*. 2013). The following are important parts of learning English as a second language in India: English was introduced during British colonial rule and has since remained a vital language for administration, education, and commerce; it is acknowledged as an associate official language in India; and English is a mandatory subject in most Indian educational institutions from the primary level onwards (Ramachandran et al. 2017). Nonetheless, the quality and methodology of English instruction differ significantly among regions and school types, there is a big difference in English proficiency between urban and rural areas. Urban students usually have more access to English learning resources and more chances to practise English. People often think that being good at English will help them get better jobs and move up in society, which is why there is a high demand for English education. There are a lot of problems in the ESL classroom, such as a lack of qualified teachers, especially in rural areas, too many students in each class, not enough time for each student to get individual attention, an emphasis on memorisation instead of communication skills, and not enough chances to use English in real life (Shin, 2008). New ways to teach ESL. There have been a number of efforts to improve ESL learning, such as using technology to improve learning, using activities to improve learning, and working with both public and private organisations to improve English education. In India, ESL learning often means finding a way to promote English proficiency while also protecting local languages and cultures. A lot of Indian students already speak more than one language, which can make learning English as a second language easier or harder (Vogelzang *et al.* 2024). The National Education Policy 2020 stresses the importance of multilingualism and suggests changes to make language learning better, including English

(Vaithianathan *et al.* 2024). This research study provides a conceptual understanding grounded by two cognitive theories namely Depth of Processing and Involvement load theory along with the instructional strategies for vocabulary learning with the help of Gen AI. To make good ESL teaching policies and plans in India, one must know all of these factors very well.

2. Research Objectives

The research objectives are as follows;

1. To comprehend the pedagogical implementation of Gen AI tools for Vocabulary acquisition and learning for Indian ESL learners.
2. To conceptualise the vocabulary learning theories with Gen AI capabilities.
3. To provide some effective strategies with Gen AI applications for Vocabulary acquisition and learning.

3. Challenges faced by Indian ESL learners in vocabulary acquisition

Indian ESL learners frequently face numerous challenges in their vocabulary acquisition. Interference from native languages: Because India has so many languages, learners' first languages can get in the way of their English pronunciation, meaning, and use (Hornberger and Vaish 2009). According to Saito, Many learners have limited access to native English speakers or authentic English content because they don't have enough exposure to real English. This makes it harder for them to learn new words naturally. Rote learning stresses old-fashioned ways of teaching that often-put memorisation ahead of learning in context. This makes it hard for students to use vocabulary correctly (Fengyu 2023). Vocabulary is often taught in isolation, without enough context or real-life examples, which makes it hard to remember and use correctly (Mammadova, 2025). Some English words or ideas may not have direct translations in Indian languages or cultures, which can make it hard to understand and remember them. If students don't have a lot of useful words in their vocabulary, they may have trouble using new words in speaking and writing, even though they can recognise them (Liontas 2002). Idiomatic expressions and colloquialisms pose significant challenges for Indian ESL learners in comprehending and utilising idiomatic language. Academic vocabulary versus everyday vocabulary on It can be hard for students to learn both academic vocabulary and everyday English at the same time. Problems with the pronunciation of Some English sounds that aren't in Indian languages can make it hard to pronounce words and remember them (Pourhosein Gilakjani 2011). Not reading enough different kinds of English texts makes it harder to learn new words and understand them in context. Many students don't have good ways to learn and remember vocabulary on their own because there aren't enough good vocabulary learning strategies. To solve these problems, we need to take a multi-faceted approach that includes better teaching methods, more exposure to real English, and the creation of effective vocabulary learning strategies that work in India.

4. Conceptual Model for Vocabulary Acquisition and Learning with Gen AI

The current study employs a conceptual and theory driven analytical framework to integrate Gen AI applications for Vocabulary learning. This paper encompasses cognitive frameworks, AI adaptability synthesis, and Instructional strategies for learners as well as language instructors. Amalgamating these concepts along with the instructional strategy provides a deep understanding on vocabulary learning and acquisition. The cognitive frameworks build a strong theoretical foundation for this study.

