The Effectiveness of Mind Mapping Techniques in Vocabulary Learning: A Mixed-Methods Study

Elhafez Morsi[1] & B Sivakami[1]

[1] School of Social Sciences and Languages, Vellore Institute of Technology, Chennai, India

Correspondence: Dr. B. Sivakami, Assistant Prof. of English (Sr.), School of Social Sciences and Languages, Vellore Institute of Technology, Chennai, India, Vandalur-Kelambakkam Road, Chennai, Tamil Nadu - 600127, India. E-mail: sivakami.b@vit.ac.in

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Abstract

The development of a strong vocabulary is critical in learning any new language, yet EFL learners often struggle in order to acquire new vocabulary due to inadequate exposure outside the classroom. The current mixed-method study examines the influence of direct vocabulary teaching using mind mapping techniques among foundation students aged 18-19 at the University of Technology and Applied Sciences-Ibra in Oman.

Forty students were involved in a quasi-experimental study and divided into an experimental group, who were instructed in vocabulary using mind mapping techniques integrated with reading texts, and a control group, who were taught through traditional instruction. Pre-tests and post-tests were used to measure improvements in vocabulary learning during a four- week intervention. Statistical analysis demonstrated significant improvements in vocabulary size and comprehension among the experimental group compared with the control group.

The findings from the paired sample t-test revealed that mind mapping significantly improved vocabulary learning ($t = 7.245$, $p < 0.001$). Although the control group's average scores showed minimal improvement (rising from 11.15 to 12.55), the experimental group's average scores increased from 11.85 to 15.80. The mean difference of 3.950 for the experimental group provides further evidence of mind mapping's efficacy as a vocabulary-learning tool.

Furthermore, qualitative phenomenological interview evidence with experimental group respondents indicated that there was increased student engagement, improved retention, and a positive attitude towards vocabulary learning. The respondents reported that the use of mind mapping assisted the learners in paying more attention to word relationships, so that they were able to retain and use new words more effectively. These findings suggest that using mind mapping as a vocabulary acquisition strategy is effective with EFL learners and may support its broader implementation in language pedagogy.

Keywords: vocabulary acquisition, direct vocabulary instruction, mind mapping, (EFL) learners

1. Introduction

1.1 Vocabulary Acquisition and Its Role in Language Proficiency

The contribution of vocabulary acquisition to language learning has long been considered the best predictor of linguistic ability. Snow (2010) claims that a wide range of vocabulary is crucial not only for communication but also for improving reading comprehension, writing proficiency, and listening skills. When vocabulary is learned in foreign language learning contexts, vocabulary learning may be more challenging because the exposure of the learners is often limited to the classroom. Therefore, classroom-based instruction remains crucial in improving the vocabulary of the learners. Teachers continually seek new and innovative strategies to enhance vocabulary learning. Although word knowledge is essential for achieving linguistic competence, efficient strategies such as mind mapping can facilitate the vocabulary acquisition process.

1.2 The Role of Mind Mapping in Vocabulary Acquisition

Mind mapping as a visual tool for learning has proven to be an effective way for better vocabulary learning. While there are various strategies for vocabulary acquisition, mind mapping stands out as an efficient visual tool that help learners memorise and organise new vocabulary. The thinking tool allows learners to visualise and organise new words, connecting what they learn with their prior knowledge, and thereby encouraging deeper cognitive-level processing and enhanced recall (Buzan, 2010). Through enabling learners to visualise the connections among the words, mind maps assist the learners in memorising as well as recalling vocabulary more effectively. The strategy is quite efficient when used with some reading texts, as the texts provide rich contextual grounds that promotes word acquisition. The current study investigates the effectiveness of mind mapping in combination with reading texts in enhancing vocabulary acquisition among foundation-level students learning English as a foreign language at the University of Technology and Applied Sciences–Ibra.

1.3 The Role of Lexical Knowledge in Acquiring a Second Language

Vocabulary development is an important aspect of second language acquisition because Coady and Huckin (1997) explain that word knowledge is the foundation of communicative ability. Morsi and Sivakami (2025) emphasise that the learners' communicative efficacy is also strongly enhanced through explicit vocabulary instruction. Wilkins (1972) asserts that while grammar provides only a limited capacity for conveying the meaning, vocabulary is indispensable, as communication cannot occur in its absence. Such a claim aligns with the vocabulary instruction approaches of Nation (2001), which ephasise the importance of sustained and repeated exposure for effective vocabulary learning. Intentional vocabulary learning in which learners are taught directly the target vocabulary, fosters the expansion of the lexicon. Hulstijn (2003) identifies intentional learning as one strategy through which learners receive explicit information regarding the vocabulary they should learn, while Schmidt (1990) stresses the necessity of noticing language features as part of the acculturation in the acquisition of the language. Such conscious approaches to learning become efficacious in enhancing the language proficiency of the learners through fostering repeated reflection and focused attention. Communication is still an essential element to the learners' development of proficiency in the target language; hence, they should be equipped with the appropriate learning approaches to expand their vocabulary repertoire.

1.4 Mind Mapping and Vocabulary Learning Strategies

Mind mapping is in alignment with these principles by enhancing explicit word acquisition. In addition, word acquisition strategies, as presented by Catalan (2003), include the strategies undertaken by learners in deciphering unfamiliar vocabulary, memorising words, and using them when they communicate. Schmitt (1997) outlines several strategies for vocabulary acquisition, such as cognitive, memory, and metacognitive strategies, which may be effectively combined with the techniques of teaching vocabulary explicitly. Utilising mind mapping as a strategy enables learners to reinforce vocabulary learning by connecting unfamiliar words with familiar ideas based on contextual clues and through engaging in word-association exercises, such as identifying synonyms, antonyms, and word definitions.

Mind mapping has been found in a wide range of settings to enhance vocabulary acquisition, although very few studies have investigated its efficacy specifically in combination with reading texts. Buzan and Griffiths (2005) argue that previous studies have established the effectiveness of mind mapping as a tool in vocabulary learning; however, there is little evidence of its effect when combined with texts that provide rich contextual frameworks for word acquisition. The current study seeks to fill the gap by examining how mind mapping paired with some chosen reading texts affects the vocabulary acquisition of EFL learners. The findings aim at offering insight into the effectiveness of mind mapping as a pedagogical tool for enhancing vocabulary acquisition in the context of foreign language learning.

2. Literature Review

Vocabulary learning is established as the foundation of language learning. Effective vocabulary is vital in aiding proficient use of language as well as the development of reading, writing, and listening skills (Snow, 2010). For foreign language learners, who have little outside exposure to new vocabulary except in the classroom, instruction in the classroom is crucial (Nation, 2013). Below is an investigation into the primary techniques of enhancing vocabulary learning, with special reference to the use of mind mapping with some of the selected reading texts.

2.1 Vocabulary Acquisition and Its Importance

Language proficiency is the foundation of vocabulary development. Effective vocabulary makes writers more competent in expressing themselves and readers more competent in comprehending texts. Wilkins (1972) argues that grammar is important, but meaning is possible because of the vocabulary. Nation's (2001) vocabulary learning hypotheses suggest high-frequent and distributed exposure to vocabulary that fosters an accelerated growth in the lexicon. Purposeful acquisition, in which learners are taught vocabulary specifically, is found to boost language proficiency (Hulstijn, 2003; Schmidt, 1990). Vocabulary learning strategies, as advocated by Schmitt (1997), are cognitive, memory, and metacognitive strategies that may be beneficial in the development of strong vocabulary.

Effective methodologies are needed in order to help with vocabulary learning because vocabulary acquisition is the foundation of language learning. The methodology that was identified as being effective in enhancing vocabulary learning is mind mapping, in particular when used with contextualised texts. The following section explicates the efficacy of using the methodology of mind mapping in aiding vocabulary learning.

2.2 Mind Mapping: A Cognitive Tool for Vocabulary Learning

Mind mapping is a thinking skill that visually represents concepts and their associations, allowing learners to think both cognitively and metacognitively about vocabulary. Buzan (2010) recognises mind mapping as the process in which an associated idea is noted in the center of the page with outward branches that represent related words or thoughts. The visual approach assists learners in organising and associating new vocabulary items with what they are familiar with, so that more cognitive processing is made possible with information retention (Buzan & Griffiths, 2005).

The application of mind mapping has been particularly helpful in vocabulary learning because it transforms abstract information into more concrete and readily accessible forms. Davies (2011) and Zipp and Maher (2013) argue that the visual content of mind maps benefits the learners in recalling the words through the presentation of an organised depiction of meanings and connections. This strategy facilitates the reinforcement of memory retention and the development of divergent thinking through the ability for learners to see the relationship between the concepts. Therefore, the mind map is utilised as an effective tool within both professional and academic settings,

and it enables better understanding and greater cooperation. The process is also linked to the increased student engagement and motivation through the presentation of active input as part of the learning process (Morse, 1991).

Research on mind mapping argues that it plays an important role in vocabulary learning, especially in the context of foreign language learning. For instance, mind mapping is reported to boost learners' memory retention, creative thinking, as well as their general academic achievements (Tarin & Yawilong, 2022; Luangkrajang, 2022).

2.2.1 Features of Mind Mapping

Mind mapping involves essential characteristics that boost its effectiveness as a learning tool. Buzan (2007) outlines that mind maps always concentrate on an overriding problem with branches stretching outward and with the use of images, symbols, and colours in helping cognitive processing. Buran and Filyukov (2015) point out that these characteristics stimulate the left and right hemispheres of the brain, prompting creativity, analytical thinking, and memory. Employing images in mind maps helps change abstract concepts into more concrete which allows learners to remember words better, thereby enhancing vocabulary retention. Through the linking of visual and linguistic aspects, mind maps solidify long-term memory and vocabulary recall.

