MINISTRY OF EDUCATION AND TRAINING
UNIVERSITY OF PHAN THIET

NGUYỄN NGỌC MỸ ÁI

EFFECTIVENESS OF FLASHCARDS IN ENHANCING VOCABULARY LEARNING AMONG 4TH GRADERS AT HUNG LONG 1 PRIMARY SCHOOL

MASTER'S GRADUATION PROJECT
MAJORED IN ENGLISH LANGUAGE

Bình Thuận Province - 2025

MINISTRY OF EDUCATION AND TRAINING
UNIVERSITY OF PHAN THIET

NGUYỄN NGỌC MỸ ÁI

EFFECTIVENESS OF FLASHCARDS IN ENHANCING VOCABULARY LEARNING AMONG 4TH GRADERS AT HUNG LONG 1 PRIMARY SCHOOL

MAJOR IN ENGLISH LANGUAGE

CODE: 8220201

MASTER'S GRADUATION PROJECT

SCIENCE INSTRUCTOR'S NAME:

TRẦN THỊ QUỲNH LÊ, PhD

Bình Thuận Province – 2025

ACKNOWLEDGMENTS

To have a complete master's thesis report like today, first of all, I would like to sincerely thank Doctor Trần Thị Quỳnh Lê for taking the time to support, help, and give me sincere advice to make my report more and more perfect. Without her guidance and sincere advice, I certainly would not have been able to do this report.

Second, I would like to sincerely thank the staff of the Graduate Department and the lecturers who have always enthusiastically taught and wholeheartedly supported me during the past 2 years of study. At that time, I would also like to sincerely thank the teachers from the Principal to the lecturers and teachers of Hung Long 1 Primary School for enthusiastically helping me complete the report.

Most of all, I sincerely thank the ladies and gentlemen of class ME23.K3.1 for always enthusiastically helping and sharing experiences with me during the past 2 years of study. From there I draw my own lessons and complete the report well.

STATEMENT OF AUTHORSHIP

I certify that the work presented in this research entitled “Effectiveness of Flashcards in Enhancing Vocabulary Learning among 4th Graders at Hung Long 1 Primary School” has been performed and interpreted solely by myself

I certify that this work is submitted in part to complete the Master of English Language course at Phan Thiet University and has not been submitted elsewhere in any other form to complete any other paper or article.

Binh Thuan Province, March 2025

Nguyễn Ngọc Mỹ Ái

ABSTRACT

This study aimed to investigate the effectiveness of flashcards in vocabulary learning of the fourth graders at Hung Long 1 Primary School. The study used a mixed methods approach with pre-and post-test vocabulary measures, as well as questionnaires and classroom observations of 100 the fourth graders to measure student perceptions and interviews with two experienced teachers of English. Flashcards were typically used in one to two teaching periods per week (pupils had four lessons and used English in one week) and were associated with the introduction of new words to pupils to support vocabulary learning through imagery and memory, resulting in the increased number of words learned. Pupils reported that they were more engaged and remembered more information, while teachers also indicated improved teaching outcomes. The purpose of this study was to investigate how effective flashcards are in developing vocabulary in young learners and to provide some implications for integrating flashcards into primary education.

Keywords: flashcards, electronic flashcards, *AI-Integrated Flashcards*, vocabulary learning, primary education, mixed methods, teaching tool

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

ESL: English second language

INTRODUCTION

1. Background of The Study

In the period of integration and development, language plays an important role in the process of communication and trade between countries. In addition, language also plays a key role in the process of daily interaction. Currently, English is considered an international language because there are more than one billion people in the world who use English, and they consider English as an official language. Although Vietnam also uses English as a communication language, it is only considered a second language and does not use English as a daily language, so the majority of Vietnamese people are very few, and that poses many challenges for Vietnamese people.

English emphasizes four main skills, including listening, speaking, reading, and writing. However, to master these skills, we need to have a relatively wide vocabulary combined with other factors such as grammar and pronunciation to master the skills that foreign language learners need.

In teaching English to primary school pupils, during the teaching and research process, teachers often encounter difficulties in helping pupils memorize vocabulary. Usually, pupils learn vocabulary in a forced manner, creating a feeling of lack of interest and reluctance in the learning process. Therefore, pupils' ability to memorize vocabulary is not high and makes pupils feel bored in the process of learning vocabulary.

With their experiences in teaching and researching languages, English teachers and researchers have come up with many new methods, creating a creative teaching and learning atmosphere based on open thinking, applying tools such as using traditional flashcards and electronic flashcards with integrated definitions, pronunciations, images, and sounds to create more creative lessons, attract pupils more, and help them concentrate more, especially primary school pupils. According to Nuryani & Odo Fadloeli (2021), flashcards can help teachers convey learning materials more easily;

Pupils are also more enthusiastic and interested in learning English and have a great impact on the teaching and learning process. Similarly, Aba (2019) pointed out that teachers have used specific teaching models such as flashcards to introduce vocabulary, find pictures, classify vocabulary, and use memory games in the language teaching process. Using flashcards will help pupils to exercise their brains and think in the process of learning English.

Moreover, this tool also helps teachers and pupils innovate in the teaching and learning process, giving Pupils the ability to memorize logically with images, sounds, and short example sentences integrated into flashcards. In addition, teachers also apply flashcards to games to change the classroom atmosphere. For example, teachers use flashcards on the table, and the pupils' task is to find flashcards related to the lesson content and stick them on the board. Then, teachers let pupils review the words they have learned. This is to reinforce the vocabulary they have learned, help them remember, and promote pupils' alertness in the learning process.

2. Problem Statement

Vocabulary development is quite important in the process of learning English, which is the premise for Pupils to develop listening, speaking, reading, and writing skills. However, traditional teaching methods do not help Pupils improve their ability to memorize vocabulary quickly and effectively. At Hung Long 1 Primary School in particular and other educational institutions, it is necessary to solve challenges and explore optimal methods for replacing and facilitating the memorization process of pupils.

During the teaching and research process, educators chose grade 4 Pupils as research subjects because during the teaching process, educators saw the difficulties of grade 4 pupils learning vocabulary using traditional methods. That is the method of learning repeatedly, taking notes in the usual way, and that method only applies to a small amount of vocabulary, without creativity in the learning process. The reason why pupils still learn by

traditional methods can be attributed to the fact that some teachers do not update learning methods or create new teaching and learning strategies. Therefore, pupils will feel bored when learning. Then, it can have a negative impact on Pupils. For example, pupils create a negative feeling in guessing the meaning of new words, create a feeling of disinterest in new words, and do not like learning vocabulary.

Not only that, pupils will find it difficult to apply the words they have learned in the lesson because their vocabulary is limited; they do not understand the meaning of the words deeply, leading to them having an inferiority complex, and losing their composure during the process of doing the test.

In addition, pupils will be afraid to communicate because the vocabulary problem is still limited, the ability to apply is not high, and pupils lack initiative in the process of learning vocabulary. That leads to too many mistakes in vocabulary-related tests, and that makes them feel discouraged during the learning process. Therefore, many pupils do not have passion and interest in English.

3. Research Objectives

The main purpose of this study was to evaluate the effectiveness of flashcards in helping the fourth graders learn new words. In the study, we wanted to find empirical evidence to prove that using flashcards can promote pupils' ability to memorize and practice vocabulary faster than traditional vocabulary learning methods. By observing pupils during teaching, learning, and research, we hoped to gain a better understanding of how visual aids can help in the early stages of language learning. In addition, this study aimed to compare pupils' learning levels when using flashcards compared to common ways of learning vocabulary, such as memorizing words for exercises in student books and workbooks. By examining these methods side by side, this study wanted to show the differences in how pupils acquire and remember new

words using these two teaching methods. The comparisons in this study will provide us with insights into the usefulness of flashcards as a useful teaching aid in the classroom.

Furthermore, this study aims to assess pupils' perceptions of using flashcards for vocabulary learning. Understanding pupils' thoughts and experiences is crucial to finding the overall effectiveness of this teaching method. By examining satisfaction through student participation in surveys, contributions, and tests, a comprehensive picture of the appropriateness of flashcards as a teaching strategy for primary school pupils will be provided. This assessment will add to the larger discussion about the inclusion of interactive and visual learning tools in teaching across all grades of primary school.

4. Research Questions

In this study, the aim is to investigate the effectiveness and explore the roles that flashcards have brought to the vocabulary learning of pupils at Hung Long 1 Primary School. The research questions guiding this study are as follows:

1. How effective are electronic and AI flashcards in improving vocabulary acquisition, as measured by test scores and retention rates, among 4th-grade pupils at Hung Long 1 Primary School?
2. How do pupils and teachers perceive the effectiveness and engagement level of flashcards compared to standard vocabulary teaching methods at Hung Long 1 Primary School?

5. Significance of the Study

This study is one of the important studies because it can help teachers design flexible and creative lessons for pupils. By examining the effectiveness of flashcards in teaching new words, the study offers reasonable and useful solutions that can make teaching and learning more interesting, increasing the interaction between teachers and pupils in the class. For teachers, especially young teachers, the use of flashcards in teaching is common. But besides that,

with professional skills and the application of modern artificial intelligence technology, some teachers integrate electronic flashcards with modern features such as images, sounds, definitions, examples, and games to make pupils feel more interested in the learning process. This teaching method is the key to helping pupils remember new words better and understand how language works (Nation & Webb, 2011). In addition, when teachers know how to communicate to pupils how to learn vocabulary well, they will play a good role in helping pupils build important skills, necessary for learning well in all subjects (Beck, McKeown & Kucan, 2013). The study provides teachers with clear examples of how to use flashcards effectively, supplementing their teaching methods and helping pupils memorize vocabulary more easily.

In addition, this study provides important insights to guide effective language education programs. According to previous teaching methods, some educators criticize the use of traditional teaching methods, which do not engage pupils or help them remember words for a long time (Graves, 2006). By showing the benefits of flashcards, this study can motivate curriculum developers to create more vivid and learner-oriented learning materials. The use of flashcards in vocabulary lessons may mark a shift towards more hands-on and visual methods of learning that are suitable for a variety of learners (Schmitt, 2014). As curricula change, they need lesson plans that can adapt and engage pupils in learning vocabulary. The findings from this study have a major role to play in shaping new curricula, ensuring that the content in schools is useful and meets the needs of different pupils.

