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# THE IMPACT OF AI-POWERED MIND MAPPING ON ENGLISH VOCABULARY ACQUISITION AMONG NON-ENGLISH MAJORS: A MIXED-METHODS STUDY

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**ABSTRACT:** Vocabulary acquisition plays a pivotal role in foreign language proficiency. This study investigates the effectiveness of Artificial Intelligence (AI)-powered mind mapping on English vocabulary acquisition among non-English-major undergraduates at Nguyen Tat Thanh University (NTTU). By employing a quasi-experimental mixed-methods design, 20 third-year students were assigned to an Experimental Group (EG), which utilized AI-powered mind-mapping tool (GitMind), and a Control Group (CG), which followed traditional vocabulary instruction methods. Quantitative data from pre-tests and post-tests indicated that the EG achieved significantly higher vocabulary gains than the CG ($p = .044$), with a medium-to-large effect size (Cohen's $d = 0.66$). Qualitative findings derived from Technology Acceptance Model-based questionnaires and focus group interviews revealed high perceived usefulness, enhanced learner confidence, and increased engagement. The findings suggest that AI-powered visual mapping can reduce extraneous cognitive load and facilitate deeper semantic processing, thereby supporting vocabulary acquisition in EFL higher education contexts.

**Keywords:** *AI in education; mind mapping; vocabulary acquisition; EFL; Cognitive Load Theory; Technology Acceptance Model.*

## 1. INTRODUCTION

Vocabulary acquisition is widely recognized as a fundamental predictor of reading comprehension, fluency, and communicative competence in a foreign language (Nation, 2001). Despite its importance, vocabulary instruction in many EFL contexts, particularly in Vietnamese higher education, is still mostly based on rote memorization and repetition without context. Such approaches often fail to sustain learner engagement or promote long-term retention.

Mind mapping has been identified as an effective visual learning strategy that supports the organization of lexical knowledge and enhances memory through associative networks (Buzan & Buzan, 2006). However, traditional hand-drawn mind maps can be time-consuming and cognitively demanding, potentially increasing extraneous cognitive load. Recent advances in AI offer promising alternatives by automating layout design, suggesting semantic relationships, and facilitating dynamic visualization.

In this context, this study explores the pedagogical potential of AI-powered mind mapping for English vocabulary acquisition among non-English-major university students at NTTU. These learners typically encounter limited English exposure and display low intrinsic motivation, making them an appropriate population for examining technology-enhanced vocabulary instruction. The study seeks to address the following research questions:

1. To what extent does AI-powered mind mapping improve vocabulary acquisition among EFL students at NTTU?
2. How do EFL students perceive the effectiveness of AI-powered mind mapping in supporting their vocabulary learning?

## 2. THEORETICAL FRAMEWORK

This study is grounded in three complementary theoretical perspectives: Cognitive Load Theory, Dual Coding Theory, and the Technology Acceptance Model.

### 2.1. Cognitive Load Theory (CLT)

CLT states that learning effectiveness depends on the efficient allocation of limited working memory resources (Sweller, 2011). AI-powered mind mapping can reduce

extrinsic cognitive load by automating structural and visual design processes, thereby allowing learners to allocate more applicable cognitive resources to constructing and integrating lexical knowledge.

### 2.2. Dual Coding Theory (DCT)

According to Paivio's (1971) DCT, information is processed through separate but interconnected verbal and visual channels. AI-powered mind maps support dual coding by linking lexical items with visual icons, colors, and semantic relationships, which increases the possibility of retention and recall.

### 2.3. Technology Acceptance Model (TAM)

Davis's TAM (1989) explains users' adoption of technology through two key factors: Perceived Usefulness (PU) and Perceived Ease of Use (PEOU). In this study, TAM is employed to examine learners' acceptance of AI-powered mind mapping as a pedagogical tool rather than a technological barrier.