4.1 Theoretical Underpinnings

The Depth of Processing (DoP) Theory and Involvement Load Hypothesis are the theoretical foundations of this research.

4.1.1 Depth of Processing Theory

Depth of Processing theory deals with retention in which its emphasis on deeper cognitive engagement (Depth) than the amount to disclosure given. Vocabulary learning process happens through applications like

contextual, semantic and reflective phases than frequent repetition (Craik & Lockhart 1972). The main goal of DoP is to pay a way towards meaningful conceptualization. Figure 1 illustrates the DoP theory.

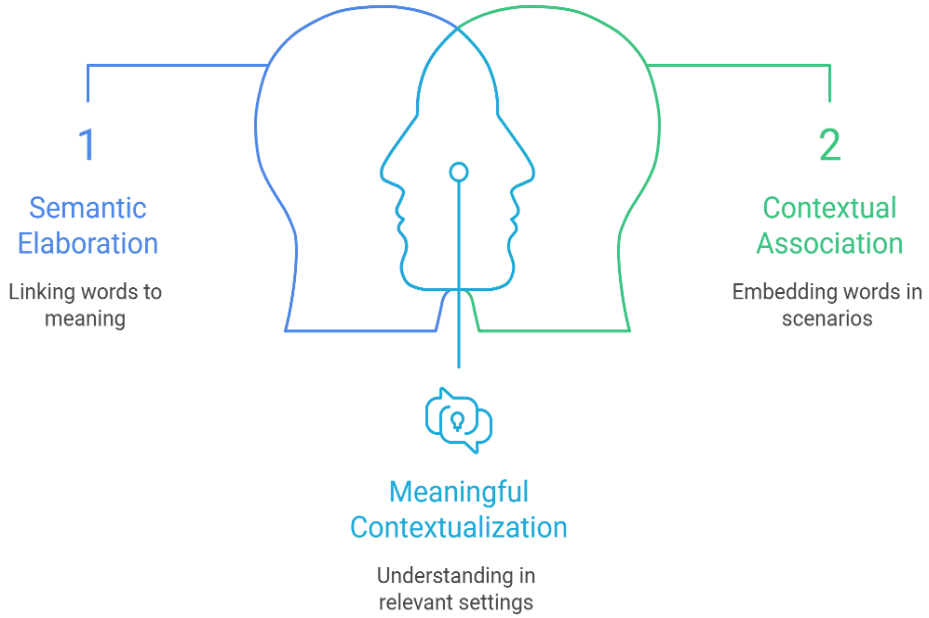

Figure 1. Depth of Processing Theory

4.1.2 Involvement Load Hypothesis

Involvement Load Hypothesis constituted of Need, Search and Evaluation (Laufer & Hulstijn 2001).

1) ***Need:*** denotes the determination to learn new word.
2) ***Search:*** emphasis on cognitive thinking to find various forms, meanings, and explanations.
3) ***Evaluation:*** deals with the critical analysis on the suitable usage.

Activities based on higher level need, search, and evaluation boosts stronger lexical knowledge.