2.2.2 The Effectiveness of Mind Mapping

The benefit of mind mapping is that the unique features suit well when learning vocabulary. Mind mapping has also been proved under diverse learning conditions. For example, Futrell et al. (2002) report that mind mapping improves the retention of information and promotes rapid learning by reinforcing word associations and enhancing recall. In addition, Zhang (2021) argues that mind mapping helps learners to think creatively and develop their expressive ability, which is crucial in linguistic learning. Li (2019) also mentions that by integrating visual organisation through hierarchical relations, mind maps enable learners to construct meaningful associations among words, thereby facilitating enhanced retention and recall of vocabulary.

2.2.3 Types of Mind Mapping

A highly productive visual way of assisting with vocabulary acquisition is the use of mind maps, with the use of non-linear structure and cognitive processing (Buzan & Buzan, 1994). Wu and Zheng (2023) tried out at a Chinese vocational school three kinds of mind maps, namely situational, synonym/antonym, as well as root/affix. They indicated that they significantly expedited the comprehension, use, and memorisation of vocabulary.

• Situational Maps allow learners to be familiar with contextual meaning through connecting vocabulary with practical situations through true associations (Wu & Zheng, 2023). Following a shopping-based situational map, the current study introduced the vocabulary terms with the theme of shopping as supermarket, store, shop, ads, product, cash, customer, and attitude. For helping learners internalise vocabulary through associations with topics and the practicability of the subjects, each vocabulary term was accompanied with the description, visual image, and sample use in context.

• Synonym/Antonym Maps better enable learners to grasp nuanced differences more effectively via graphical comparison among semantically similar terms (Wu & Zheng, 2023).

• Root and Affix Maps allow learners to decipher unfamiliar vocabulary through the word structure breakdown (prefix, root, and suffix) (Wu & Zheng, 2023).

As was concluded in an in-depth meta-analysis undertaken by Sari et al. (2023), mind mapping strengthens desire, autonomy of the learner, and both short- and long-term memory, in part through the activation of both hemispheres of processing (Syukur et al., 2023). Similarly, an Iranian-based study established that using mind maps significantly increased desire and will to communicate (WTC), word recall, and retention (Yousefi et al., 2023).

Word Family-Based Mind Mapping was introduced as the fourth type of map. The strategy links each target word with its grammatical variants (e.g., verb, noun, adjective), definitions, derived forms, and context examples. For instance, one visual template can link related forms such as the verb *celebrate*, the noun *celebration*, the adjective *celebratory*, and the noun *celebrity*. The approach effectively deals with the morphological, semantic, and contextual aspects of vocabulary learning simultaneously by displaying related components within a structured framework.

2.2.3.1 Benefits of Maps Based on Word Families

There are three categories that strengthen the word family-based maps. First, they construct grammatical awareness by intentionally showing the associations among parts of speech. Second, semantic depth is fostered by presenting both base and extended meanings in autonomous yet cognate branches. Third, functional relevance is demonstrated by linking vocabulary to extra-linguistic contexts.

There is empirical evidence supporting the efficiency of holistic map-based methods that incorporate morphological, semantic, and visual features in improving vocabulary recall and comprehension (Akbar et al., 2024; Liu & Cheok, 2023; Almaidah et al., 2025). Almaidah et al. (2025) illustrated, as a case in point, that high school students who were taught with mind mapping scored substantially higher than control groups in vocabulary learning. Similarly, Liu and Cheok (2023) revealed that mind mapping is effective in professional learning environments.

Theoretically, this type of mapping underpins dual-coding theory, in which integration of visual and verbal input improves memory, as well as Ausubel's (1960) model of meaningful learning, in which graphic organisers work as advance organisers that improve retention

(Sari et al., 2023). The approach is also underpinned by the "testing effect," in which match-and-fill activity in mind maps functions as retrieval practice that consolidates long-term memory (Roediger & Butler, 2011).

Word Family-Based Mind Mapping, therefore, becomes a robust, whole-word vocabulary acquisition method that simultaneously provides morphological, contextual, and semantic support within a single graphical representation. Supported by an ever-increasing corpus of empirical research, it benefits from the established effectiveness of situational, synonym/antonym, and root/affix maps (Wu & Zheng, 2023).

2.3 Contextualised Vocabulary Learning with Reading Texts

Texts offer rich possibilities of vocabulary acquisition through the introduction of contextualised forms of how words are applied in realistic situations. The texts lean more in the direction of presenting in-depth information concerning people, places, or events and are comprised of narratives that have characters, events, and plots (Creswell, 2013). These chosen texts introduce learners to the broader opportunities of a wide range of vocabulary that includes not only nouns, but also adjectives, verbs, and adverbs that are essential in the construction of meaningful and well-structured sentences in the foreign language. Through the introduction of such texts, learners get exposure to various linguistic structures that aid in the understanding of the meaning and use of words in context (Snow, 2010).

The selected texts also encourage learners to infer the meanings of the words from context, which is considered an essential skill in learning vocabulary effectively (Nation, 2001). Experimental studies have demonstrated that contextualised learning with reading can contribute significantly more growth in the vocabulary knowledge of the students (Nagy & Townsend, 2012). When combined with the use of mind mapping, the selected texts become an effective word learning tool. By using mind maps, the learners are allowed to structure and link the new vocabulary encountered in the texts to enhance retention and recall (Wu & Zheng, 2023). Through the application of these two strategies, the learners are able to visualise the relationship between words and their meanings, making vocabulary learning more meaningful and easier to retrieve.

2.4 International Perceptions on Using Mind Maps for EFL Vocabulary Acquisition

Recent empirical research across different countries supports the utilisation of mind mapping as an effective technique for vocabulary learning among EFL learners. Feng et al. (2023) conducted a well-controlled quasi-experiment with Iranian EFL learners and found that the learners who were trained on mind-mapping far surpassed those who were provided with conventional instruction in vocabulary recall, retention, acquisition, motivation, and enhancement towards communication (WTC). Also, Shi and Tsai (2022) investigated the effect of a mobile-assisted mind-mapping programme (MALL) on northern Taiwanese EFL learners. The findings indicated that the experimental group significantly outperformed the control group in the immediate and delayed posttest ($t \approx 3.68$, $p < .05$, Cohen's $d \approx .81$). Furthermore, students were word conscious, possessed greater long-term memory, and had a positive learning attitude towards vocabulary.

Another instance was a pre-experimental intervention carried out under the Coggle computer programme for plotting electronic mind maps in Vietnam by Tran (2024). EFL students who were not English majors showed a marked enhancement in learning vocabulary and independent learning skill in a ten-week intervention programme, and evidence in favour of the benefit in the use of technology with visual learning methods. Based on such evidence, Haiyao (2025) undertook a systematic review of 2014-2024 studies in different foreign language acquisition settings. It found that mind mapping is a method to improve language acquisition proficiency across cultures, particularly in vocabulary learning, and as a facilitator of innovative learning approaches across different cultural and pedagogical settings. These studies jointly confirm that mind mapping has global applicability, educational efficacy, and cross-contextual influence, thereby establishing a solid foundation for its future implementation in the Omani EFL context.

2.5 Augmenting Uniqueness of Current Work

As international evidence overwhelmingly supports the learning of vocabulary through mind mapping (Feng et al., 2023; Shi & Tsai, 2022; Tran, 2024; Haiyao, 2025), there exist huge gaps in the literature up to now, making the current study distinctive. While most previous studies have examined mind mapping in isolation or in conjunction with computerised aids, few have investigated its use with contextualised reading texts to enhance vocabulary learning in EFL learners. Research reveals that contextualised texts present immeasurable potential for learners to draw inferences, integrate lexical material, and build deeper semantic networks (Nagy & Townsend, 2012). Since the potential for integrating mind mapping with situational texts in reading—by exploiting both visual cognition and contextual exposure—has rarely been explored in previous studies, this current research addresses this methodological gap by employing mind mapping alongside carefully chosen texts. This approach enables learners to construct semantic connections and develop visual word networks grounded in authentic contexts.

In addition, few empirical studies have evaluated mind mapping in the Middle Eastern EFL context, particularly in Oman. Oman EFL learners are typically faced with word retention challenges brought on by limited exposure to English in real-life contexts (Behforouz & Al Ghaithi, 2022). While the vocabulary learning strategy in Oman was previously explored, no study explored critically the complementary use of mind mapping and contextualised reading in the foundation programme. Conducting such a study in the University of Technology and Applied Sciences–Ibra fills a major geographical and pedagogical gap and provides new contributions transferable to EFL learners in similar contexts in the Gulf region.

Another feature of the present study lies in its mixed-methods framework, in which quantitative quasi-experimental data are combined with qualitative phenomenological interviews. While numerous previous studies have depended solely on statistical conclusions in

isolation, the present study also considers learners' dispositions, engagement, and experience in learning vocabulary through mind mapping. Through a triangulation of both quantitative and qualitative evidence, it presents a comprehensive picture of how mind mapping facilitates vocabulary learning. According to established theories, the current study is grounded in Paivio's (1991) dual coding theory, which holds that learning is enhanced when material is simultaneously processed through verbal and visual channels, and Ausubel's (1960) meaningful learning theory, which emphasises the integration of new information with the learners' prior knowledge. Together, these theories provide a solid theoretical ground for combining visual mapping strategies with contextualised reading to support EFL learners' vocabulary learning development.

2.6 Research Gaps and Justification

Although previous studies have investigated the effectiveness of mind mapping and contextualised word learning in isolation, little attention has been paid to their combined effect, particularly in the context of learning English as a Foreign Language (EFL). The current research seeks to bridge this gap by investigating the extent to which the integration of mind mapping with selected texts is effective in facilitating vocabulary acquisition. It also aims to provide deeper insight into the effectiveness of mind mapping as an educational tool for vocabulary learning in EFL contexts by examining the interaction among these strategies.

3. Learning Theory

A constructivist learning approach is grounded in the belief that the most effective learning outcomes occur when the student is actively engaged in the learning experience. As pointed out by Yu (2013), learning is an interactive and dynamic process during which the learner integrates new information with prior experience. The approach is suited most effectively in group-based settings, in which the teacher is the facilitator rather than the provider of information.