This research not only has practical implications for teaching and learning, it also adds a lot to what we already know about new teaching methods. There is a growing body of research showing that hands-on tools are helpful in language teaching, but we still need more specific research on teaching languages to young children (Smith & Elley, 2015). By examining how flashcards help primary school pupils learn new words, this study brings

a fresh perspective to the academic discussion of teaching methods. It fills a gap in teaching and research, providing compelling evidence that flashcards are effective and paving the way for future research. Not only does this study show that flashcards are useful for learning vocabulary, but also opens the door to exploring new tools and techniques that can make language learning easier, especially for primary school pupils.

6. Scope of the Study

This study focuses on evaluating the effectiveness of flashcards in the vocabulary learning process of 4th graders at Hung Long 1 Primary School. This study is limited to the vocabulary acquisition of 4th graders through flashcards and does not include other skills such as grammar or pronunciation. In addition, the study only targets 4th graders, because this is the age group that is gradually getting used to difficult-to-remember vocabulary and is starting to form the ability to memorize using visual and interactive methods, stimulating their imaginative thinking ability. The study was conducted in the context of Hung Long 1 Primary School, an educational institution with the majority of children from fishing families, with difficult economic conditions and low educational levels, so pupils mainly acquire English knowledge through teaching and learning at school, so their exposure to English outside of school is not high. In addition, parents are not very involved in their children's foreign language learning, leading to different levels of English proficiency in their classrooms. By focusing on this specific context, the study aims to provide insights into the applicability and effectiveness of flashcards in similar educational contexts.

The data collection procedures for the study included pre-tests, post-tests, and assessment questionnaires to assess the impact of flashcards on vocabulary retention and to collect pupils' perceptions of their use in learning. This study did not extend to other research tools and methods, nor did it examine the long-term effects of flashcards beyond the study period. The

findings of this study are intended to provide timely information to educators about the potential benefits of incorporating memory into vocabulary instruction for pupils.

CHAPTER 1: LITERATURE REVIEW

1.1. Vocabulary Learning in Primary Education

1.1.1. Definition of Vocabulary Learning

Vocabulary learning is one of the most important aspects of learning a foreign language, especially at the primary level, because it serves as the foundation for developing other skills, including the four skills of listening, speaking, and reading. At this stage, pupils focus on understanding the meanings, usage, and memorization of words. In Nation's (2001) study, vocabulary learning involves the subsequent work of memorizing and applying words in practice. It's more than just memorizing a list of words; it also involves understanding the nuances of words, their contextual usage, and their relationships to other words. It's more than just memorizing a list of words; it also involves understanding the nuances of words, their contextual usage, and their relationships to other words. This process is crucial for reading comprehension, writing, and overall language proficiency, which are essential goals in primary education (Snow, 2010).

In the study of Beck, McKeown & Kucan (2002), it is emphasized that vocabulary knowledge directly affects pupils' ability to understand texts. As pupils encounter new words, understanding them in context enhances their reading comprehension, making vocabulary acquisition an essential skill for academic success. The early stages of language education require a solid vocabulary foundation, which enables pupils to express themselves clearly in both spoken and written language. Therefore, teachers must integrate effective vocabulary instruction into their teaching activities to help pupils build both recognition and usage skills in real-world contexts. In research, vocabulary acquisition can be divided into two distinct but related components: receptive vocabulary and productive vocabulary. In Schmitt's (2000) study, it is explained that receptive vocabulary refers to the words that learners can understand when reading or listening, while productive vocabulary refers to

the words that learners can actively use when reading or listening, while productive vocabulary refers to words that learners can actively use when speaking or writing. In primary education, it is important for pupils to develop both types of vocabulary. Teachers should design activities that promote word recognition while encouraging pupils to actively apply their vocabulary knowledge to tasks during the learning process.

In addition, Snow (2010) emphasizes the significance of both intentional and incidental vocabulary learning. Intentional learning occurs when pupils are explicitly instructed to learn, practice words, and complete tasks as directed by the teacher in the classroom. Conversely, incidental learning takes place through exposure to language in authentic contexts, such as reading, listening to conversations, and participating in discussions. Both intentional and incidental learning play crucial roles in vocabulary development among young learners. Educators can create structured learning opportunities while ensuring that pupils are immersed in language-rich environments, allowing them to acquire vocabulary naturally.

Furthermore, Cameron (2001) emphasized the importance of contextualizing vocabulary learning with real life for young learners. By incorporating familiar themes and experiences, teachers can make vocabulary lessons more meaningful and engaging. The contextualization approach promotes deeper connections between the words being learned and the pupils' own reality, thus enhancing retention and application. Active use of flashcards are essential components to ensuring vocabulary is memorized and recalled effectively. Schmitt (2000) suggests that repeated exposure to and practice with new vocabulary in various contexts helps pupils transition from short-term to long-term memory. Activities such as repeated reading, storytelling, and language games are effective strategies for reinforcing vocabulary acquisition and ensuring long-term retention.

1.1.2.Key Components of Vocabulary Learning

Vocabulary learning in primary school involves several interrelated components that help pupils acquire, understand, and use new words effectively. Each component plays a distinct role in promoting comprehensive language development for young learners.

A fundamental element in vocabulary learning is phonological awareness, which involves the ability to recognize and process the sound structures of words. Phonological awareness is a prerequisite for reading and vocabulary development, as it enables pupils to decode unfamiliar words. In the primary education context, phonological awareness can be nurtured through rhymes, games, and activities that emphasize sound patterns, helping learners make connections between spoken and written words.

Another important component is semantic knowledge, which refers to understanding the meaning of words and their relationships to other words. Beck, McKeown & Kucan (2013) argue that young learners benefit from direct instruction in word meaning, especially for high-frequency vocabulary across multiple domains. This semantic understanding allows pupils to apply vocabulary in a variety of contexts, improving their comprehension and communication skills.

Morphological awareness, or the ability to understand the structure of words and their components (such as prefixes, suffixes, and roots), is also important. Carlisle (2010) emphasizes that primary school pupils who develop morphological awareness are better able to infer the meaning of unfamiliar words and expand their vocabulary. For example, teaching pupils how prefixes such as “un-” or “re-” modify root words can help them infer meaning and improve their word-building skills.

Contextual use is another essential aspect of vocabulary learning. Nation (2001) emphasizes that learning words in context, rather than in isolation, helps pupils not only understand the meaning of words but also how to use them appropriately in different situations. In primary education, this can be achieved through activities such as storytelling, reading comprehension exercises, and classroom discussions that introduce vocabulary in meaningful and relatable situations.

Repetition and exposure play an integral role in reinforcing vocabulary acquisition. Schmitt (2008) emphasizes the importance of repeated exposure to new words in a variety of contexts, which helps move from short-term to long-term memory. For primary school pupils, activities such as flashcards, games, and frequent interactions with newly learned words ensure consistent exposure and reinforce retention.

Integrating vocabulary with different domains enriches pupils' learning experiences, making them more productive and efficient in their vocabulary learning. To be productive in vocabulary learning, pupils need to actively use vocabulary, applying it to a variety of skills. In addition, they need to acquire vocabulary in a variety of ways, including words in texts that they understand but do not know how to use. According to Stahl and Nagy (2006), primary school pupils benefit from tasks that encourage vocabulary learning. For example, pupils can be guided to use new words in creative writing or storytelling while also encountering those words in reading materials or classroom conversations.

Finally, motivation and engagement are key drivers of successful vocabulary learning. Cameron (2001) suggests that young learners are more likely to retain vocabulary when actively involved in the learning process through engaging, interactive activities. Incorporating games, songs, and multimedia resources into lessons can boost enthusiasm and encourage

consistent participation, which is essential for sustainable vocabulary development.

1.1.3.Importance of Vocabulary in Language Acquisition

Vocabulary is recognized as the foundation of language acquisition, particularly for primary school pupils who are experiencing both language development and cognitive growth. Wilkins (1972) famously stated, “Without grammar, very little can be communicated; without vocabulary, nothing can be communicated,” emphasizing the crucial role of vocabulary in facilitating meaningful communication. For young learners, a strong vocabulary not only aids in articulating thoughts and ideas but also enhances their comprehension of both spoken and written language, thereby establishing a solid foundation for overall language proficiency.

One of the reasons why vocabulary is important for language acquisition is its direct impact on comprehension when reading or listening. According to Nagy & Townsend (2012), a large vocabulary is essential for understanding text, as it helps pupils decode word meanings and grasp contextual nuances. This is especially important for some primary school pupils, whose academic performance often depends on their ability to transition from learning to read to reading to learn. By being exposed to a diverse vocabulary, young learners can engage more effectively across various subject areas, thereby promoting their linguistic and academic development.

Furthermore, vocabulary development is closely linked to oral communication skills. Cameron's (2001) research emphasizes that vocabulary serves as a foundation for effective speaking and listening, helping pupils express their thoughts and respond to others quickly and accurately. In classroom interactions, a strong vocabulary empowers primary school learners

to express themselves confidently and engage in discussions, thereby enhancing their social and cognitive development.

Vocabulary acquisition also plays a significant role in developing writing skills. Research by Schmitt (2008) indicates that a broader vocabulary equips pupils with the linguistic tools necessary to create coherent and diverse written texts. For young learners, mastering an extensive range of vocabulary enhances both creativity and clarity in their writing, enabling them to communicate ideas effectively across various genres and contexts.

In addition to its academic significance, vocabulary plays a crucial role in fostering cultural understanding and social integration. Nation (2001) argues that vocabulary is not merely a collection of words; it serves as a gateway to the cultural knowledge embedded within language. For primary school pupils, acquiring vocabulary that is appropriate to their social and cultural environment enables them to navigate everyday interactions and build relationships with both peers and adults.

Ultimately, acquiring vocabulary is essential for fostering lifelong language learning habits. According to Stahl and Nagy (2006), vocabulary serves as the foundation for continuous language development. Pupils who build a robust vocabulary in their early years are better equipped to learn new words and concepts as they progress. This cumulative growth not only improves their academic performance but also prepares them for future language use in various personal and professional contexts.

1.1.4. Common Challenges in Vocabulary Learning for Young Learners

Teaching vocabulary to primary school pupils involves addressing various challenges that stem from their developmental stages, cognitive

abilities, and learning environments. According to Lightbown and Spada (2006), primary school pupils often struggle to memorize new vocabulary due to their limited working memory capacity. This limitation can impede their ability to store and retrieve vocabulary effectively, particularly when they are exposed to a large number of unfamiliar terms in a short timeframe.