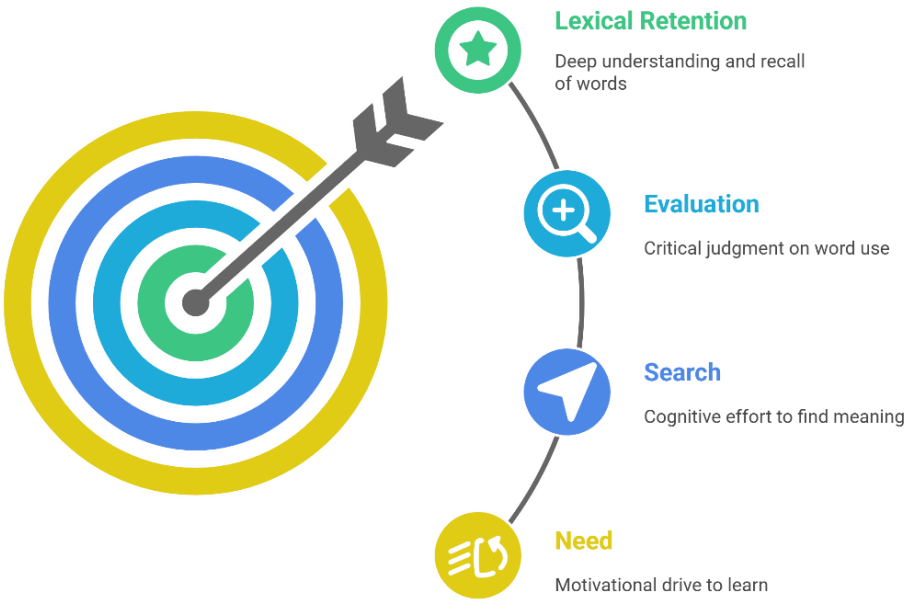

Figure 2. Involvement Load Hypothesis

Figure 2 illustrates the process of involvement load. Depth of Processing Theory and Involvement Load Hypothesis plays an essential role in conceptualizing vocabulary acquisition and learning.

4.1.3 Vocabulary Acquisition Theories with Gen AI Functional Components

Gen AI tools pose exceptional functional components like adaptive prompt generation, multisource feedback and analysis, contextual and personalized learning that trigger Depth of Processing and Involvement Load Hypothesis techniques. Table 1 shows the connectivity of Gen AI functional components along with cognitive process, theoretical linkage and its pedagogical outcome.

Table 1. Gen AI Functional Components

Sl.No.	Gen AI Functional Components	Cognitive Process	Theoretical Linkage	Pedagogical Outcome
1	Prompt Generation – Adaptive and Contextual	Semantic Description	Depth of Processing	Vocabulary Encoding and retention
2	Role-play with Gen AI	Communication, self-monitoring	Involvement Load	Enriched Vocabulary Usage
3	Gen AI – generated visuals.	Extensive rehearsal	Depth of Processing	Multimodal Vocabulary retention
4	Corrective Feedback	Evaluation and Metalinguistic progress	Involvement Load	Personalized learning
5	Gen AI – based quiz	Repetition	Depth of Processing	Long-term vocabulary retention
6	Gen AI- based contextual adaption (Indian Multilingual contexts)	Cross-Cultural based motivation	Involvement Load	Contextual encounter

Through these techniques, Gen AI becomes a cognitive booster by providing deep interactive and feedback based adaptive processing.

5. Generative AI in language learning

According to (Moulieswaran and Kumar 2023) AI becomes an undeniable force in language education. Recent studies indicates that AI helps learners in positive aspects and also few negatives include accessibility and network connectivity (Moulieswaran and Prasantha Kumar 2023). Once these problem resolves integrating AI tools will be highly beneficial for learners and teachers (Moulieswaran and Kumar 2023). Generative AI is a type of artificial intelligence that can make new things, like text, pictures, audio, and even video, by finding patterns and information in large amounts of data (Ironsi 2024). These advanced systems use deep-learning algorithms, usually with complex neural networks, to make new outputs that look and feel like content made by people in terms of style, structure, and coherence (Kar *et al.* 2023). Generative AI has made a lot of progress in the last few years, and it can be used in many different areas. In the field of language learning and education, a number of new AI-powered tools have come out that have changed how people learn and practise new languages (Dong 2023). Some important changes are adaptive learning platforms that change the content and difficulty of lessons based on how well each student is doing. This makes sure that each student has a unique and optimal learning experience. Smart chatbots made for practicing conversations in target languages give learners chances to talk to each other in real time and get feedback right away. Advanced speech recognition and pronunciation feedback systems that look at how students speak give them detailed advice on how to improve their accent and intonation (Suryanto *et al.* 2023). AI-powered grammar checkers and writing assistants not only find mistakes, but they also give explanations and suggestions for how to fix them. More advanced automated translation tools show that they are more accurate and have a better understanding of context, subtle differences, and idiomatic phrases (Kovalenko and Baranivska 2024).