Under constructivism, there is an instructional role that is scaffolded and teacher-directed, helping the learner fill knowledge gaps and achieve conceptual meaning. The teacher does not use direct instruction but rather assists the learner in building meaning through exploration and critical thinking.

Mind mapping correlates with constructivist viewpoints as it promotes active participation from the learner and helps them associate new information with their experience and prior knowledge. Kress and Van Leeuwen (2001) point out that the implementation of visual material, such as images and symbols, facilitates cognitive processing in addition to benefits in terms of retention. With the application of visual organisation of knowledge, the mind map facilitates the student in establishing more effective relationships across unfamiliar and familiar words by enhancing long-term recall of vocabulary. Moreover, in its systematic format of visualising knowledge, mind mapping promotes conceptual understanding as well as cognitive development (Sun & Wang, 2022).

The study is based on the social constructivist language learning framework, which extends broader constructivist principles and is consistent with the manner in which learners become actively engaged in constructing knowledge through contact with others within a cultural context. Vygotsky (1978) posits that cultural and social contexts are major contributors to cognitive development. Acquisition starts at the social or inter-psychological level and then at the individual or intra-psychological level. The process highlights the merit in group learning whose activities are such as to develop individual mastery. It is particularly true in language learning, wherein internalisation of terms and concepts is impossible without effective linguistic interaction.

4. Procedures for Mind Mapping Application

The experimental group was instructed in vocabulary with teacher-made mind maps over a period of one month. The control group was instructed with traditional vocabulary instruction. The integration of mind maps into the curriculum was as follows:

4.1 Mind Mapping Presentation and Keyword Introduction

Students acquired vocabulary terms with the help of mind maps. Each mind map visually structures crucial words and definitions, illustrating word relations such as *ingredient, recipe, dish,* and *menu*. Word definitions and illustrations were provided so that the students would be well-versed in the application of words in context.

As shown in Figure 1 that the food-related mind maps included core vocabulary terms along with their definitions, in-context usage, and visual descriptions. These mind maps were taken from *Pathways Level 1 Reading and Writing* (Blass & Jones, 2018), specifically from Unit 5, Lesson B, *"Cooking the World"* (pp. 92–93), and page 91 of Unit 5, describing world food patterns and Mediterranean cuisine.

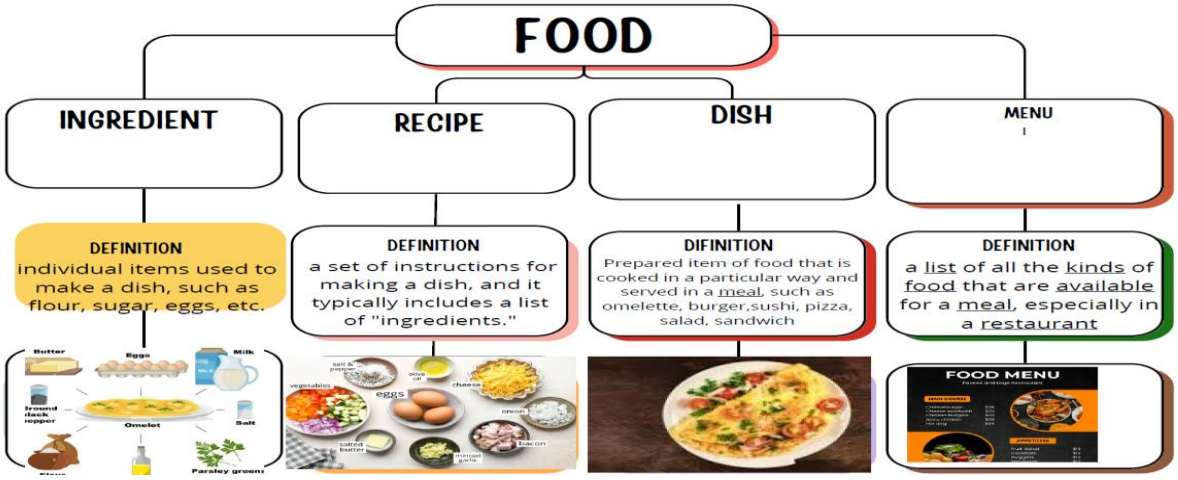

Figure 1. Sample Mind Map Used for Teaching Food-Related Vocabulary

4.1.2 Introducing Vocabulary with Mind Maps and Text Reading

Using mind maps and a contextualised reading passage, students were introduced to the vocabulary concepts migrate, celebration, evacuate, and solution. As shown in Figure 2,3,4, and 5, each word and its family were graphically organised in the mind maps, which also included definitions, contextual examples, and related terms to enhance comprehension.

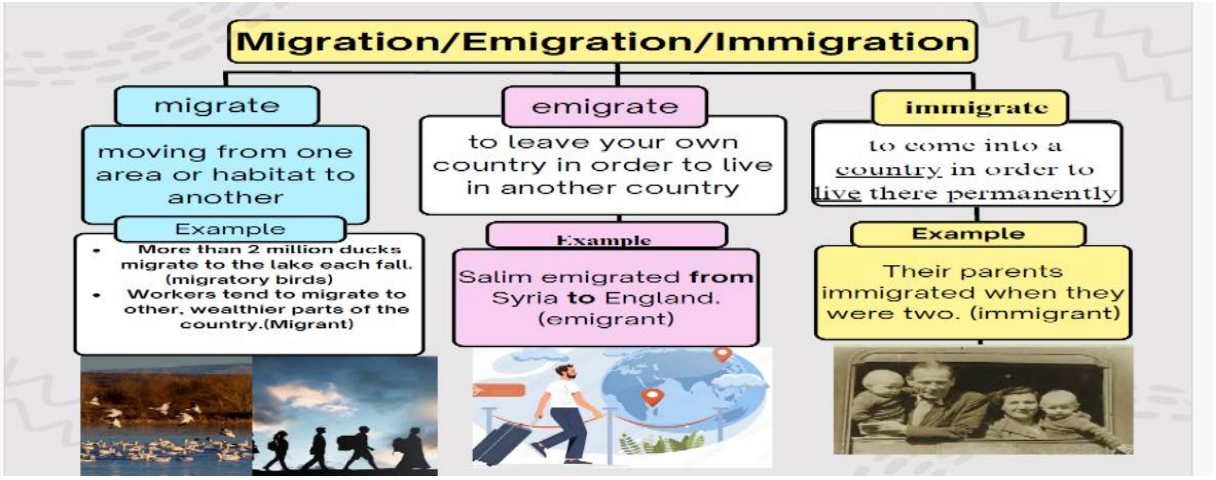

Figure 2. Sample Mind Map for teaching the word migrate and its word family

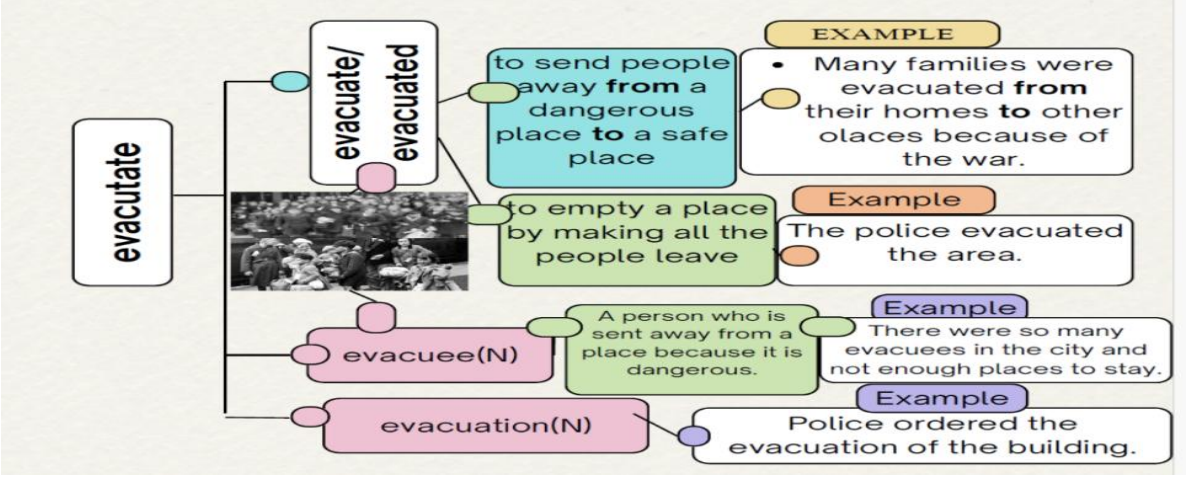

Figure 3. Sample Mind Map for teaching the word evacuate, and its word family

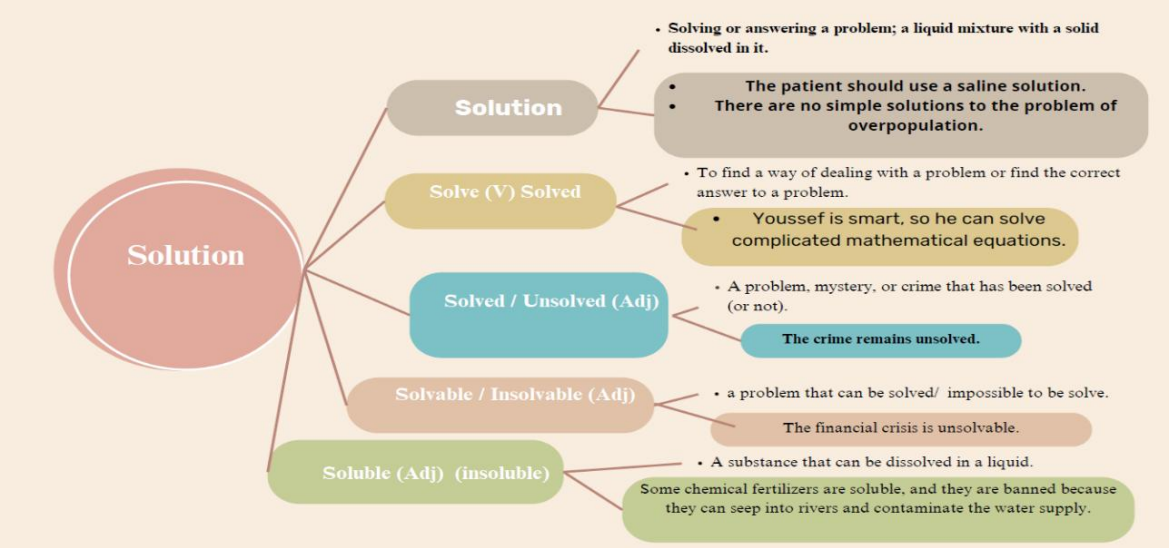

Figure 4. Sample Mind Map for teaching the word solution and its word family

Figure 5. Sample Mind Map for Celebration & Celebrity Vocabulary

4.2 Vocabulary Expansion Through Mind Mapping Activities

Students finished structured exercises, such as filling in the blanks in mind maps. The activity boosted vocabulary analysis as well as short-term and long-term recall. Wu and Zheng (2023) believe that mind mapping strengthens organised recall of vocabulary as well as the integration of new words with prior knowledge.