## 3. METHODOLOGY

### 3.1. Research Design and Participants

A quasi-experimental mixed-methods design with pre-test and post-test measures was adopted. The participants were 40 third-year non-English-major undergraduates at NTTU with an approximate CEFR B1 proficiency level. Using purposive sampling, the students were divided into two groups such as EG ($n$ = 20) and CG ($n$ = 20).

### 3.2. Instruments and Procedure

- **Intervention:** Over a six-week period, the EG used GitMind, an AI-powered mind-mapping tool, to generate semantic networks and automated layouts for vocabulary units from the *Personal Best A2B* textbook. The CG received traditional instruction involving teacher-led explanation, repetition, and manual note-taking.
- **Quantitative Measures:** A standardized 30-item vocabulary test was administered as a pre-test and an immediate post-test.

- **Qualitative Measures:** Learners in the EG completed a TAM-based Likert-scale questionnaire and participated in semi-structured focus group interviews ($n$ = 8).

## 4. RESULTS AND DISCUSSION

Quantitative analysis revealed no statistically significant difference between the Experimental Group (EG) and the Control Group (CG) at the pre-test stage ($p$ = .43), indicating baseline equivalence. Following the six-week intervention, both groups demonstrated improvement in vocabulary performance; however, the EG achieved significantly higher post-test scores than the CG.

**Table 1:** Comparison of Post-test Performance

| **Group** | ***N*** | ***M*** | ***SD*** | ***t-value*** | ***df*** | ***p-value*** | ***Cohen's d*** |
|---|---|---|---|---|---|---|---|
| Experimental Group | 20 | 8.37 | 0.57 | 2.09 | 38 | 0.044 | 0.66 |
| Control Group | 20 | 7.91 | 0.80 | | | | |

The statistically significant difference ($p$ = .044) and the medium-to-large effect size (Cohen's $d$ = 0.66) suggest that AI-powered mind mapping provided a meaningful advantage over traditional text-based vocabulary instruction.

Qualitative findings further supported the quantitative results. Data from the Technology Acceptance Model (TAM)-based questionnaire indicated generally positive learner perceptions toward AI-powered mind mapping. As shown in Table 2, perceived usefulness, confidence, and enjoyment all achieved mean scores close to 4.0 on a five-point Likert scale, while technical know-how also received a favorable rating.

**Table 2:** *Mean Scores of Learners' Perceptions toward AI-Powered Mind Mapping Constructs*

| **Construct** | **Mean (*M*)** |
|---|---|
| Perceived Usefulness | 3.90 |

| | |
|---|---|
| Confidence | 3.95 |
| Enjoyment | 3.92 |
| Technical Know-how | 3.75 |

Insights from focus group interviews provided further explanation for these perceptions. Participants reported that AI-powered mind maps made vocabulary learning "faster," "clearer," and "less tiring," particularly due to automated hierarchical organization and visual clarity. Although several learners noted minor initial technical challenges, they emphasized that the reduction in manual effort helped them concentrate on understanding word meanings and semantic relationships rather than on formatting or note-taking.

Overall, the convergence of quantitative gains and positive learner perceptions indicates that AI-supported mind mapping not only enhances vocabulary acquisition outcomes but also fosters favorable cognitive and affective learning conditions.

## 5. CONCLUSION AND IMPLICATIONS

This study demonstrates that AI-powered mind mapping is an effective pedagogical approach for enhancing English vocabulary acquisition among non-English-major university students.

### Pedagogical Implications

1. EFL instructors are encouraged to integrate AI-powered visualization tools into vocabulary instruction to promote deeper semantic learning.
2. Higher education institutions should provide basic digital literacy training to maximize the pedagogical benefits of AI-powered tools.

### Limitations and Future Research

The study is limited by its relatively small sample size ($N$ = 40) and short intervention duration (six weeks). Future research should adopt longitudinal designs

with larger samples to examine long-term retention and explore the impact of AI-powered mind mapping on other language skills.

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