5.1 Integration of Gen AI Technologies in Vocabulary Instruction

The prominent Gen AI tool named ChatGPT and other Large Language Models (LLM) based tools facilitate learner autonomy, contextual awareness and authentic vocabulary boosting dialogues. Nevertheless, an instructor's inconsistent feedback is required. Using generative artificial intelligence (Gen-AI) technologies in vocabulary lessons can have a number of benefits and ways of doing things, such as personalised learning experiences. Adaptive algorithms can change vocabulary lessons to fit the needs of each student. AI can look at how well students are doing and change the levels of difficulty as needed. Content that is interactive and interesting: AI-created vocabulary games, quizzes, exercises, virtual reality, or augmented reality experiences that are interactive (Rathika *et al*. 2024). Learning with a lot of context: AI can make sentences and examples that use the target vocabulary in a natural way, and natural language processing can give examples of how to use it in the real world. Automated grading and feedback, quick evaluation of student answers, and in-depth tracking of progress and performance analytics (Sajja et al. 2024). Multimodal learning support: AI-generated visual aids, audio pronunciations, video content, and the combination of text, images, and sound to help students learn new words. Practice making language: AI chatbots for practicing conversation with target vocabulary, automated writing prompts, and feedback that uses the words learnt (Abusahyon *et al.* 2023). Connections between languages; AI-powered tools to show cognates and word origins; comparing vocabulary across several languages. Support for real-time translation and definitions; immediate access to definitions, synonyms, and translations; understanding of idiomatic phrases in context (Ying Soon *et al*. 2024). Corpus-based vocabulary selection: AI looks at large language corpora to find words that are used often and are relevant, and then makes word lists that are tailored to certain fields or learning goals (Fang 2025) Integrating Gen-AI technologies for vocabulary instruction can enrich Indian ESL Learners.

5.2 Vocabulary Acquisition Models and Gen AI

Incidental versus intentional learning: Gen-AI can help incidental learning by making content that has a lot of context. Gen-AI can make vocabulary exercises that are specific to the person who wants to learn on purpose (Joe 1998). Depth of processing theory: Gen-AI can create tasks that require multiple levels of engagement for deeper processing. Make new words fit into different situations and make connections. The Involvement Load Hypothesis says that Gen. AI can make activities that require a lot of involvement. Need: Create situations where certain words must be used. - Search: gives learners tools to look up the meanings of words. Evaluation: Give students tasks to see if they are using the right words (Hulstijn and Laufer 2001). Practical Gen-AI uses include making personalised reading materials with target vocabulary built in, interactive exercises that help students make deep semantic connections, adaptive learning systems that change the difficulty of tasks based on how engaged the learner is, and virtual conversation partners for practicing vocabulary in context.

5.3 Features and capabilities of AI vocabulary tools

Gen. AI vocabulary tools have a lot of features and functions. For example, they can use natural language processing to find and fix mistakes, create personalised study plans, give feedback and track progress in real time, use adaptive learning algorithms to make sure that content is presented in the best way, provide contextual learning support with relevant examples, use audio and visual aids to help with multimodal learning, and support learning in multiple languages (Abusahyon et al. 2023). These tools find and fix spelling, grammar, and contextual mistakes, suggest ways to improve based on linguistic analysis, adapt to different writing styles, figure out how much each person knows, make personalised study plans, suggest targeted exercises, change difficulty levels on the fly, give immediate corrections and explanations, suggest words to use right away, track progress with data analytics, make detailed reports on acquisition and use, find areas that need improvement, update content based on user interactions, guess hard words, optimise the order in which words are presented, show vocabulary in context, give examples of how to use words, give related words, include audio pronunciation guides, use visual aids, give interactive exercises and games, help people learn multiple languages, provide translations and comparisons, and highlight cognates and false friends (Mandour 2025).

5.4 Examples of popular Gen AI-powered vocabulary tools

The text describes several popular vocabulary learning tools that leverage AI to enhance the learning experience. The applications are as follows; Vocabulary.com, Quizlet, Memrise, Duolingo, Anki, Lingvist, WordUp,

Magoosh Vocabulary Builder, Rewordify, and Knoword. Figure 3. Provide a brief introduction and use of Gen AI tools for vocabulary learning.