4.3 Vocabulary Practice Through Scaffolded Word Lists

To enhance vocabulary retention, students completed structured scaffolded word lists (see Appendix C: Scaffolded Students' Personal Wordlists). This approach guided students in personalising their vocabulary learning through the following steps:

1.Word Recording: Students wrote down the target vocabulary from the mind maps.

2.Definition/Meaning: Students recorded a definition of the word from the class materials or from what they know themselves.

3.Usage in Contextual Sentence: Students created a sentence using the word in context.

4.Clue Identification: Students identified the contextual or structural clues that would facilitate their recall of the word.

For instance, the word "dish", students wrote:

- Definition: A cooked product that was specially prepared and consumed as part of a meal (e.g., pizza, omelette).
- Sentence in Context: My favourite dish is spaghetti with tomato sauce.
- Clue: Eat your favourite food.

The systematic approach allowed the learners to widen their vocabulary learning through contextualised learning.

4.4 Application Through Reading and Structured Tasks

Following the scaffolded word lists, the learners used the selected reading texts to apply vocabulary in real-life situations. The selected reading texts were from Pathways Level 1 Reading and Writing (Blass & Jones, 2018) and comprised (passages included in Appendix B)**:**

- *"Cooking the World" (pp. 92–93) is Sasha Martin's perspective on travelling the world through food.*
- *Mediterranean Food Culture (p. 91) talks about the traditional ways of eating in the Mediterranean.*

Students did comprehension questions, summary exercises, and vocabulary tasks. For example, they answered multiple-choice questions to verify their understanding of the major topics, they used the new words to complete fill-in-the-gap tasks, and they completed definition-matching exercises in which students wrote the word that went with each definition in the text.
These texts gave real language input and helped students remember words they had acquired via mind mapping.

4.5 Assessing Lexical Knowledge

The most important factor that predicts linguistic competence is vocabulary size. According to Nation (2001), developing fundamental fluency in English necessitates that learners possess a foundational vocabulary of 2,000 to 3,000 words. To evaluate vocabulary acquisition, the study included a combination of pre-tests, post-tests, and formative assessments administered throughout the intervention.

- Pre- and Post-Tests: Nation's Vocabulary Levels Test (Version B), given before and after the intervention.
- Practice Exercises: Lessons included vocabulary gap-fill exercises and matching assignments.
- Cloze Tests and Reading Comprehension Tests: These were designed to measure how well students can understand and use words in context.

5. Research Questions

This study seeks to address the following research questions:

1. Does the use of explicit vocabulary teaching through mind mapping, combined with contextualised texts, result in a notable growth in the vocabulary size of students in the experimental group compared to those in the control group?

2. Is there a statistically significant difference in the mean vocabulary test scores between students who received vocabulary instruction via mind mapping and contextualised reading texts, and those who received traditional instruction?

6. Methodology

6.1 Research Design

This study implemented a mixed-methods design, integrating both quantitative and qualitative methods for data collection. An experimental design was employed in the quantitative phase to evaluate the effect of mind mapping on vocabulary learning.

The role of mind mapping and scaffolded word lists in the acquisition of students' vocabulary was explored in the current study under the framework of an exploratory qualitative design and a descriptive approach. The main goal of the descriptive approach is the presentation of a clear description of the current state of events and behaviours faced during the research process. According to Best and Kahn (2006) descriptive research is used to provide information regarding the current state of a phenomenon and to give a description of "what exists" in situations or variables in an environment. Although it does not manipulate variables, it is a systematic procedure of observing and critiquing human collectives, attitudes, or pedagogical approaches. In this research, the researcher investigated how the application of scaffolded word lists and mind maps promoted contextualised learning and active engagement and hence helped in the acquisition of words. The approach adheres to constructivist theory in which learner-centred strategies are promoted and the learners actively participate along with their peers and the content in constructing new knowledge. Qualitative aspects monitored students' use of mind mapping by conducting phenomenological interviews.

6.2 Participants

There were 40 students (20 male and 20 female) involved in this study from the University of Technology and Applied Sciences-Ibra who were enrolled in the second level of the foundation programme. The participants were 18-19 years old and were selected based on their marks in an English placement test. They were placed into two groups: an experimental group, which received vocabulary instruction through mind maps, and a control group, which followed the normal course of study.

6.3 Procedure

The study was conducted over a period of four weeks. A pre-test of baseline vocabulary was administered to both groups. Explicit vocabulary instruction was taught through mind maps and reading texts for the experimental group, whereas the control group received traditional vocabulary instruction. Following the intervention, both groups completed a post-test to assess its effect on vocabulary learning.

6.4 Data Collection

Data were collected in a systematic manner through the use of a mixed-methods strategy, involving both quantitative and qualitative methods in order to offer a holistic view of the research variables.

- Quantitative Data: Vocabulary size and the students' knowledge were assessed through pre-test and post-test scores of both the experimental and the control groups.

● Qualitative Data: Phenomenological interviews were conducted with experimental group students in an attempt to gauge their perceptions on learning vocabulary. Interviews explored students' experiences of learning vocabulary before and after the use of mind mapping strategies.

6.5 Data Analysis

Quantitative data were analysed using statistical tests in the form of paired-samples *t*-tests to examine within-group changes from pre-test to post-test, and independent-samples *t*-tests to compare score differences between the experimental and control groups. This allowed for a rigorous analysis of the effect of the intervention on vocabulary learning. Qualitative interview data were thematically analysed to identify key patterns and themes in students' lived experiences of mind mapping and vocabulary learning.

7. Results

Paired-samples and independent-samples t-tests were used to assess and compare the mean scores of the pre- and post-tests within each group. The findings are presented below.

7.1 Quantitative Findings

Findings showed a statistically significant improvement in the vocabulary performance of the experimental group, who were instructed in explicit vocabulary through mind mapping and reading texts. Results from the paired-samples t-test revealed a significant increase in the experimental group's post-test mean score compared to their pre-test score. Furthermore, the independent-samples t-test demonstrated that the experimental group participants who received the mind mapping intervention achieved significantly higher mean scores in the post-test than those in the control group.

7.2 Qualitative Findings

Qualitative data from the phenomenological interviews revealed several key themes:

● Enhanced interest: Mind mapping is very interactive, so most of the students in the experimental group showed greater engagement and interest in vocabulary learning. A student, Amna Khalid Said Al Masruri, for example, said that she felt happier and more motivated, as the mind mapping method made it easier for her to learn vocabulary.

● Improved comprehension and memory: Mind mapping helped students in comprehending and memorising vocabulary. As Sarah Azeem Mohamed Al Balushi pointed out, "Mind mapping helped me memorise vocabulary more clearly and easily."

● Increased excitement: Some of the students reported that the process of using mind maps was enjoyable as well as effective. Adnan Khalfan Humaid Al Musalami explained, "It was fun to use mind maps, and I could remember the vocabulary better."

Qualitative findings also enhanced the quantitative results, in which experimental group students demonstrated higher engagement, understanding, and retention of vocabulary in their test scores. Their positive reactions towards mind mapping strategies highlight the application of mind mapping in vocabulary learning, as demonstrated in the qualitative analysis section.

8. Discussion

The study carried out descriptive statistics to gain valuable insights and inferential statistics to ascertain the significant improvement of experimental group participants.