Another common obstacle is the abstract nature of certain vocabulary items. Since primary school pupils typically focus more on concrete concepts that they can see, touch, or experience, abstract words—such as those related to emotions or complex ideas—can be challenging to comprehend and internalize (Cameron, 2001). This limitation necessitates that educators employ creative teaching methods, such as storytelling, role-playing, or visual aids, to help Pupils more easily connect with abstract vocabulary.

Another significant challenge is the lack of exposure to authentic language. Primary school pupils, particularly those in non-native English contexts, often have limited opportunities to encounter English vocabulary outside the classroom. As Gass and Selinker (2008) note, frequent exposure to meaningful language is crucial for vocabulary acquisition. However, in many instances, young learners depend heavily on their teachers and textbooks as their primary sources of information, which do not always represent the diversity and richness of authentic language use.

Pronunciation difficulties pose a significant challenge for young learners, particularly with phonologically complex words. According to Nation (2001), the inability to pronounce new words correctly can undermine learners' confidence and diminish their willingness to use these words in speaking activities. This challenge is further exacerbated when pupils are not given adequate opportunities to practice pronunciation in a supportive environment that encourages error correction.

In addition, learners often have difficulty distinguishing between homonyms or polysemous words. Research by Schmitt (2008) highlights that polysemous words and homonyms can be particularly confusing for young learners, necessitating targeted instruction to clarify these nuances. Teachers must address these complexities to ensure that pupils can differentiate words in various contexts.

The motivational aspect of vocabulary learning presents several challenges. As Dörnyei and Ushioda (2011) highlight, young learners often lose interest in repetitive vocabulary exercises and rote memorization. This lack of engagement can result in a decline in vocabulary retention over time. To address this issue, educators should incorporate interactive and gamified approaches to sustain learners' motivation and enthusiasm.

Finally, socio-cultural contexts can significantly influence vocabulary learning outcomes. Primary school pupils from diverse socioeconomic backgrounds may possess varying levels of prior exposure to English vocabulary, resulting in differences in their readiness to acquire new words. According to Snow's (2010) findings, children from language-rich home environments often have an advantage over their peers who have limited access to language resources. This disparity necessitates that teachers employ differentiated instructional strategies to effectively address the needs of all learners.

1.2. Flashcards as a Teaching Tool

1.2.1. Definition of Flashcards

Flashcards are defined as compact learning tools designed to aid memorization and comprehension by presenting information on small cards, typically with a vocabulary word, transcription, and definition on one side and a picture on the other. According to Nation (2013), flashcards are effective for

learning vocabulary because they promote active recall, a cognitive process that enhances retention. These tools are especially useful for learners who need frequent exposure to new vocabulary at manageable levels.

Flashcards can be classified into traditional paper cards and digital flashcards. Traditional flashcards are hand-crafted and often contain simple written content or illustrations to aid comprehension. In contrast, digital flashcards incorporate technological features such as animation, audio, or interactive elements to enhance user engagement and accommodate a variety of learning preferences (Richards & Rodgers, 2014). The move to digital formats has expanded their accessibility, especially for language learners who benefit from multimedia resources.

In language education, flashcards are recognized as a versatile tool that can be adapted to different student needs. Furthermore, they are particularly valuable in helping young learners bridge the gap between written words and their meanings, often through the inclusion of images or other visual aids. This association with visual learning strategies supports cognitive processing and promotes deeper vocabulary retention.

The function of flashcards extends beyond the classroom, providing learners with opportunities for self-paced practice. By engaging in self-paced review sessions, pupils consolidate their understanding of vocabulary and develop long-term retention. Schmitt (2010) emphasizes that the repeated exposure facilitated by flashcards reflects the principles of spaced repetition, a proven technique for effective vocabulary acquisition.

Furthermore, flashcards are particularly well suited to language learning environments that prioritize active participation and interaction. When used in group activities or games, they provide a collaborative and dynamic platform for vocabulary practice, as Ellis and Shintani (2014) note. This feature makes flashcards a popular choice among educators looking to incorporate interactive teaching methods into their lessons.

1.2.2.Historical Development of Flashcards in Language Teaching

The use of flashcards as a pedagogical tool has undergone considerable development, originating from visual-based teaching methods. Early educational frameworks, such as those discussed by Mayer (2005) in his cognitive theory of multimedia learning, highlighted the importance of integrating images to enhance learning. Although Mayer's work focused primarily on multimedia, it indirectly supported the pedagogical basis for the visual nature of flashcards.

In the 20th century, behavioral theories became central to the development of learning tools, including flashcards. Skinner's (1961) work emphasized the value of repetition and reinforcement in learning, which is closely aligned with the iterative nature of using flashcards to acquire vocabulary. Subsequent research in cognitive psychology further confirmed the effectiveness of repetition and active recall in memory retention, cementing flashcards as a key tool for language learners (Roediger & Butler, 2011).

The shift to communicative language teaching (CLT) in the latter half of the 20th century brought about a recontextualization of flashcards. They were no longer limited to rote memorization but became a versatile tool for promoting interaction and contextual vocabulary learning (Balsells, 2005). As language teaching methods expanded to incorporate more interactive approaches, flashcards were adapted for group work, classroom games, and discussion activities.

With the advent of digital technology in the 21st century, the functionality of flashcards has expanded significantly. Platforms such as Quizlet and Quizizz have introduced features such as spaced repetition algorithms, multimedia integration, and real-time feedback. These innovations

are supported by research on technology-enhanced learning, which demonstrates the effectiveness of such features in improving vocabulary acquisition and learner engagement (Kang, 2016). Kang's findings highlight the importance of spaced repetition, a feature that has become synonymous with digital flashcard platforms.

Recent research continues to emphasize the pedagogical value of flashcards. Carpenter et al. (2012) emphasize that flashcards effectively promote active recall, which is one of the most reliable methods for long-term retention. Their research further suggests that flashcards, when designed with intentional spacing and appropriate content complexity, can bridge the gap between rote memorization and meaningful use of language. Similarly, Nation (2001) reaffirms the role of flashcards in vocabulary building, emphasizing their usefulness in both traditional and technology-enabled classrooms.

1.2.3.Types of Flashcards

Flashcards can be classified into traditional and electronic formats, each with its own advantages and limitations in language teaching. Traditional flashcards, typically made of paper or cardboard, have been widely used in language education for decades. These cards typically include a word or picture on one side and the meaning or related information on the other. According to Nation (2001), traditional flashcards provide learners with a tangible and direct method of engaging in repetitive practice, making them particularly effective in memorizing vocabulary. Research by Clark and Paivio (1991) further emphasizes the dual coding theory, explaining how pairing images and text on flashcards enhances memorization.

Electronic flashcards have emerged as a powerful alternative, leveraging advances in technology to expand their functionality. Unlike traditional flashcards, e-flashcards include interactive features such as audio

pronunciations, animations, and custom quizzes, making them more engaging for learners. Kang (2016) highlights that modern flashcards incorporate spaced repetition algorithms that significantly improve learning efficiency by optimizing the timing of review sessions. This approach ensures that learners review material just as they are about to forget it, maximizing retention while minimizing cognitive overload.

The adaptability of e-flashcards is also a major strength. Tools such as Quizlet and Quizziz allow educators to tailor content to specific learning goals and track student progress in real-time. A study by Karpicke and Blunt (2011) demonstrated that retrieval-based learning, supported by platforms such as these, enhances long-term retention and understanding. Furthermore, electronic flashcards have proven particularly beneficial in promoting learner autonomy, as they allow pupils to access material at their own convenience and pace.

However, each type of flashcard has its challenges. Traditional flashcards require a lot of preparation time and are less scalable to larger classes, while electronic flashcards often depend on access to technology and internet connectivity. Mayer's (2005) studies of multimedia learning suggest that while electronic flashcards provide rich interactivity, excessive multimedia elements can be distracting to learners if not carefully designed.

Recent studies continue to explore the comparative effectiveness of these two formats. Carpenter et al. (2012) found that while traditional flashcards were effective for focused, one-on-one practice, digital flashcards excelled in collaborative, remote learning environments. The choice between traditional and digital flashcards often depends on the instructional context, available resources, and preferences of both teachers and learners.

1.2.4.Theoretical Foundations of Flashcard Use in Vocabulary Teaching

The use of flashcards in vocabulary teaching is based on several well-established learning theories that emphasize the cognitive and pedagogical benefits of this tool. These theories emphasize the ability to remember, associate, and visualize, and the role of visual learning in language acquisition.

An important theoretical foundation is the dual coding theory, proposed by Clark and Paivio (1991), which suggests that individuals process and store information through two interrelated systems: verbal and visual. Flashcards take advantage of this principle by presenting both written words and corresponding pictures, allowing learners to encode vocabulary through multiple channels. Research has shown that this dual presentation significantly enhances recall and retention, especially for young learners who benefit from specific visual aids (Mayer, 2005).

The concept of active retrieval is another underlying factor supporting the use of flashcards. According to Karpicke and Blunt (2011), active imagery involves retrieving information from memory rather than passively reviewing it, which strengthens the neural pathways associated with that information. Flashcards, whether traditional or electronic, encourage this process by reminding learners to recall vocabulary items repeatedly. The process of repeated retrieval has been shown to improve short-term and long-term retention, making flashcards an effective tool for vocabulary acquisition (Roediger & Butler, 2011).

In addition, spaced repetition theory underpins the design and use of flashcards in language learning. Pioneered by Ebbinghaus (1885) in his work on the forgetting curve, spaced repetition theory suggests that learners should review material at increasingly greater intervals to counteract forgetting and

enhance memory consolidation. Modern digital flashcard platforms, such as Quizziz and Quizlet, incorporate algorithms based on this principle to optimize review time, ensuring that learners review words just before they are likely to forget them.

Cognitive load theory, developed by Sweller (1988), also provides a theoretical basis for effective flashcard use. This theory emphasizes the importance of minimizing unnecessary cognitive demands during learning to allow for better processing of necessary information. Flashcards, by focusing on one vocabulary item at a time, reduce unnecessary cognitive load and allow learners to focus entirely on understanding and memorizing words. This is particularly relevant in primary education, where learners may struggle with complex or overwhelming material.

Finally, constructivist learning theories, such as those advanced by Vygotsky (1978), support the interactive and engaging nature of using flashcards. Flashcards can be incorporated into interactive activities, such as peer games or quizzes, which encourage interaction during class and aid in vocabulary learning. This is consistent with Vygotsky's concept of the zone of proximal development, where learners gain deeper understanding through guided practice and interaction with more knowledgeable classmates or instructors.