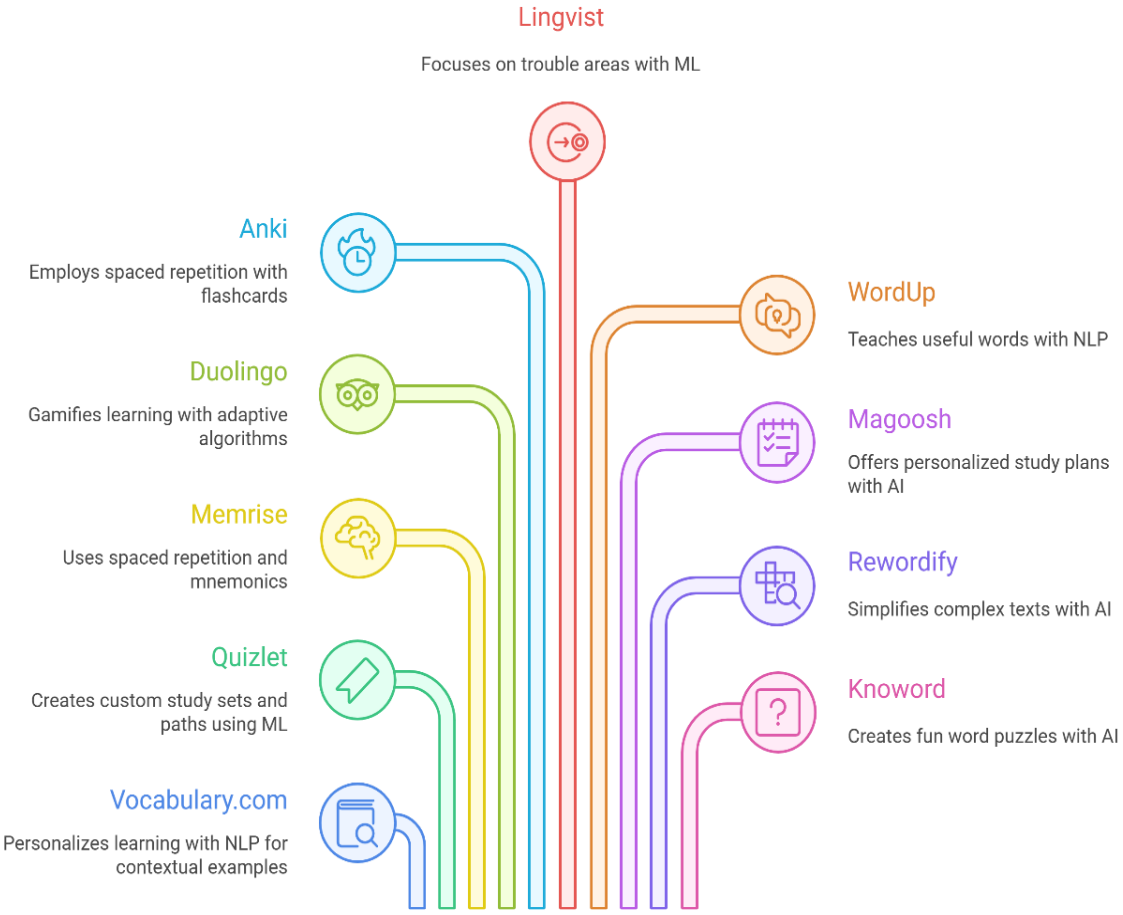

Figure 3. Gen AI Tools for Vocabulary Learning

These resources use algorithms in various manners to make instruction more tailored to meet the needs of each person, and help them learn new phrases more quickly. They employ NLP, ML, and adaptive algorithms to see how well users were doing, figure out where they could improve, and send them content that was useful to them. Using AI, these platforms can help you learn new words faster and better than traditional methods.

5.5 Instructional strategies to use Gen AI tools for Vocabulary Learning

Table 2 Clearly states few strategies and Gen AI applications for effective vocabulary learning. In addition, Figure 4 and 5 provide brief explanation for the strategies visually.