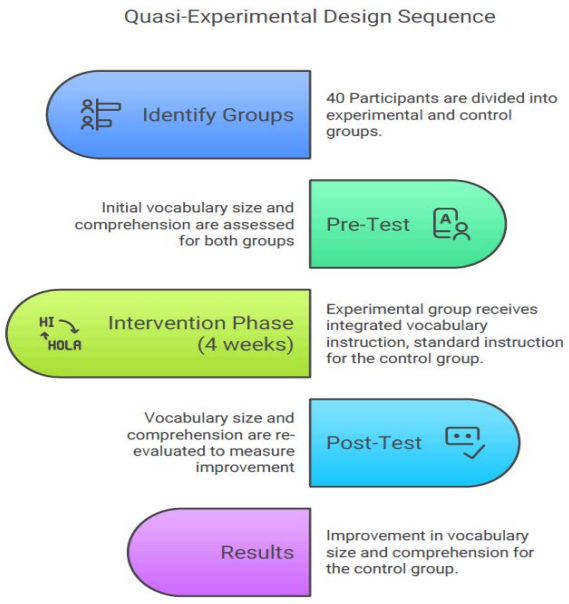

Figure 1. Quasi-Experimental Design Sequence

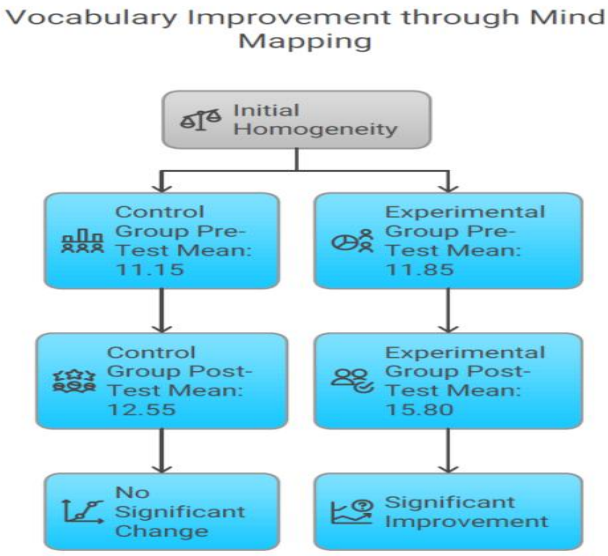

Figure 2. Vocabulary Improvement through Mind Mapping

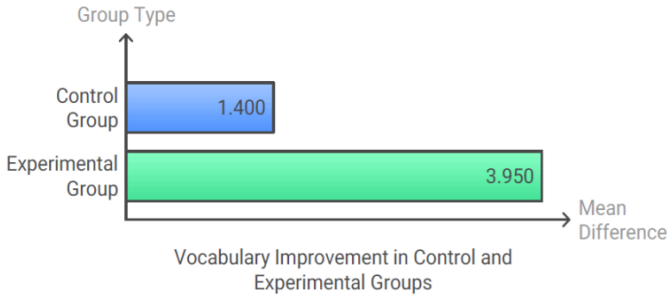

Figure 3. Vocabulary Improvement in Control and Experimental Groups

8.1 Descriptive Statistics

The descriptive data for the experimental group (EG) and control group (CG) in the pre-test and post-test evaluations are presented in Table 1.

Table 1. Descriptive Statistics for Pre-test and Post-test Scores

Descriptive Statistics					
Group		**Mean**	**N**	**Std. Deviation**	**Std. Error Mean**
Pair 1	Pre-test CG	11.15	20	3.329	0.744
	Post-test CG	12.55	20	3.170	0.709
Pair 2	Pre-test EG	11.85	20	2.498	0.559
	Post-test EG	15.80	20	3.071	0.687

CG -Control Group, EG -Experimental Group

The descriptive statistics show that the difference between the pre-test mean value (11.15) of the control group and the pre-test mean value (11.85) of the experimental group is negligible, indicating the homogeneity of the groups before the intervention. In contrast, the difference between the post-test mean of the control group (12.55) and the experimental group's post-test mean (15.80) indicates a significant improvement in vocabulary proficiency of the learners in the experimental group through the use of mind mapping in instruction.

8.1.2 Paired-Samples t-Test Findings

In this study, paired-samples t-tests were used to determine the statistical significance of the improvements within each group. The results are shown in Table 2.

Table 2. Paired-Samples t-Test Results for Pre-test and Post-test Scores

Paired-Samples Test									
Pair		Paired Differences					t	df	Sig. (2-tailed)
		Mean Difference	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					lower	upper			
Pair 1	Pre-test CG - Post-test CG	-1.400	2.521	0.564	-2.580	-0.220	-2.483	19	.023
Pair 2	Pre-test EG - Post-test EG	-3.950	2.438	0.545	-5.091	-2.809	-7.245	19	.001

Pair 1 - Pre-test & Post-test of CG

Pair 2 - Pre-test & Post-test of EG

(*) Significant at $p < 0.05$, (**) Significant at $p < 0.001$

The control group (CG) recorded a mean increase of -1.400 from pre-test to post-test scores and a p-value of 0.023, suggesting a moderate but statistically significant improvement in vocabulary. The experimental group (EG) recorded a larger mean increase of -3.950 with a highly significant p-value of 0.001. Compared to the control group, the experimental group indicates substantially greater improvement in vocabulary acquisition. Both groups improved overall as demonstrated by the t-values and the levels of significance (p-values); however, the experimental group showed significantly greater improvement.

8.1.3 Intervention Impacts on the Experimental Group

To examine the specific effect of the intervention on the experimental group in greater detail, a separate paired-samples t-test was employed.

Table 3. Paired Samples T-Test Comparing Pre-test and Post-test of the Experimental Group

Paired-Samples Test									
Pair		Paired Differences					*t*-value	df	Sig. (2-tailed)
		Mean Difference	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Pre-test EG - Post-test EG	-3.950	2.438	0.545	-5.091	-2.809	-7.245	19	.001

(**) Significant at $p < 0.001$

A mean difference of 3.950 from pre-test to post-test scores of the experimental group indicates a statistically significant improvement in performance as a result of the intervention. The 95% confidence interval for the mean difference ranged from 5.091 to 2.809 affirming the reliability of this effect. The standard deviation of 2.438 reflects moderate variability in the students' improvement scores, suggesting that certain students benefited more strongly from utilising the mind mapping technique than others.

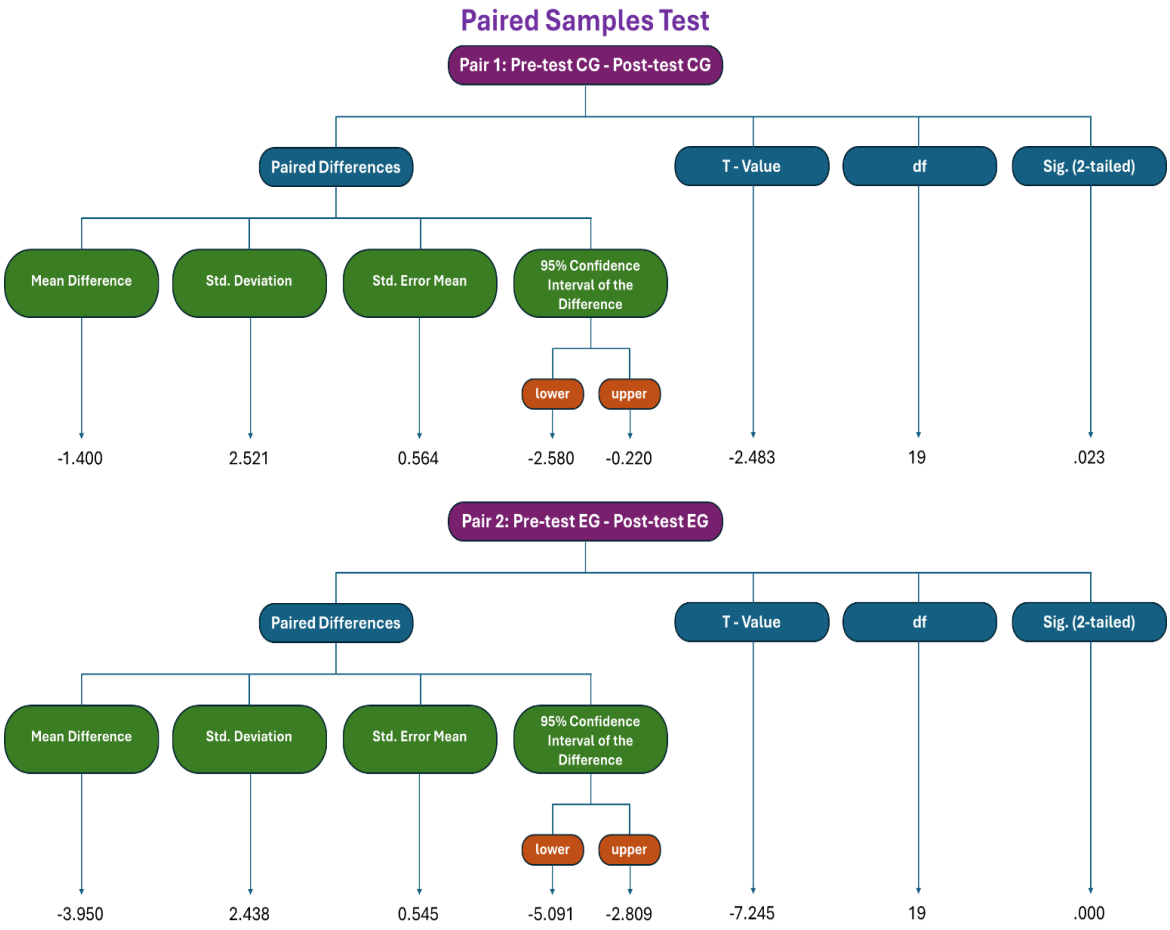

Figure 1. Paired Samples Test

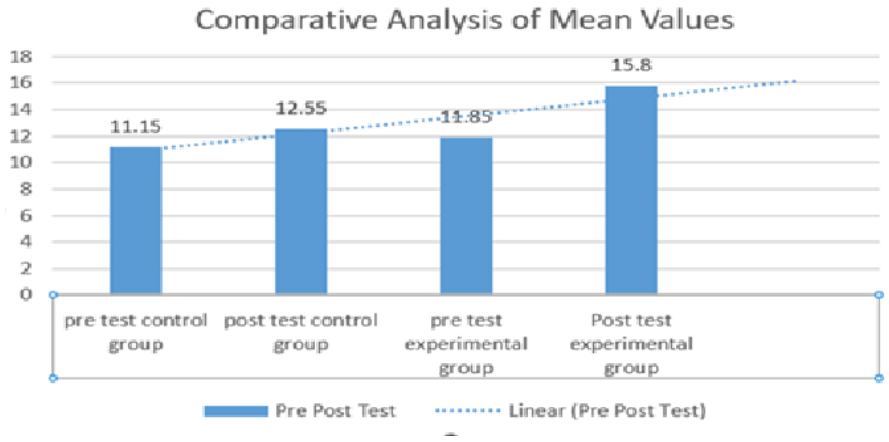

Figure 2. Comparative Analysis of Mean Values

Figure 1 illustrates a significant improvement in the experimental group participants after the intervention, but a negligible improvement in the control group students, as a traditional teaching method was adopted in their vocabulary teaching.