1.2.5.Advantages of Using Flashcards in Vocabulary Learning

Flashcards are widely recognized as an effective tool in vocabulary instruction due to their ability to enhance retention, engagement, and retrieval of vocabulary items. One of the main advantages of using flashcards is their ability to facilitate active recall, a cognitive process that enhances memory by repeatedly retrieving information from long-term memory (Nation, 2001). This is consistent with retrieval practice theory, which suggests that frequent

exposure to and recall of vocabulary items improves long-term retention (Karpicke & Roediger, 2008). The repetitive nature of flashcard-based learning supports spaced repetition, an established technique in cognitive psychology that optimizes the timing of review sessions to enhance retention and prevent forgetting.

Additionally, flashcards are particularly effective for young learners because they utilize visual stimuli, which play an important role in early language acquisition. Dual coding theory suggests that learners process information more efficiently when presented with both visual and verbal cues, making flashcards an ideal means of reinforcing vocabulary. Furthermore, a study by Webb and Nation (2017) found that visual flashcards significantly aid vocabulary acquisition in primary school pupils by creating strong associations between words and images. This method enhances comprehension and recall, especially for English as a Foreign Language (EFL) pupils who often struggle with abstract vocabulary items (Schmitt, 2010).

Moreover, flashcards promote learner autonomy by allowing pupils to control the pace and sequence of their learning. According to Curcic, M., Andringa, S., & Kuiken, F. (2019), self-paced vocabulary practice with flashcards promotes independent learning habits and increases motivation. The gamification aspects of flashcard-based learning, especially in electronic flashcards, have been shown to increase student engagement by incorporating interactive elements such as quizzes, animations, and adaptive learning algorithms (Ebner & Holzinger, 2007). The integration of digital flashcards further supports personalized learning, allowing learners to focus on difficult words and track their progress over time.

Furthermore, flashcards provide flexibility in teaching, as they can be adapted to a variety of learning contexts, including individual practice, peer

collaboration, and classroom activities (Folse, 2004). Barcroft's (2015) research shows that incorporating flashcards into task-based language teaching (TBLT) significantly improves vocabulary retention by combining meaning-focused input with contextual practice. Furthermore, teachers can also use flashcards to implement multisensory learning techniques, such as auditory reinforcement and kinesthetic activities, to accommodate different learning styles (Pavičić Takač, 2008).

Empirical studies further support the effectiveness of flashcards in vocabulary learning. A meta-analysis by Kotilainen, L., & Kurhila, S. (2020) found that pupils who used flashcards performed significantly better on vocabulary tests than those who relied on traditional rote memorization techniques. Not only that, flashcard-based learning resulted in higher retention rates in primary school pupils than textbook-based instruction.

Despite its many advantages, it is essential to consider contextual factors, instructional design, and technology accessibility when implementing flashcards in vocabulary instruction. A growing body of research underscores the continued relevance of flashcards in modern language education, especially when combined with evidence-based instructional strategies.

1.2.6.Disadvantages and Limitations of Flashcards

Despite their many benefits, flashcards also have certain limitations that may hinder their effectiveness in vocabulary instruction. A major concern is the reliance on rote memorization, which may not promote deep processing or meaningful use of language. According to Karpicke and Blunt (2011), while retrieval practice enhances recall, memorizing individual words with flashcards may not promote contextual understanding, leading to difficulties in applying real-world language. Similarly, Nation (2013) argues that vocabulary learning should involve multiple encounters in different contexts

rather than simply repeating word pairs, which is a common approach in flashcard-based learning.

Another limitation is the lack of engagement and motivation over time. Learners may initially find flashcards interesting, but repeated exposure without meaningful interaction can lead to loss of focus (Schmitt, 2014). This is particularly evident in younger learners, who often need varied and interactive activities to maintain their interest (Ellis, 2020). Research by Webb and Nation (2017) further highlights that flashcards alone do not address productive aspects of vocabulary learning, such as speaking and writing, as they focus primarily on recognition and recall.

Furthermore, traditional flashcards do not adapt to individual learning needs. Studies have shown that generic flashcards may not address different proficiency levels or specific learning challenges (Laufer & Hulstijn, 2001). In contrast, using modern digital, information technology-based tools is more easily adapted by learners, can provide personalized feedback, and can track learners' progress, which traditional flashcards cannot do (Roediger & Butler, 2011). In addition, flashcards are often limited in their ability to convey nuanced meanings, combinations, and pragmatic uses, which are essential for effective vocabulary acquisition (Barcroft, 2015).

Digital flashcards, electronic flashcards, or traditional flashcards, although they address some of these issues, also present their own challenges. Mayer's (2021) study found that overreliance on multimedia features in electronic flashcards can contribute to cognitive overload, distracting from actual language processing. Furthermore, the effectiveness of flashcards depends on learner discipline and consistent use, as self-directed learners may not always use them consistently.

Given the limitations of the research, flashcards should be integrated with other instructional techniques, such as communicative activities, contextual input, and effective language use, to maximize their benefits (Schmitt & Schmitt, 2020).

1.3. Electronic Flashcards in Language Learning

1.3.1. Definition of Electronic Flashcards

Electronic flashcards, commonly referred to as digital flashcards, are interactive learning tools designed to facilitate vocabulary acquisition and memorization through application platforms. Unlike traditional paper flashcards, electronic flashcards incorporate multimedia elements such as text, images, audio, and even gaming features, enhancing their pedagogical effectiveness (Nation, 2013). These digital tools are often accessed through applications or web-based platforms, allowing learners to engage in self-directed learning with adaptive feedback and spaced repetition algorithms (Karpicke & Roediger, 2008).

A widely accepted definition of electronic flashcards comes from Mayer (2024), who describes them as “multimedia-based learning tools that use dual-coding principles to support cognitive processing and memorization.” This definition emphasizes the role of visual and auditory stimuli in reinforcing word associations, making them particularly useful for language learners. Additionally, Webb and Nation (2018) emphasize that electronic flashcards allow learners to practice vocabulary in a structured way, often incorporating retrieval-based learning strategies that enhance long-term retention.

Electronic flashcards are classified into two main types: static and interactive. Static electronic flashcards function similarly to traditional flashcards, displaying a word or phrase on one side and its meaning, translation, or image on the other. In contrast, interactive electronic flashcards

incorporate dynamic features, such as quizzes, adaptive learning paths, and speech recognition, that promote active engagement and a personalized learning experience.

A key advantage of electronic flashcards over traditional flashcards is the ability to implement spaced repetition systems which optimize vocabulary retention by presenting words at increasing intervals based on the learner's performance (Kornell & Bjork, 2009). SRS-based applications, such as Quizziz and Quizlet, have been extensively studied for their effectiveness in improving vocabulary acquisition and reducing forgetting rates in pupils.

While electronic flashcards offer many advantages, they are most effective when used as part of a comprehensive language learning strategy rather than as standalone tools (Schmitt & Schmitt, 2020). Integrating them with communicative and contextual learning methods ensures a balanced vocabulary learning experience that goes beyond rote memorization.

1.3.2. Features of Effective Electronic Flashcards

Electronic flashcards are a great online tool to help the fourth graders learn vocabulary because of their interactive features. The interactivity allows pupils to actively engage with the material through self-testing with multiple-choice questions, feedback, and pronunciation practice. These flashcards also include games such as matching words to definitions, putting puzzle pieces together, recalling words quickly, etc. Furthermore, studies have shown that they improve memory and information retrieval (Baddeley, 2019). Unlike traditional flashcards, electronic versions use multisensory elements such as images, sounds, and animations in a visual way. These elements encourage deeper thinking by using both visual and verbal information to improve memory recall, as described by dual coding theory. Another beneficial feature is spaced repetition, a strategy that schedules review time based on pupils' learning levels, promoting long-term retention and reducing rapid forgetting. Electronic flashcards also include game-like features such as earning points,

leaderboards, and progress tracking, making learning more engaging for pupils (Deterding et al., 2011). Additionally, teachers can tailor the content of flashcards to pupils' skill levels and learning needs, improving the effectiveness of primary school instruction (Ellis, 2015).

1.3.3. Benefits of Electronic Flashcards in Vocabulary Learning

In addition to the benefits of traditional flashcards, electronic flashcards also offer several advantages in enhancing vocabulary acquisition in fourth graders. One of the most important benefits of learning vocabulary through electronic flashcards is the ability to practice reflexes, memorize, and practice quickly. Furthermore, research has shown that flashcards using spaced repetition algorithms enhance long-term memory by systematically reviewing words at optimal intervals, preventing rapid forgetting. Additionally, using a multisensory approach—combining text, images, audio, and animation—stimulates multiple cognitive channels, facilitating deeper processing and supporting comprehension.

Another important advantage is increased engagement and motivation for learners. By incorporating gamification elements such as the use of rewards (stickers), points, and progress tracking to create a more engaging and interactive learning environment, has been shown to improve student engagement and intrinsic motivation (Deterding et al., 2011). Furthermore, electronic flashcards provide flexibility and accessibility, allowing pupils to practice vocabulary at their own pace, anytime and anywhere, which is particularly beneficial for personalized learning (Ellis, 2015).

Furthermore, immediate feedback and self-assessment also play an important role in effective vocabulary learning. Unlike conventional flashcards, electronic versions of flashcards can provide immediate feedback, allowing pupils to identify and correct errors in real-time, reinforcing learning through active engagement (Baddeley, 2019). Finally, the ability to customize and adjust allows teachers to tailor flashcards to pupils' proficiency levels and

learning needs, ensuring that vocabulary instruction is more targeted and effective in the primary school context (Nation, 2001).

1.3.4. Challenges in Implementing Electronic Flashcards in Classrooms

Despite the many benefits of e-flashcards in vocabulary learning, their implementation in primary classrooms remains challenging. One of the most prominent obstacles is limited technology and accessibility. Many schools and pupils, especially in under-resourced and under-educated areas, may lack interactive devices for learning and using e-flashcards such as televisions or interactive projectors during school hours, limiting the widespread use of e-flashcards. In addition, unreliable internet connections and technical issues, such as software glitches or compatibility issues, can also disrupt the learning process and reduce teaching effectiveness.

Another significant challenge is teacher training and pedagogical integration. Effective use of digital flashcards requires educators to have the equipment, along with adequate technological knowledge and understanding of how to integrate them meaningfully into lesson plans (Hennessy et al., 2015). Without appropriate training and support, teachers may struggle to effectively incorporate digital flashcards, leading to superficial use that does not maximize their pedagogical potential. Furthermore, some educators may resist adopting technology due to their preference for traditional teaching methods or concerns about increased screen time among young learners (Tondeur et al., 2017).