Table 2. Learning Strategies and Gen AI Applications

Sl. No	Strategies	Applications
1	Spaced Repetition	Anki, Quizlit
2	Gaming Elements	Duolingo, Memrise
3	Group Learning	Quizlit, Vocabulary.com
4	Media	Anki, Rosetta stone
5	Relevant Words	WordUp, Rewordify
6	Promoting Connections between Languages	Magoosh Vocabulary Builder
7	Personalising Learning Paths	Lingvist
8	Daily Practice	Duolingo, Memrise
9	Adaptive Learning	Vocabulary.com
10	Cultural Learning	Anki, Quizlit

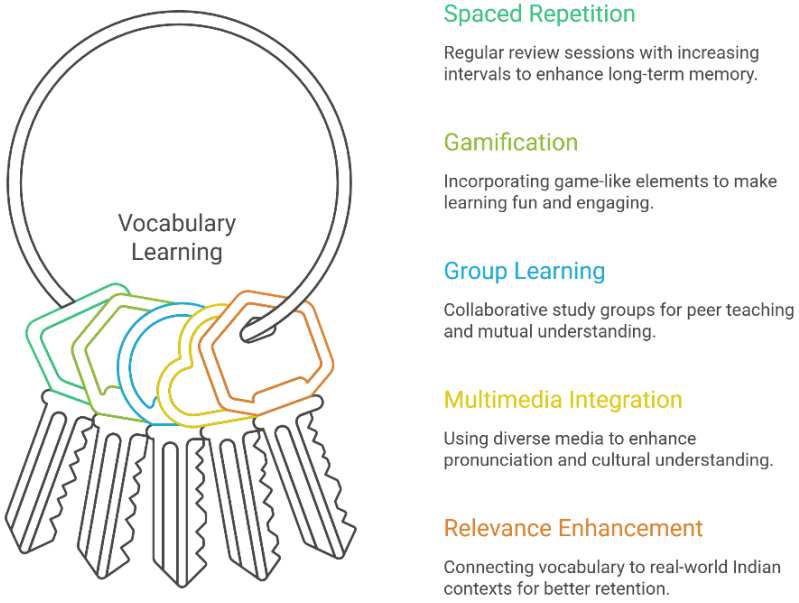

Figure 4. Effective Vocabulary Learning Strategies - I

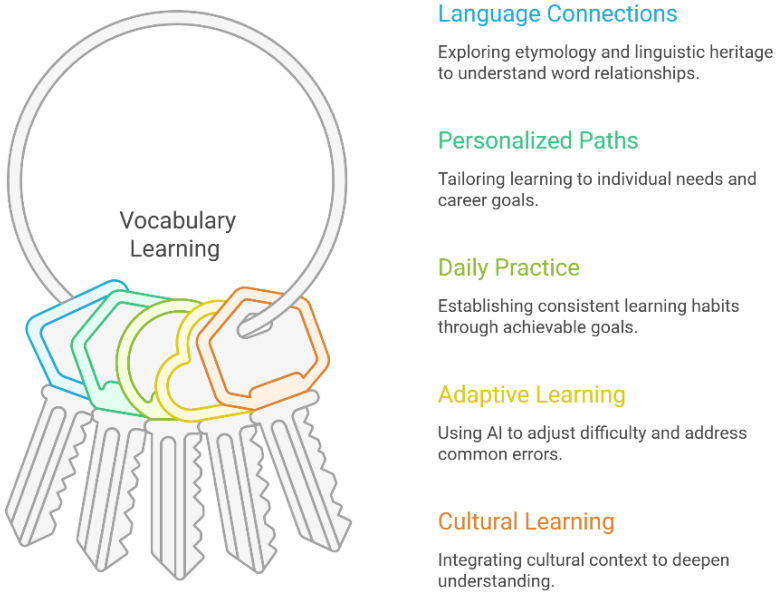

Figure 5. Effective Vocabulary Learning Strategies – II

These strategies will help ESL learners to achieve their English language proficiency.

6. Blended learning approaches and Gen AI

Generative AI (Gen-AI) blended learning methods are new ways to use AI-powered tools along with conventional teaching, flipped classrooms, and group learning activities to make education better. Instructional professionals can use Gen-AI to make customised practice questions, give real-time feedback on assignments, provide guidance to pupils online, and add additional information (Chen, *et al* 2024). Flipped educational models can use AI-generated instructional materials, interactive models, personalised educational paths, and AI chatbots to help students study on their schedules. AI-based scheduling tools, optimal setup of groups, AI-driven chat rooms, and AI-generated situations for solving problems (Anggoro 2025) can all make collaborative learning better. These

methods help teachers make learning more interesting, personalised, and effective, while still keeping the good things about traditional teaching and talking to people.