The importance of mind mapping for learning vocabulary is confirmed in the form of a t-value of 7.245 and a p-value <0.001. Mind mapping significantly enhances vocabulary acquisition when combined with reading texts, as evidenced by both quantitative and qualitative studies. Students in the experimental group indicated elevated levels of engagement, comprehension, and enjoyment, along with significant gains in vocabulary growth. The positive outcome reinforces the substantial improvement in the performance of participants after the intervention.

These results are consistent with earlier studies showing the advantages of mind mapping for vocabulary acquisition. Mind mapping facilitates deeper cognitive processing of words and their connections, according to Buzan (2010) and Davies (2011). Moreover, through associating newly acquired vocabulary with pre-acquired associations and prior knowledge, this systematic vocabulary learning approach through mind maps facilitates recall. The key aspect of context in vocabulary learning was evidenced in the experimental group's increased recall and use of newly acquired words (Wu & Zheng, 2023).

Moreover, results also verify those found by Kress and Van Leeuwen (2001) and Sun and Wang (2022), who assert that mind maps indicate a more effective approach to visually reinforce memory as well as comprehension. Students comprehended as well as applied vocabulary comfortably in different contexts if they were asked to explore their connections among words.

9. Conclusion

Findings indicate that the use of mind mapping approaches can significantly foster vocabulary learning among EFL students. When mind mapping was combined with contextualised texts, it enhanced the students' vocabulary size and mastery. It is reported by the study that implementing mind mapping techniques in learning vocabulary can engage students in a more innovative, interactive, and efficient manner.

The positive impact of mind mapping on vocabulary learning demonstrated in this study carries significant pedagogical benefits for teaching vocabulary in EFL contexts. Language teachers can employ mind maps as an educational strategy to expand vocabulary repertoire among learners, create interest, and facilitate long-term recall. Moreover, mind mapping presents an intriguing area for future investigation, particularly concerning its appropriateness for different language learning proficiency levels and contexts, thereby allowing teachers to maximise learning of vocabulary among different types of learners.

10. Limitations and Prospective Research

The current study has a few limitations. The sample is relatively small and context-specific, thus limiting generalisability. Long-term retention of vocabulary also might not be measured with a highly brief intervention. Moreover, to be more comprehensive, reading passages were employed in general but various genres such as expository, narrative or descriptive would have influenced mind maps differentially. Lastly, the tests were mostly vocabulary size- and breadth-based but did not comprise depth-based aspects such as collocations as well as pragmatic competence.

Future research, then, should involve more extensive and more heterogeneous samples, adopt longitudinal designs, and explore the effectiveness of mind mapping with different reading genres. Wider assessment tools would also facilitate a more complete vocabulary development profile. These lines of research could also help narrow down the pedagogical application of mind mapping in the classroom and optimise its yield for EFL learners.

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Authors' contributions

Elhafez Morsi has conceptualised, collected resources, analysed, and written the original draft. B. Sivakami is the corresponding author and supervisor. She edited, reviewed, and developed the final draft. All authors read and approved the final manuscript.

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The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

Data sharing statement

No additional data are available.

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Appendix A: Sample Mind Maps Used in the Study