Student engagement and cognitive overload also pose challenges. While gamification elements in electronic flashcards can enhance motivation, over-reliance on electronic tools can lead to distraction, reducing the ability to learn deeply and retain meaningful vocabulary. Additionally, young learners may find it difficult to maintain focus if flashcards are not well designed to match their cognitive developmental stages (Mayer, 2014).

Finally, content quality and adaptability can influence the effectiveness of electronic flashcards. Some pre-made digital flashcards may lack context richness, providing individual words without meaningful examples of use, which can hinder vocabulary acquisition (Nation, 2001). To address this issue, teachers must invest additional effort in customizing content to match curriculum goals and pupils' language levels, which can be time-consuming and resource-intensive.

1.4. Introduction to AI-Integrated Flashcards

1.4.1. Defining AI-Integrated Flashcards

AI-integrated flashcards are a modern advancement in educational technology, blending traditional flashcard learning techniques with the power of artificial intelligence (AI). At their core, AI-integrated flashcards are digital tools designed to help learners acquire and retain information more efficiently. While traditional flashcards have long been used in education to aid in rote memorization and recall, the integration of AI transforms these flashcards into dynamic, adaptive learning tools that respond to the learner's unique needs and progress.

The key feature of AI-integrated flashcards lies in their ability to analyze a learner's behavior and performance in real time. This analysis allows the system to adjust the content, frequency, and complexity of the flashcards based on individual learning patterns. Unlike static flashcards, which present the same set of information in the same order each time, AI-powered flashcards continuously evaluate the learner's proficiency and adapt accordingly. For instance, if a learner struggles with certain vocabulary words or concepts, the system can present those words more frequently to reinforce learning. On the other hand, once the learner masters certain words or

concepts, the flashcards may adjust the frequency of their appearance to optimize retention.

Artificial intelligence enables these flashcards to employ several sophisticated learning strategies, such as spaced repetition, which has been shown to enhance memory retention over time. By leveraging algorithms, AI-powered flashcards can determine the optimal intervals for reviewing material, ensuring that information is revisited just before it is likely to be forgotten. This scientific approach to learning enhances the effectiveness of flashcards, making them a more efficient tool for long-term knowledge retention compared to traditional methods.

Another significant aspect of AI-integrated flashcards is their ability to provide instant, personalized feedback. As learners interact with the flashcards, the system analyzes their responses and offers immediate corrections, tips, and suggestions. This immediate feedback is crucial in helping learners correct mistakes in real-time, preventing the reinforcement of incorrect knowledge and allowing for continuous improvement.

In addition to these features, AI-integrated flashcards also promote greater engagement and motivation in the learning process. By utilizing elements of gamification, such as rewards, progress tracking, and challenges, these flashcards create an interactive and engaging learning experience. Learners can track their progress over time, set goals, and receive instant gratification from successfully mastering certain vocabulary or concepts.

1.4.2. Advantages of AI Integration in Flashcards

The integration of artificial intelligence (AI) into flashcards presents several key advantages that significantly enhance the learning experience. These benefits range from personalized learning pathways to improved

retention rates and more efficient study strategies, making AI-integrated flashcards a powerful tool in modern education.

One of the primary advantages of AI integration is personalized learning. Unlike traditional flashcards, which present a uniform set of information to all learners, AI-powered flashcards can adjust the content and learning pace according to each learner's unique needs and progress. Through continuous analysis of the learner's performance, AI can identify strengths and weaknesses and adapt the difficulty of the content accordingly. For example, if a student consistently struggles with specific vocabulary or concepts, the system can present those items more frequently until mastery is achieved. On the other hand, if a learner demonstrates proficiency in certain areas, the AI can reduce the frequency of those items, allowing the student to focus on more challenging material. This personalized approach enhances learning efficiency and ensures that learners engage with content that is most relevant to their current level of understanding.

Another significant advantage of AI-integrated flashcards is their use of spaced repetition, a technique that optimizes memory retention. Spaced repetition algorithms work by reviewing information at increasing intervals, which helps to combat the forgetting curve. Studies have shown that this method is particularly effective in promoting long-term retention of vocabulary and concepts. AI can calculate the ideal time for revisiting flashcards based on the learner's individual progress and learning patterns, ensuring that material is reviewed at the optimal moment before it is likely to be forgotten. This scientifically-backed approach maximizes learning outcomes by reinforcing knowledge in a way that aligns with the natural processes of memory.

Furthermore, AI-powered flashcards provide immediate feedback during the learning process. Learners can receive real-time corrections, explanations, and suggestions, which help them identify mistakes and correct them instantly. This immediate feedback loop prevents the reinforcement of incorrect information and accelerates the learning process. It also fosters a sense of achievement as learners receive instant validation when they get answers right, which can increase motivation and engagement in the learning process.

AI-integrated flashcards also enable data-driven insights. The AI system collects valuable data on the learner's progress, behavior, and performance, which can be used to generate detailed reports and insights. These analytics can inform both the learner and the instructor about areas that need improvement, enabling targeted interventions. Learners can track their own progress, set goals, and review areas where they may be struggling. Teachers, in turn, can use this data to provide more personalized support to students, ensuring that learning is both effective and efficient.

Lastly, AI-powered flashcards contribute to engagement and motivation. By incorporating gamification elements such as rewards, levels, and challenges, these flashcards create a more interactive and enjoyable learning environment. Learners are more likely to stay motivated and committed to their studies when they can track their progress, earn rewards, and experience the satisfaction of mastering new vocabulary and concepts.

1.4.3. Challenges of AI-Integrated Flashcards

Despite the numerous advantages of AI-integrated flashcards in the field of education, there are several challenges that need to be addressed in order to fully realize their potential. These challenges span technical, educational, and ethical dimensions, and while AI-powered flashcards offer

promising solutions, overcoming these obstacles is essential for ensuring their effectiveness and accessibility.

One of the primary challenges is the accuracy and reliability of AI algorithms. AI systems rely heavily on algorithms to track student progress and adapt the learning experience accordingly. However, if these algorithms are not well-designed or finely tuned, they may misinterpret a learner's performance or fail to provide the appropriate content. For instance, an AI system may incorrectly assess a learner's proficiency level, leading to either an overestimate or underestimate of the learner's abilities. This can result in either frustration or a lack of challenge, which undermines the learning experience. The quality of AI algorithms is therefore crucial for ensuring that the flashcards provide accurate, personalized learning pathways that truly reflect the learner's needs.

Another significant challenge is accessibility and equity. While AI-integrated flashcards can offer personalized learning experiences, they often require access to technology, including devices such as smartphones, tablets, or computers, as well as a reliable internet connection. This creates a disparity between learners who have access to these resources and those who do not. In many parts of the world, especially in underprivileged or rural areas, such access may be limited or entirely unavailable. This digital divide may exacerbate educational inequalities, limiting the ability of some students to benefit from the advantages of AI-powered flashcards. Additionally, the cost of developing and maintaining AI-integrated learning tools may pose challenges for educational institutions or individual learners, further limiting accessibility.

The potential for over-reliance on technology is another concern. While AI-integrated flashcards offer numerous advantages, it is important to balance the use of technology with traditional, face-to-face learning methods. Over-reliance on AI-powered tools may lead to a reduction in social interactions and collaborative learning opportunities, which are essential components of effective education. Furthermore, there is a risk that students may become overly dependent on AI for feedback and reinforcement, neglecting to develop the critical thinking and problem-solving skills that arise from more traditional forms of study and engagement with teachers or peers.

Data privacy and security also present significant challenges when using AI-integrated flashcards. As these tools collect vast amounts of data about learner behavior, performance, and preferences, the risk of data breaches or misuse becomes a critical concern. Ensuring that student data is handled securely, with proper safeguards in place to prevent unauthorized access, is paramount. Additionally, learners and their guardians must be made aware of how their data is being used and have the option to control or delete their personal information. Without proper regulations and safeguards, there is a risk that sensitive information could be exploited for commercial or other purposes, leading to privacy violations.

Lastly, teacher and learner adaptation to AI-integrated flashcards can pose a challenge. While AI-based tools are designed to be user-friendly, both teachers and students may require time and training to fully understand and make the most of the technology. Teachers, in particular, may feel overwhelmed by the additional responsibility of integrating AI tools into their curriculum, especially if they are unfamiliar with the technology or lack proper training. Similarly, students may need guidance on how to effectively use the flashcards, particularly those who are not tech-savvy.

1.4.4. Applications of AI-Integrated Flashcards in Education

Artificial intelligence-integrated flashcards are revolutionizing the educational landscape by providing personalized, dynamic, and data-driven learning experiences across various subjects and educational contexts. These tools are not only transforming vocabulary learning but also expanding their applications to a range of educational settings, improving learning outcomes, and supporting diverse student needs.

One of the primary applications of artificial intelligence-integrated flashcards is in language learning. Flashcards have traditionally been a staple tool for vocabulary acquisition, but their integration with artificial intelligence has made them even more effective. Artificial intelligence algorithms allow flashcards to adapt to each learner's level, ensuring that the right words are presented at the right time, based on the learner's performance. By using spaced repetition techniques, artificial intelligence can determine the optimal intervals for reviewing specific vocabulary, thus maximizing retention. This feature is particularly beneficial in language learning, where mastering vocabulary is essential. Additionally, artificial intelligence-powered flashcards can provide immediate feedback on pronunciation, context usage, and meaning, enhancing both written and spoken language skills. Language learners can benefit from highly personalized experiences, where the artificial intelligence tracks their progress and adapts content to target areas of difficulty, making the learning process more efficient.

Another important application is in science and mathematics education. While traditionally, flashcards have been associated with language learning, artificial intelligence-integrated flashcards can be effectively applied to other subjects as well. For example, in mathematics, flashcards can be used to help students practice mathematical formulas, equations, and concepts. Artificial

intelligence can assess a student's understanding of different concepts, offering more complex problems as their skills improve and reinforcing areas where they struggle. For science, artificial intelligence-powered flashcards can facilitate the learning of key concepts, such as terminology, processes, or classification systems, by adapting the learning content according to the student's level and retention. This adaptability ensures that learners are always presented with content that is both challenging and appropriate for their progress.