7. Contextual Appropriation for Indian ESL Learners

Indian ESL classroom settings are often marked as scoring-oriented, and also multilingual in basis. Since India is a multilingual country and citizen hold various cultural backgrounds, Gen AI tools could facilitate multilingual examples for easy understanding and comprehending other cultural practices. As mentioned earlier, Gen AI could be used in a blended learning setting.

8. Gen AI based Conceptual Evaluation Framework

Table 3 shows the Gen AI based Conceptual Evaluation Framework.

Table 3. Gen AI based Conceptual Evaluation Framework

Sl.No.	Criteria	Conceptual Indication	Outcome
1	Cognitive Encounter	Deep semantic and contextual handling	Stronger memory retention
2	Activities	Need, Search, Evaluation	High Vocabulary development
3	Personalized Learning	Self-regulated prompts	Improved motivation
4	Context	Fitting into Indian ESL Setting	Real-world and multicultural learning
5	Feedback	Relevance of AI generated content	Increased self-confidence

This conceptual evaluation framework could be used an evaluation technique for forthcoming quantitative authentication.

9. Pedagogical and Policy Implications

Instructors may use Gen AI mediated models to create instructing strategies for vocabulary enhancement. This will foster higher processing and involvement loads. Blended learning could be an ideal solution for easier instructor led feedback. Gen AI can be a mediating tool not as a full pedagogical replacement. Higher educational institutions can incorporate NEP 2020 Educational Policy, which highly positions the integration of AI tools. Encouraging domestic AI developer to research and provide data on Indian-specific areas. Every institution must create a for special AI-framework to enable AI facilitated and Instructor led program within the curriculum.

10. Implementation Challenges and Solutions

The primary issue with using Gen-AI technology in educational institutions is that it doesn't perform well in remote areas where there aren't many devices or internet connections. Old hardware makes it even harder to adopt. We can fix these issues by adding offline capabilities, portable versions, local memory caching, gradual loading, and asynchronous instruction modules. Working with the government and manufacturers is extremely significant for getting more people connected to the internet, connecting low-cost technology, and receiving money regarding the technological infrastructure (Yasin *et al.* 2024). The goal of these solutions is to make sure that everyone has fair equitable access to AI-enhanced educational resources.

11. Ethical and Pedagogical Concerns

AI can make education better by tailoring it to each student and giving them more tools, but it shouldn't replace teachers or critical thinking. Instructors need to find an acceptable compromise between incorporating AI and conventional strategies. They should use AI's potential while still encouraging students to think for themselves and interact with others (Malik *et al.* 2025). To keep AI from becoming too important, there need to be regulations

and tests to make sure people don't rely on it too much. Instructors should give students assignments that require greater imagination than AI can provide, such as collaborative work, and use material generated by AI as a foundation for additional discussion (Wu *et al*. 2021).

12. Conclusion

Some important ways to use Gen-AI in vocabulary lessons are to make personalised learning paths for each student based on their needs, use AI to make vocabulary games and exercises more fun, use AI to make examples and usage scenarios suitable for the context, use personalised evaluations to keep track of advancement and find parts that need work, and use virtual language partners to practise conversation (Lee and Muncie 2006). AI-curated authentic materials could help Indian ESL learners learn vocabulary faster and remember it better, feel more confident and fluent in the language, understand other cultures better, close the learning gap between urban and rural students, and get easier access to quality language instruction resources (Fang 2005). Instructional professionals should use AI tools to help with conventional approaches to instruction and give each student a unique learning experience. Since this research is a conceptual model, researchers ought to conduct longitudinal studies on the efficacy of Gen-AI in vocabulary instruction for Indian ESL learners, while policymakers should establish regulations for the responsible integration of AI in language education.

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Conflict of interest

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