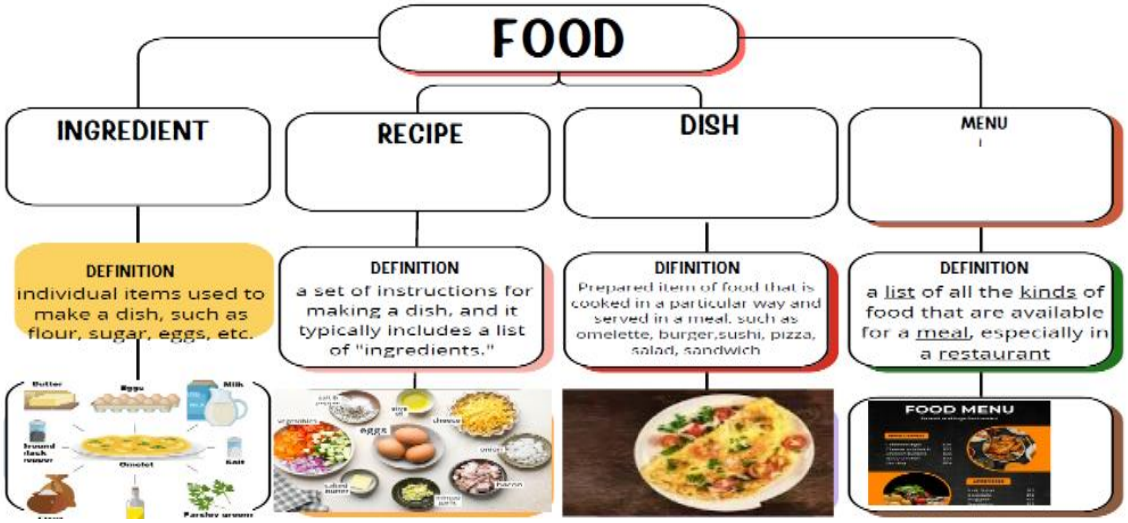


Figure A1. Sample Mind Map for Food Vocabulary

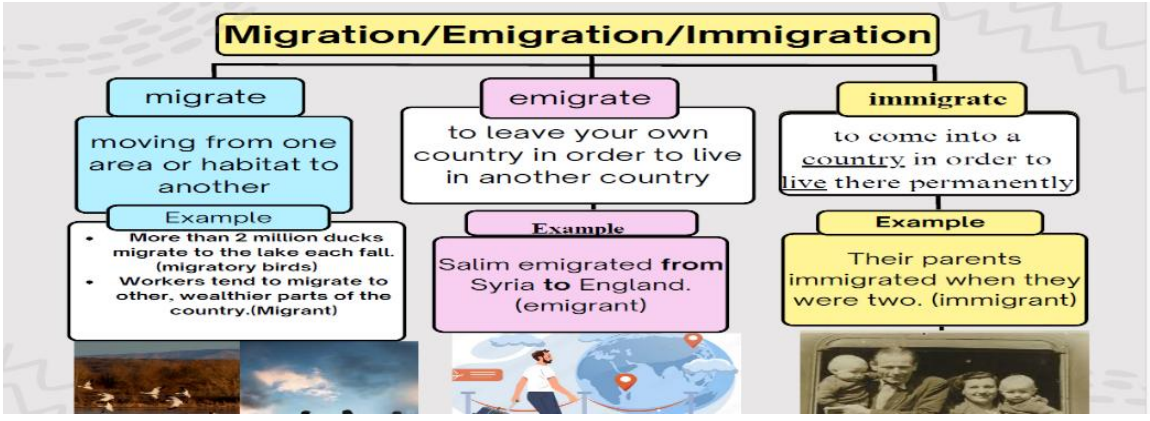


Figure A2. Sample Mind Map for Migration Vocabulary

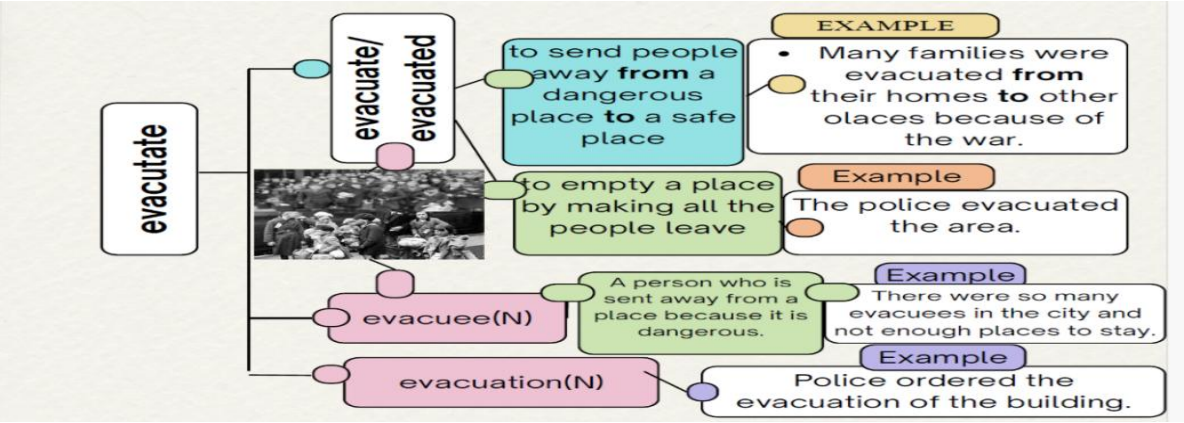


Figure A3. Sample Mind Map for Evacuation Vocabulary

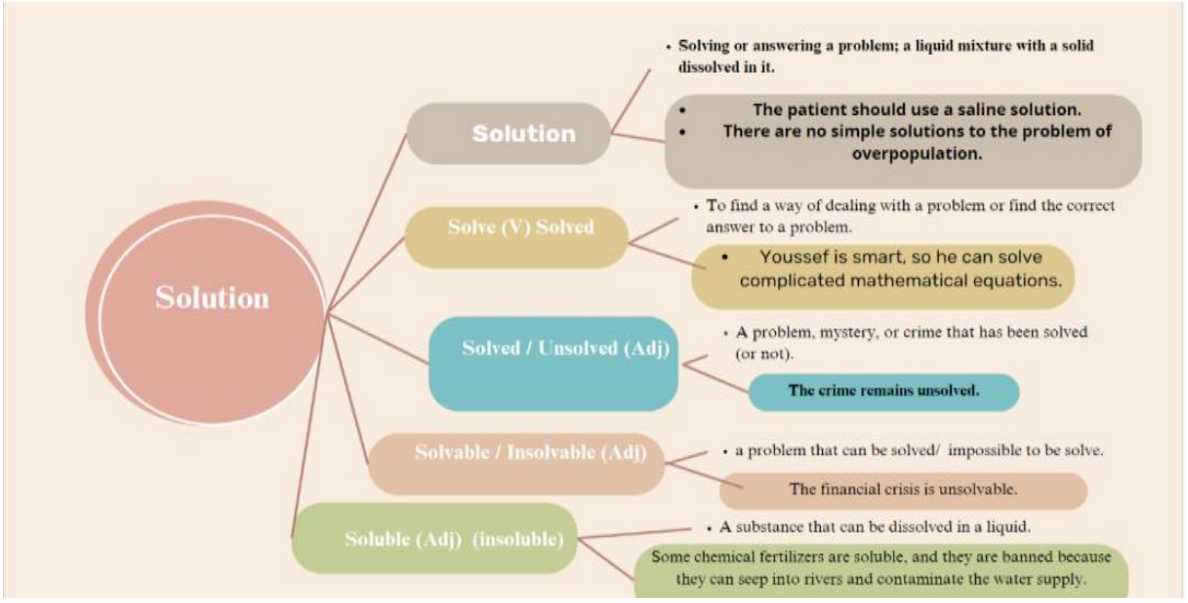


Figure A4. Sample Mind Map for Solution Vocabulary

Figure A5. Sample Mind Map for Celebration & Celebrity Vocabulary

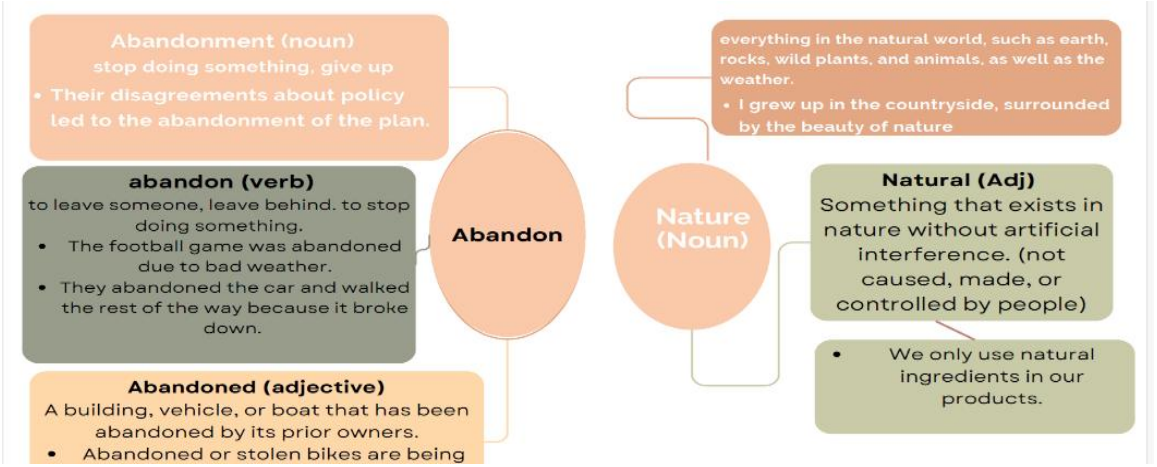


Figure A6. Sample Mind Map for Abandon & Nature Vocabulary

Figure A7. Sample Mind Map for Senses Vocabulary

Appendix B: Reading Texts Used in the Study

B.1. "Cooking the World" Blass, L., & Jones, L. (2018). *Pathways Level 1 Reading and Writing*. National Geographic Learning.

It tells the story of food writer Sasha Martin's attempt to cook a recipe from each country in the world. Interviewed, she describes how food brought the world to her home so that she could "travel" without ever having to leave and refers to it as a form of "stovetop travel." She describes introducing foreign foods to her daughter as a means of inculcating cultural appreciation and bringing the world a little closer together.

Excerpts from the text:

“So many people dream of travel. But I believe you can have adventures without getting out of your own home.” (Martin, 2018, p. 92)

B.2. Mediterranean Food Culture (Summary)

It is a text describing the food culture in Mediterranean areas such as Italy and Greece. It traces the local dining habits, e.g., harvesting newly grown herbs and vegetables from backyard spaces and preparing food with olive oil. Typical preparations are fried in olive oil fish and salad prepared from newly cultivated vegetables.

Excerpts from the text:

“One fruit in particular, the olive, does well in the Mediterranean type of climate, so they use quite a bit of olive oil there.” (Blass & Jones, 2018, p. 91)

Blass, L., & Jones, L. (2018). *Pathways Level 1 Reading and Writing: Reading Unit 5 Lesson B Cooking the World* (pp. 92-93). National Geographic Learning.

B.3. Pathways Level 1 Reading and Writing. Reading Unit 5_Lesson B Cooking the World (pages 92-93)

Sasha Martin, a popular food blogger, began the blog *Global Table Adventure* in 2010 with a simple mission in mind: cooking up traditional recipes from every country in the world. Over four years, Martin worked up more than 650 recipes, a total of one from every 195 countries. In an interview in *Pathways*, Martin wrote about the experience and how it brought the world home (Blass & Jones, 2018). She framed cooking as a major way of engaging with world cultures. Provided with the right ingredients, one can relive the flavor of distant lands and identify with distant communities. Martin details such a practice as a type of what she refers to as "stovetop travel," comparable to armchair travel but something more immediate and available (Blass & Jones, 2018).

One of Martin's greatest ***hopes*** was that this project would help her daughter feel a sense of belonging in the world. She also wanted her to grow up respecting and appreciating people from different cultures, whom she affectionately calls global ***neighbors*** (Blass & Jones, 2018). Martin thinks that exchanging food builds empathy and mutual understanding in people.

Instead of emphasizing shocking or foreign food, Martin was more interested in introducing recipes common enough to make people comfortable and open to learning different foreign cultures. That way, she might help overcome resistance and inspire curiosity (Blass & Jones, 2018).

Similarly, Anje, a history student, united her passions for food culture and historic studies. On her website, Kitchen Historic and Food Roots, she provides virtual tours of historic recipes from the 13th century onward until the 1980s (Blass & Jones, 2018).

Read the scanning sheet "A Global Food Journey" and answer the questions.

1.Who launched the Global Table Adventure blog back in 2010?

2.How many dishes did Sasha Martin cook from 195 countries?

3.What do you need to get right in your cooking to recreate the flavors of another place?

4.How did Sasha Martin use food to create a sense of belonging?

5.What types of dishes can visitors discover on Anje's websites, Kitchen Historic and Food Roots, spanning from the 13th century to the 1980s?

Questions 6 to 10

Complete the summary below using words from the box. The words are from the passage.

neighbors	**ingredients**	**recipes**	**dishes**	**popular**

Sasha Martin said that it is essential for kids to know people from other countries as and she called them "global **(6)** _____ "because the world is so small now. Sasha loved trying new **(7)** _____ from different countries as part of her culinary adventure. To prepare her international meals, she needed a wide range of **(8)** _____, some of which were hard to find locally. She often posted her favorite international **(9)** _____ on her blog, so her readers could recreate the *dishes* at home. Her Global Table Adventure blog that she created in 2010 was **(10)** _____.

Pathways Level 1 Reading and Writing Unit 5 Pages 91 Citation:

Blass, L., & Jones, L. (2018). *Pathways Level 1 Reading and Writing*. National Geographic Learning.

Reference:

Blass, L., & Jones, L. (2018). *Pathways Level 1 Reading and Writing: Unit 5* (pp. 91). National Geographic Learning.

***B.4.The text describes the food culture and practices in Mediterranean countries. Also, it provides examples of fried fish cooked in olive oil and a salad of fresh vegetables*.**

The words in **blue** below are used in the reading passage on pages 85–86. Write the correct form of each word next to its definition.

Many **types** of edible plants—plants you can eat—grow in Mediterranean countries such as Italy and Greece. Sometimes these plants—herbs, vegetables, and fruits—grow near people's homes. People often **pick** them, take them home, and use them right away. This way, they are still very **fresh**. One fruit in particular, the olive, grows well in the Mediterranean climate, so people use a lot of olive oil there. The oil has a good **taste**, so people often pour it right on their food. They also use it to **prepare** food. For example, if you visit a Mediterranean home, someone might **offer** you **fried** fish cooked in olive oil and a salad of fresh vegetables mixed with the oil.

A. The words in **bold** are used in the reading text above. Write the correct form of each word next to its definition. **Write the correct part of speech (verb, noun, adjective)**

1. _____(v) to make something, such as food
2. _____(n) a kind or a category
3. _____(adj) cooked in fat, such as butter or oil
4. _____(adj) recently made or produced; not old

B. Complete each sentence with the correct word from the words in blue below.

A **dish** is a kind of meal or recipe.
If something is **popular**, a lot of people like it.
A **recipe** is a set of instructions for making a type of food.
An **ingredient** is one of the things that you use to make a particular dish or meal.
A **variety** is a group of things of a particular type that are all different in some way.

1. Salt is an important _____. Cooks use it in almost every kind of _____.
2. Some restaurants have secret _____for making their food.
3. You can learn to cook a(n) _____of dishes from food blogs.
4. If you hope to create a(n) _____blog, you should write about things that a lot of people are interested in.

B.5. Read the following passage and then answer the questions:

It was a small California town named Sunnyvale where the sunshine was always a wee bit brighter. It was a unique period for birds residing in Sunnyvale in the spring. It was **migration** season for birds to fly to warmer places. Annually, those birds **migrate** thousands of miles away from home for warmer weather as families travel to warmer cities during winter vacations.

One afternoon, at a school science fair, a young scientist named Emily showcased a project—the amazing **solution** she invented to help in the growth of plants. It was a huge success, and Emily was happy and ecstatic to showcase her accomplishment in front of her peers.

While this was happening, the town was set up for the summer festival they had every year. It was going to feature music, dance, and a lot of delicious food for everyone to sample. It was a time for folks to mingle and party.

As the festival loomed close, the town was reminded of the time when they had struggled for independence against a far-off monarch. As a result, they **celebrated** their freedom with parades and fireworks.