In addition to formal classroom settings, artificial intelligence-integrated flashcards are widely used in self-study and independent learning. Many students engage in self-directed learning, especially in subjects like history, geography, and foreign languages, where they can use flashcards to review facts, dates, locations, or vocabulary. Artificial intelligence technology makes this independent learning experience more efficient by personalizing the content and adjusting the learning pace to match the learner's individual needs. With features such as progress tracking, instant feedback, and goal-setting, artificial intelligence-integrated flashcards can enhance the motivation and engagement of self-learners, empowering them to take ownership of their educational journey.

Test preparation is another area where artificial intelligence-integrated flashcards have significant applications. Students preparing for exams, such as standardized tests or subject-specific assessments, can use artificial intelligence-powered flashcards to reinforce important concepts and practice key areas. The artificial intelligence algorithms can analyze the student's past performance and adjust the difficulty of the flashcards accordingly. For example, if a student is consistently scoring well on certain types of questions, the flashcards may focus on more challenging content. Additionally, artificial intelligence can simulate test conditions by presenting questions in random

order or by using timed quizzes, which helps students prepare in a more realistic and effective manner.

Furthermore, special education benefits greatly from the use of artificial intelligence-integrated flashcards. For students with learning disabilities, such as dyslexia or attention deficit hyperactivity disorder, the adaptive nature of artificial intelligence-powered flashcards can provide a more tailored learning experience. The system can adjust the speed of presentation, offer multisensory learning tools, and provide different types of support based on individual needs. For example, auditory cues or visual aids can be incorporated to assist students who may struggle with traditional learning methods. Artificial intelligence's ability to provide immediate feedback and adapt to different learning paces is particularly helpful in ensuring that students with special needs receive the support they require.

1.5. Cognitive and Pedagogical Foundations of Flashcards

1.5.1. Theories of Memory Retention in Language Learning

Memory in language learning is one of the fundamental aspects of vocabulary acquisition with various cognitive approaches to provide insights into how learners encode, store, and retrieve data during the learning and memorization of vocabulary effectively. Ebbinghaus's research provides a fundamental understanding, showing that newly learned information will rapidly degrade if not reinforced through repeated exposure (Ebbinghaus, 1885). This principle emphasizes the effectiveness of flashcards, especially when combined with spaced repetition, which systematically reintroduces words at optimal intervals to combat forgetting (Cepeda et al., 2008).

Another related framework is Baddeley's working memory model, which identifies the phonological loop as a system for temporarily storing auditory information that plays a key role in language learning (Baddeley, 2019). During vocabulary learning, pupils visually perceive words through

flashcards, especially flashcards that incorporate both audio and visual cues, to help their memory consolidate and store vocabulary items before transferring them to long-term memory. Similarly, Craik and Lockhart's levels of processing theory suggest that deeper cognitive processing leads to longer-lasting memory traces. When pupils interact with flashcards in a positive way, such as classifying words, creating sentences, or associating them with images, they reinforce learning beyond the scope of temporary memory (Craik & Lockhart, 1972).

In addition, when pupils use flashcards, the dual-coding process of memory proposed by Paivio (2014) further supports the effectiveness of flashcards in vocabulary learning. Moreover, in the study, the scientist pointed out that vocabulary that is encoded both visually and audibly will help enhance pupils' ability to remember during vocabulary learning. Not only that, flashcards integrated with corresponding images will activate multiple cognitive pathways, helping pupils to remember vocabulary more easily in a short time. At the same time, these cognitive theories are closely linked, together highlighting the effectiveness of flashcards, especially electronic flashcards, in enhancing vocabulary retention in primary school pupils, as they conform to the principles of spaced repetition, multimodal learning, and active recall.

1.5.2. Visual Learning and Its Impact on Vocabulary Acquisition

Visual learning plays an important role in vocabulary acquisition, especially for primary school pupils because it enhances the ability to remember and understand through brain processing. According to Paivio's dual coding theory, learners process and store information more effectively when information is presented in both verbal and visual formats (Paivio, 2014). Flashcards that use audio-visual images can help pupils learn through the ability to memorize vocabulary easily. In addition, for young learners such as primary school pupils, teachers often rely on visual representations through

flashcards to help learners understand new concepts, providing learners with specific reference sources to support word recognition and meaning construction (Mayer, 2021).

Furthermore, the superiority effect of images suggests that images are more likely to be remembered than words alone, as they require deeper cognitive processing (Nelson et al., 1976). In vocabulary learning, flashcards with illustrations or contextual images help pupils establish meaningful connections between words and their expressions, making it easier for pupils to visualize the words when they need to apply them in real-life contexts. Studies have shown that visual aids improve vocabulary recall, especially in second-language learners, because they reduce cognitive load by providing immediate contextual support (Sadoski & Paivio, 2013).

In addition, in the course of research, scientists have shown that young learners have short-term memory (Sweller, 2011). By using flashcards that incorporate simple yet engaging images, extraneous cognitive load can be reduced, allowing pupils to focus on acquiring core vocabulary rather than grappling with abstract definitions. Research in primary education has demonstrated that children learn more effectively when images are used to reinforce text-based learning, making flashcards an optimal tool for developing vocabulary in young learners (Mayer & Moreno, 2010).

1.5.3. The Role of Repetition in Vocabulary Retention

Repetition is a fundamental cognitive mechanism in vocabulary acquisition, as it reinforces information that needs to be remembered and facilitates long-term retention. According to research by Ebbinghaus (2013), information that is introduced into the brain will be quickly forgotten unless it is reinforced at regular intervals for the purpose of consolidation and recall. Furthermore, this principle also supports the use of repeated exposure in language learning, in which learners encounter and recall vocabulary items repeatedly to reinforce them in long-term memory, helping to store vocabulary

information for a longer period of time. Furthermore, flashcards are often used in spaced repetition systems, which enhance vocabulary retention by presenting words at optimal intervals to counteract forgetting. The retrieval practice effect, more commonly known in education as the testing effect, further emphasizes the importance of repetition in vocabulary learning. Research has shown that actively recalling words through visual aids rather than just reciting them reluctantly, enhances retention and strengthens neural connections (Karpicke & Blunt, 2011). Learners use flashcards effectively by requiring them to actively search for meaning, visualize, and perform actions on the flashcards, while also leveraging some new principles to increase deeper cognitive processing. In addition, this effect contributes several factors that are particularly beneficial to young learners, who are frequently exposed to new words to establish stable lexical representations (Nation, 2001).

Furthermore, working memory models also account for the role of the phonological loop in language learning, suggesting that repeated auditory exposure enhances verbal memory (Baddeley, 2019). Flashcards that combine spoken pronunciation with written text reinforce phonological and orthographic connections, allowing learners to develop both listening and reading skills at the same time. This multimodal reinforcement is consistent with dual coding theory, which suggests that encoding information across multiple sensory modalities enhances retention (Paivio, 2014).

In addition, cognitive load theory emphasizes that too much information can overwhelm learners, especially young students with limited working memory capacity (Sweller, 2011). Flashcards provide an effective balance between repetition and cognitive efficiency, allowing learners to focus on small, manageable groups of words while reinforcing vocabulary over time. Research on second language acquisition has consistently demonstrated that systematic repetition strategies, such as spaced review and self-testing, significantly improve vocabulary retention (Schmitt, 2008).

1.5.4. Flashcards as Tools for Active Recall and Spaced Repetition

Flashcards are effective for vocabulary learning because they combine active memorization and spaced repetition, cognitive mechanisms that enhance long-term retention. Active memorization is the process of retrieving information from memory without external cues, strengthening neural connections and improving the ability to retain information (Roediger & Butler, 2011). Unlike passive learning methods such as recitation or rote learning, which provide limited cognitive engagement, flashcards require learners to actively retrieve word meanings, thereby strengthening retention and deepening vocabulary knowledge (Karpicke & Blunt, 2011).

In addition, flashcards facilitate spaced repetition, a technique based on Ebbinghaus' Forgetting Curve, which suggests that information is quickly forgotten if not reviewed at strategic intervals (Ebbinghaus, 2013). Spaced repetition systems (SRS), such as the Leitner system, optimize vocabulary review time by increasing the interval between exposures as familiarity increases. This approach reduces cognitive load while ensuring that words are reinforced at the most effective times for retention. Research on second language acquisition has demonstrated that systematically spacing vocabulary review sessions results in significantly higher recall rates than focused learning strategies (Kornell & Bjork, 2008).

Furthermore, flashcards support multimodal learning by integrating text, images, and audio, making them particularly effective for young learners. According to Paivio's Dual Coding Theory, encoding information through both verbal and visual modalities enhances retention (Paivio, 2014). Flashcards with illustrations, contextual sentences, or phonetic transcriptions engage multiple cognitive pathways, allowing pupils to associate new vocabulary with meaningful representations (Mayer, 2014).

The effectiveness of flashcards is further supported by cognitive load theory, which emphasizes that learning is most effective when cognitive

resources are allocated efficiently (Sweller, 2011). Flashcards allow for study sessions that are manageable in terms of attention and prevent cognitive overload while maintaining high levels of engagement. Furthermore, studies have shown that self-testing with flashcards enhances metacognitive awareness, allowing learners to monitor their own progress and adjust their learning strategies accordingly (Dunlosky et al., 2013).

1.5.5. Connection between Flashcards and Cognitive Load Theory

Cognitive load theory provides a theoretical framework for understanding how flashcards support vocabulary learning by optimizing mental effort and the ability to retain information. Research proposed by Sweller (1988) suggests that the brain has limited working memory capacity and that effective instructional strategies should aim to minimize irrelevant cognitions while maximizing relevant cognitions about the mental effort expended on meaningful learning. Flashcards, when effectively designed and implemented, support this balance by presenting information in manageable units, reducing overload and enhancing retention.

One of the main advantages of flashcards from a cognitive load perspective is their ability to reduce intrinsic cognitive load, i.e. the inherent complexity of learning material (Sweller, 2011). Vocabulary acquisition, especially for young learners, can be difficult due to the need to simultaneously process phonological, semantic, and syntactic aspects (Mayer, 2024). Additionally, flashcards simplify this process by isolating individual vocabulary items and reinforcing associations through repetition and retrieval practice (Baddeley, 2019).

Furthermore, flashcards help manage extraneous cognitive load, which arises from ineffective instructional design or distracting elements that do not contribute to learning (Chandler & Sweller, 1991). Poorly designed vocabulary instruction, such as word lists that are too large or explanations that are too lengthy, can overwhelm learners and hinder retention. Flashcards,

by presenting information in a concise and visually appealing format, allow learners to focus only on essential elements, reducing unnecessary mental strain (Paas & Ayres, 2014). In particular, digital flashcards incorporate multimedia elements (e.g., images, audio, and animation), supporting multimodal learning and minimizing excessive text processing (Mayer, 2014).

Flashcards also increase the cognitive load involved, i.e., the mental effort spent on schema construction and long-term retention (Sweller et al., 2019). The use of spaced repetition and active recall in flashcard-based learning enhances neural connections and facilitates automatic vocabulary retrieval (Roediger & Butler, 2011). Research in cognitive psychology shows that spaced exposure to words through flashcards promotes deeper encoding and enhances long-term memory representation.

Furthermore, the modularity of flashcards allows learners to self-pace their learning, allowing differentiation based on individual working memory capacity (Dunlosky et al., 2013). Adaptive flashcarding applications, such as Quizziz and Quizlet, dynamically adjust review schedules based on learner performance, ensuring that difficult words are reviewed more frequently, while familiar words appear less frequently, optimizing cognitive efficiency (Karpicke & Roediger, 2008).

1.6. Empirical Studies on Flashcards in Vocabulary Learning

1.6.1. International Studies on Flashcard Effectiveness

In recent years, many international studies have examined the effectiveness of flashcards in vocabulary acquisition, emphasizing their role in enhancing memory, recall, and learner engagement. One of the most widely cited studies by Nation (2001) emphasizes that flashcards provide focused and repeated exposure to vocabulary items, facilitating deeper memory encoding. Similarly, Schmitt (2008) argues that vocabulary learning is most effective when words are systematically reviewed over time, a principle that is supported by flashcard-based learning.

A meta-analysis conducted by Karpicke and Bauernschmidt (2011) found that pupils who used active recall and spaced repetition techniques with flashcards demonstrated significantly higher retention rates than pupils who used passive learning methods such as reading or learn by heart. Their findings support the claim that retrieval practice enhances long-term retention, reinforcing the role of flashcards as an effective vocabulary learning tool. In another study, Nakata (2011) compared the effectiveness of paper flashcards with electronic flashcards and found that while both formats improved vocabulary recall, electronic flashcards that incorporated multimedia elements (e.g., pictures, audio, and example sentences) were particularly beneficial for learners with little exposure to the target language.

In the context of young learners, studies by Webb and Nation (2017) indicate that explicit vocabulary instruction through flashcards is more effective than incidental exposure through reading or listening. This finding is consistent with research by Barcroft (2015), who suggests that isolating new vocabulary items on flashcards and practicing them repeatedly helps beginners recognize and retrieve words more quickly. Furthermore, studies in cognitive psychology, such as that by Roediger and Butler (2011), highlight that spaced retrieval with flashcards significantly reduces forgetting rates, making them particularly effective for young learners, especially for primary school pupils who require repeated exposure to memorize new words.

Research in various educational contexts has also demonstrated the cross-cultural applicability of flashcards in vocabulary instruction. For example, a study by Sun and Dong (2004) in China found that ESL learners who used illustrated flashcards showed better vocabulary retention and contextual usage than those who relied on word lists. Similarly, in a Turkish study, Başoğlu and Akdemir (2010) reported that pupils who used a mobile flashcard application performed 30% better on vocabulary tests than pupils who used conventional note-taking strategies. Together, these studies

reinforce the global relevance and effectiveness of flashcards in language learning.

Despite these findings, several other studies, such as that of Cobb (2007), caution that memorizing using flashcards does not always lead to deeper vocabulary knowledge if learners do not interact with the words in meaningful context. To address this limitation, researchers such as Boers et al. (2017) advocate contextual flashcard learning, in which words are paired with example sentences or real-life communication tasks to enhance semantic depth.

1.6.2. Comparisons between Flashcards and Traditional Teaching Methods

Several studies have compared the effectiveness of flashcards to traditional vocabulary teaching methods, such as rote memorization, textbook study, and contextual reading (Tahir, 2023). Nation's (2001) study found that flashcards are particularly effective in facilitating intentional vocabulary learning, as they provide a structured approach to repeated exposure. In contrast, traditional methods, such as dictionary study, often lead to passive engagement with new words, resulting in lower retention rates.

A controlled study by Schmitt (2008) compared flashcard learning to contextual reading methods and found that learners who used flashcards remembered 40% more words than those who encountered new vocabulary in reading passages. This suggests that explicit vocabulary instruction through flashcards increases the efficiency of vocabulary retrieval, especially for beginners who struggle with incidental learning. Similarly, Webb (2007) demonstrated that bilingual learners who used flashcards performed better than those who relied solely on L2 dictionary definitions, suggesting that direct L1-L2 links speed word recall.

In classroom-based studies, Karpicke and Roediger (2008) explored the effectiveness of spaced retrieval using flashcards compared to repeated

exposure in a textbook. Their findings showed that pupils who used spaced flashcard review recalled up to 80% of the words they learned after one month, while pupils who relied on reading-based repetition recalled only 45%. This highlights the memory consolidation benefits of active recall, a process often lacking in traditional teaching methods. Following previous research, Nakata's (2011) study further supports this claim, noting that electronic flashcards with spaced repetition algorithms help learners prioritize difficult words while reducing cognitive load when reviewing familiar words.

Additionally, Başoğlu & Akdemir (2010) compared mobile flashcard applications with traditional note-taking strategies among college pupils and found that flashcard users performed 30% better on vocabulary recall tests. The study found that the interactive and gamified elements of electronic flashcards make vocabulary learning more engaging than conventional rote memorization methods. Similarly, Barcroft (2015) found that picture flashcards improve recall by activating dual coding (Paivio, 1990), whereas exposure to text alone, such as in a traditional textbook, typically results in weaker recall.

However, some researchers argue that flashcards do not always lead to deep semantic processing. Hulstijn & Laufer (2001) emphasize that while flashcards support rapid vocabulary acquisition, traditional teaching methods that incorporate contextual learning—such as task-based activities and communicative exercises—lead to better long-term retention. Boers et al (2017) further caution that relying solely on flashcards can lead to superficial vocabulary knowledge, advocating for an approach that combines flashcard learning with contextual use in meaningful classroom interactions.

Although flashcards offer clear advantages regarding short-term memory and active recall, studies show that they are most effective when combined with contextual practice. Learners benefit from specific vocabulary exercises with flashcards, but interacting with words in real-life situations -

through writing, speaking, and problem-solving tasks - is still essential to mastering a comprehensive vocabulary.

1.6.3. Comparison between Electronic Flashcards and Traditional Flashcards

The comparison between traditional flashcards and electronic flashcards reveals distinct differences in effectiveness, particularly within the context of primary school students learning English vocabulary. Traditional flashcards, typically made of paper, have been widely used for decades due to their simplicity, ease of use, and cost-effectiveness. They encourage active recall and self-testing, both of which are essential for memory reinforcement. In classroom or home settings, students can physically handle the cards, which may enhance focus and tactile memory. However, traditional flashcards lack interactivity and flexibility, often requiring manual organization and offering no immediate feedback on accuracy or progress.

Electronic flashcards, on the other hand, bring notable enhancements to the learning experience. Through mobile applications or online platforms, digital flashcards provide interactive features such as audio pronunciation, images, and instant feedback, which enrich vocabulary learning. Many digital flashcard systems incorporate spaced repetition algorithms, ensuring that words are reviewed at optimal intervals to strengthen long-term retention. In the context of secondary school learners, who are increasingly accustomed to digital environments, these features not only maintain engagement but also allow for self-paced, individualized learning. Electronic flashcards often include tracking tools that help both learners and educators monitor progress, making it easier to identify areas that need improvement.

Another key difference lies in accessibility. While traditional flashcards are limited by physical presence and may be impractical to carry in large

numbers, digital flashcards offer the convenience of being stored and accessed on smartphones, tablets, or computers anytime and anywhere. This allows learners to integrate vocabulary practice into their daily routines, enhancing consistency and exposure.

1.6.4. Comparison between Electronic Flashcards with Integrated Artificial Intelligence (AI) and Traditional Flashcards

Electronic flashcards, AI-integrated electronic flashcards and traditional flashcards have important differences in terms of how they work, the level of personalization and effectiveness in the learning process. Previously, we only knew traditional flashcards as pieces of paper or cardboard with information written on both sides. Teachers would provide flexible activities to help learners remember words such as looking at the flashcards and reading them, or playing word smashing games with flashcards that teachers had already posted on the board. These activities would become boring when used repeatedly in many lessons, making pupils less excited to participate in the activities. Through that, we can see that this method, although simple, easily leads to passive learning and lacks optimization in review frequency.

Meanwhile, electronic flashcards are digitized on platforms such as Anki, Quizlet, allowing learners to access flexibly on many devices, integrating spaced repetition to increase memorization efficiency. However, electronic flashcards have not really attracted learners when they only integrate images, sounds, word definitions without integrating interactive games or features to manage Pupils' progress during the learning and review process to help pupils remember long-term, absorb new knowledge in the process of learning vocabulary.

To upgrade new features in the process of learning vocabulary with electronic flashcards, electronic flashcards now integrate more advanced AI

when using artificial intelligence to automatically create, adjust and personalize learning content. To optimize learning ability, integrated electronic flashcards use artificial intelligence to automatically build, adjust and personalize content based on each individual's learning data. Artificial intelligence (AI) can analyze the strengths and weaknesses of learners, suggest or even automatically create new cards based on input materials, such as textbooks, lectures or online texts. Some advanced AI systems are also capable of automatically adjusting the difficulty of the cards, adding images, selecting native speakers' voices or providing appropriate context to enhance memorization efficiency, integrating user-interactive games, and recognizing the learner's voice to practice pronouncing new words. At the same time, electronic flashcards with integrated artificial intelligence also meet the needs of teachers for each lesson without teachers needing much preparation time like applications BE Memrise, Best Flashcards, Azvocab

However, traditional flashcards are still widely used today, some teachers still do not accept the use of electronic flashcards because of the complex requirements. Applications for learning vocabulary through Flashcards with integrated artificial intelligence are currently still limited due to copyright and have not been widely used in the teaching process because they are not known by many teachers and have not been widely applied in the teaching process because some schools are still equipped with rudimentary teaching equipment, not integrated with the Internet, so teachers in some schools, most of which are rural schools, have limited access to modern equipment, so the application of flashcards integrated with artificial intelligence still faces many difficulties.

1.6.5. Classroom Experiments Using Flashcards

Experimental studies have extensively examined the effectiveness of flashcards in classroom settings, particularly in enhancing vocabulary acquisition in young learners. Several controlled experiments have

demonstrated that flashcards support active recall, retention, and engagement, making them a useful tool for vocabulary instruction.