In Sunnyvale, life was always full of surprises and adventures, just like the journeys of the **migrating** birds and the transformations of delicate butterflies. The townspeople cherished their town's beauty and the spirit of togetherness that made every **celebration** unforgettable.

1. Choose the correct answer: A, B, C or D:

1. What is the journey to warmer places called for the local birds in Sunnyvale?

A) time to build nests B) migration C) time to arrive D) time to search for food

2. Why do the local birds in Sunnyvale fly far away yearly? They do this to avoid the ----

A) desert B) food C) cold winter D) warmer places

3. What did Emily showcase at the school science fair?

A) a special solution to help plants grow B) her collection of butterflies

C) her dancing skills D) her favorite music playlist

4. What was the town preparing for as mentioned in the passage?

A) winter festival B) spring cleaning event

C) annual summer festival D) town hall meeting

5. How does Sunnyvale celebrate its freedom every year?

A) by hosting a science fair B) by planting new trees

C) with parades and fireworks D) by organizing a bird-watching event

2.Match the words to their correct definitions:

1. Migrate _____	a. to send people away from a dangerous place to a safe place, or to empty a place.
1. Celebrate _____	b. to leave someone, leave behind. to stop doing something.
2. Evacuate _____	c. it refers to the act of moving from one area or habitat to another, especially on a seasonal basis.
3. Solution _____	e. to commemorate an important moment, occasion, or event with parties.
4. Abandon _____	f. solving or answering a problem; a liquid mixture with a solid dissolved in it.

3. Fill in the blanks with the correct words from the box below:

migrate	celebrate	evacuate	solution	abandon

1. After the earthquake, the government ordered everyone to _____ the coastal areas due to the risk of a tsunami.
2. The scientist developed a new chemical _____ to dissolve the stubborn stain.
3. Every year, many birds _____ to warmer regions to escape the harsh winter.
4. The team decided to _____ the project because of unforeseen challenges.
5. Families across the country gathered to _____ the national holiday with parades and fireworks.

Appendix C: Scaffolded Students' Personal Word lists

C.1. Introduction

As a way of supporting word learning, students completed scaffolded word lists as part of the mind mapping approach. Through such an activity, they were themselves actively engaged in learning through prediction of meaning, identifying contextual clues, and dictionary use only where necessary.

Each wordlist followed a structured format, where students:

1. Wrote down the word from the mind maps.
2. Guessed the meaning of the word from their prior knowledge.
3. Identified structural or contextual clues for recalling the word.
4. Checked a dictionary only when necessary.

These word lists were categorized based on different vocabulary themes used in the study.

C.2. Scaffolded Students' Personal Word lists

Vocabulary from the "Food and Cooking" Mind Map

Word	What I Think It Means	Clues (Context or Structure)	Dictionary Definition (if needed)
Food			
Ingredients			
Recipe			
Dish			
Menu			

Vocabulary from the "Migration and Movement" Mind Map

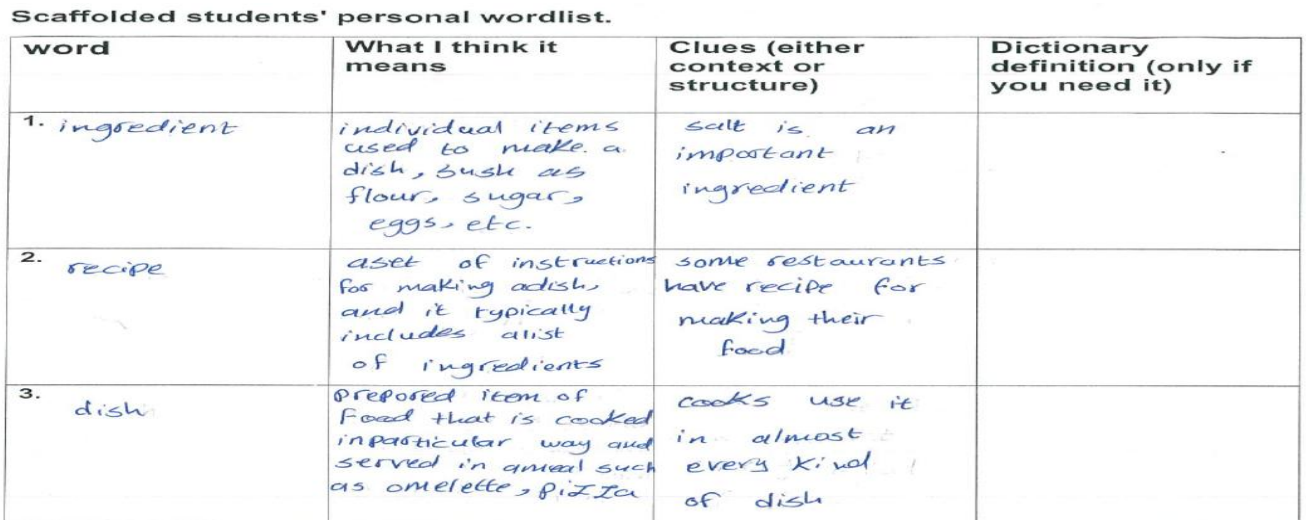
Word	What I Think It Means	Clues (Context or Structure)	Dictionary Definition (if needed)
Migrate			
Emigrate			
Immigrate			
Emigration			
Migration			

Vocabulary from the "Celebration and Abandonment" Mind Map

Word	What I Think It Means	Clues (Context or Structure)	Dictionary Definition (if needed)
Celebrated			
Celebratory			
Abandon			
Abandoned			
Abandonment			

Vocabulary from the "Evacuation and Celebration" Mind Map

Word	What I Think It Means	Clues (Context or Structure)	Dictionary Definition (if needed)
Evacuate			
Evacuated			
Evacuation			
Celebrate			
Celebration			



Scaffolded students' personal wordlist.

word	What I think it means	Clues (either context or structure)	Dictionary definition (only if you need it)
1. ingredient	individual items used to make a dish, such as flour, sugar, eggs, etc.	salt is an important ingredient	
2. recipe	a set of instructions for making a dish, and it typically includes a list of ingredients	some restaurants have recipe for making their food	
3. dish	Prepared item of food that is cooked in particular way and served in a meal such as omelette, pizza	cooks use it in almost every kind of dish	

Figure C.2.1. Sample of Scaffolded Students' Personal Word lists

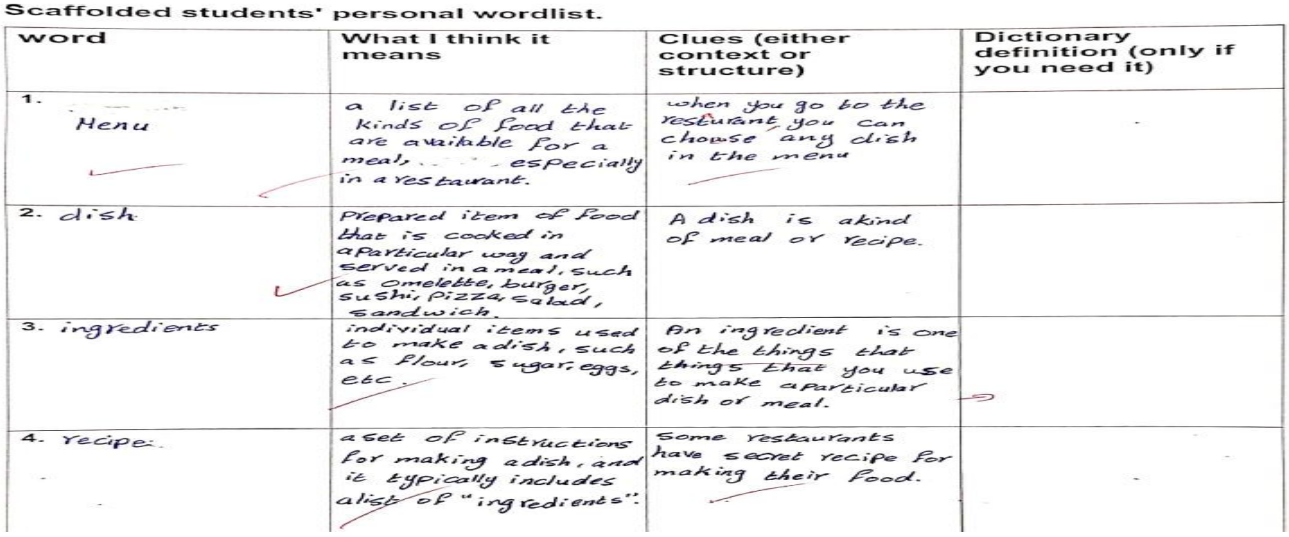
C.3. Observations from Student Wordl ists

• Learners tried to predict the meaning of the word before they consulted the dictionary to be actively involved.

• Contextual cues included parts from reading texts and structural clues consisted of some features such as prefixes (e.g., migrate → immigrate).

• Word lists spanned various thematic areas (e.g., food, migration, evacuation, and celebration), supporting learning in various contexts.

These scaffolded word lists assisted in vocabulary retention through developing independent learning strategies in students.



Scaffolded students' personal wordlist.

word	What I think it means	Clues (either context or structure)	Dictionary definition (only if you need it)
1. Menu	a list of all the kinds of food that are available for a meal, especially in a restaurant.	when you go to the restaurant you can chowse any dish in the menu	
2. dish	Prepared item of food that is cooked in a particular way and served in a meal, such as omelette, burger, sushi, pizza, salad, sandwich.	A dish is akind of meal or recipe.	
3. ingredients	individual items used to make a dish, such as flour, sugar, eggs, etc.	An ingredient is one of the things that things that you use to make a particular dish or meal.	
4. recipe:	a set of instructions for making a dish, and it typically includes a list of "ingredients".	Some restaurants have secret recipe for making their food.	

Figure C.3.1. Sample of Scaffolded Students' Personal Word lists