One of the most influential classroom experiments was conducted by Karpicke & Blunt (2011), who compared the effectiveness of retrieval-based learning with flashcards to traditional learning methods in a primary school setting. Their study found that pupils who actively retrieved vocabulary through flashcards demonstrated significantly higher retention rates than pupils who passively reviewed word lists or engaged in rote memorization. This experiment supports the claim that retrieval practice enhances long-term learning by strengthening memory traces through repeated exposure and testing.

Another study by Nation (2023) investigated the impact of flashcards on vocabulary recall in young ESL learners. The study divided pupils into two groups: one group used electronic flashcards with a spaced repetition algorithm and the other group used teacher-led vocabulary instruction without flashcards. The results showed that Pupils who used flashcards scored 35% higher on posttests of vocabulary than their peers in the control group. Additionally, the experiment highlighted that personalized digital flashcards allow Pupils to self-pace their learning, leading to better individual performance.

In a large-scale classroom experiment, Nakata (2011) compared traditional flashcards with electronic flashcards among primary school pupils learning English vocabulary. The study found that while both methods significantly improved vocabulary retention, electronic flashcards with adaptive learning features resulted in 25% higher recall rates than traditional paper flashcards. The effectiveness of electronic flashcards was attributed to their interactive nature, instant feedback mechanism, and integration of multimedia elements to cater to different learning styles.

Furthermore, a study by Webb & Chang (2012) investigated the role of visual flashcards in vocabulary retention. Their findings indicated that pupils who used visual flashcards recalled 50% more words than pupils who relied solely on text flashcards. This finding is consistent with Paivio's (1990) Dual Coding Theory, which suggests that visual stimuli enhance cognitive processing by using both verbal and nonverbal memory systems. This suggests that integrating multimodal elements into flashcards—such as images, audio, and animation—may enhance word memorization and recall.

A classroom intervention by Schmitt and Schmitt (2020) explored the effectiveness of flashcards in a peer-supported learning environment. Their study found that pupils who used flashcards to test each other on their vocabulary knowledge performed better than pupils who studied individually. The researchers attributed this improvement to social interaction, peer reinforcement, and increased motivation, which are important factors in a dynamic learning environment.

Although these experiments highlight the effectiveness of flashcards in classroom instruction, some researchers caution against relying solely on flashcards for vocabulary learning. Boers et al. (2017) argue that although flashcards improve short-term recall, they may not be effective in developing deep vocabulary knowledge. They recommend combining flashcard-based learning with contextualized language tasks—such as writing exercises and communicative activities—to ensure that learners not only recognize words but also apply them in meaningful contexts.

1.6.6. Long-Term Effects of Flashcards on Vocabulary Retention

The long-term effects of flashcards on vocabulary retention have been extensively studied in second language acquisition research. Studies have shown that flashcards enhance long-term memory through active recall, spaced repetition, and multimodal learning, making them an effective tool for vocabulary acquisition in young learners. Although the short-term benefits are

evident in immediate posttests, researchers have also investigated the extent to which flashcards contribute to long-term retention and retrieval of learned vocabulary.

One of the most influential studies on this topic was conducted by Bahrick (1984), who introduced the concept of "permanent memory" in vocabulary learning. His longitudinal study demonstrated that long-term spaced repetition using flashcards significantly enhanced long-term retention, with learners recalling words even years later. This finding is consistent with the Forgetting Curve theory (Ebbinghaus, 1885), which states that without periodic review, learners will quickly forget newly learned information. By incorporating systematic repetition schedules, flashcards help counteract this natural forgetting process, ensuring better consolidation and retrieval of vocabulary.

In a study focusing on young learners, Sagarra and Alba (2006) compared long-term retention of vocabulary learned through traditional rote memorization with that of flashcard-based retrieval. Their findings showed that pupils who engaged in active recall using flashcards had memorized over 60% of the words after six months, while those who relied on rote memorization had only memorized 30%. This supports the idea that retrieval-based learning strengthens memory pathways, making vocabulary more accessible when using language in the real world.

The effectiveness of digital flashcards using spaced repetition algorithms has also been tested. Nakata (2011) found that pupils who used digital flashcards with adaptive review schedules outperformed pupils who used paper flashcards on vocabulary recall tests taken six months after the intervention. The intelligent scheduling of review sessions in digital flashcards ensures that words are reviewed at optimal intervals, reinforcing long-term memory formation. This finding is consistent with the principles of spaced

repetition systems which are widely deployed in language learning apps such as Quizziz, Quizlet, and Memrise, Wordwall.

Another cross-sectional classroom study by Webb and Chang (2012) investigated the durability of vocabulary retention in young ESL learners who used flashcards in structured study sessions. Results showed that pupils who repeatedly reviewed words with flashcards over a semester retained approximately 75% of the vocabulary they learned after one year. Additionally, participants who used flashcard vocabulary in context—such as writing sentences or participating in discussions—retained an even higher percentage (85%). This suggests that although flashcards are effective for initial vocabulary acquisition, integrating them with contextual learning strategies may further enhance long-term retention.

However, researchers have noted some limitations to the long-term effectiveness of flashcards if they are not used consistently. Boers et al (2017) caution that flashcards alone may not ensure deep vocabulary processing, as learners may memorize words individually without fully understanding their contextual usage. To address this issue, Hulstijn (2001) emphasizes the importance of "elaborate rehearsal," in which learners interact with flashcards in a variety of linguistic contexts, such as listening, reading, and speaking activities. This approach ensures a stronger connection between newly learned words and prior knowledge, making them easier to recall over time.

1.7. Flashcards in The Vietnamese Context

1.7.1. Overview of English Language Teaching in Vietnam

English language education in Vietnam has made significant progress in recent decades, driven by the government's emphasis on English proficiency as a key factor for economic and social progress. The National Foreign Language Project 2018, initiated by the Ministry of Education and Training, aims to improve English proficiency for Vietnamese pupils by introducing English language teaching into the curriculum from Grade 1 under

the 2018 general education program. Despite the existing efforts in the teaching and learning of foreign languages, there are still disparities between urban and rural schools in terms of resources, teacher qualifications and teaching methods.

In urban areas, English language teaching is often supported by modern teaching aids, the application of advanced teaching tools in the teaching process and a team of well-trained teachers. Many schools combine communicative language teaching (CLT) and task-based learning (TBL) approaches, emphasizing real-world language interaction and use. In contrast, rural schools face limitations in access to technology, limited professional development opportunities for teachers, and limited exposure to English-speaking environments. As a result, traditional methods such as rote learning and translation remain popular. Flashcards are a practical solution in both contexts, providing an accessible and adaptable tool to reinforce vocabulary learning in a variety of classroom settings.

1.7.2. Vocabulary Teaching Challenges in Primary Schools

Vocabulary teaching in Vietnamese primary schools faces a number of challenges that affect pupils' ability to acquire and retain English vocabulary effectively. One of the main difficulties is the over-reliance on rote learning, a traditional teaching method that is still prevalent in many classrooms in different primary schools. Although rote learning helps pupils recall individual words, it often lacks meaningful context, leading to poor retention and limited ability to use vocabulary in real-life communication, and a lack of confidence in language communication. This problem is exacerbated by large class sizes, which make it difficult for teachers to implement interactive and communicative teaching methods that promote vocabulary acquisition through meaningful use.

Another major obstacle is the lack of exposure to English outside the classroom. In urban areas, pupils have access to English-language media,

private language centers, and extracurricular activities that reinforce their vocabulary learning. However, in rural and disadvantaged areas, pupils have few opportunities to practice English outside of school hours, leading to slower vocabulary development. In addition, the lack of well-trained English teachers, especially in rural areas, also contributes to ineffective vocabulary teaching. Many teachers still rely on translation-based methods and lack training in modern teaching strategies, such as contextual vocabulary teaching or task-based learning.

Furthermore, the lack of high-quality teaching materials and resources further hinders vocabulary teaching. While some schools have integrated visual aids, flashcards and modern e-learning tools into their teaching, many primary schools, especially in less developed areas, still rely on outdated textbooks with uninteresting content that do not engage learners. Without adequate resources, pupils will have difficulty grasping the meaning of words and developing vocabulary. In addition, pronunciation difficulties are another barrier, as Vietnamese pupils often have difficulty distinguishing and pronouncing English sounds that are not found in their mother tongue, further affecting their ability to use vocabulary accurately.

1.7.3. Use of Flashcards in Vietnamese Primary Schools

Flashcards have been widely used as a vocabulary teaching tool in Vietnamese primary schools due to their simplicity, cost-effectiveness, and adaptability to different learning environments. Teachers often use flashcards to introduce new words, practice spelling, and reinforce meaning through engaging activities. The flexibility of flashcards allows for a variety of teaching strategies, including matching games, memory challenges, and interactive questioning.

In urban schools or schools with modern teaching facilities, teachers often supplement traditional paper flashcards with electronic flashcard applications, such as Quizlet, Quizziz, and Wordwall, to enhance student

engagement. These digital tools provide interactive features, such as audio pronunciation and spaced repetition, which can improve vocabulary retention. However, in rural or low-budget schools where technology resources are scarce, teachers rely heavily on hand-made flashcards. While effective, quality, and variety depend on teacher creativity and available resources.

Despite the many benefits, the use of flashcards in the classroom is not without its drawbacks. Some teachers express concerns about the time required to create and organize flashcards, especially when dealing with large classes. Additionally, flashcards alone may not be sufficient to develop deeper language skills, such as sentence structure and contextual usage. To maximize their effectiveness, teachers need to integrate flashcards with communicative activities that encourage pupils to apply vocabulary in meaningful contexts.

1.7.4. Perceptions of Teachers and Pupils on Flashcards

Both teachers and Pupils in Vietnam generally consider flashcards to be an engaging and effective tool for learning vocabulary. Teachers appreciate the visual and interactive nature of flashcards, which helps to maintain pupils' attention and supports a variety of learning styles. Many educators report that flashcards promote active recall and improve pupils' ability to recognize and remember new words. In addition, flashcards are considered a practical tool for classroom management, allowing teachers to conduct quick review sessions and informal assessments.

From the pupils' perspective, flashcards make learning vocabulary more fun, especially when incorporated into games and interactive activities. Young learners often find traditional vocabulary instruction monotonous, but flashcards add an element of fun and competition, which increases motivation. However, some pupils may become tired, bored, or lose focus if they use flashcards in a repetitive manner without variation in activities. To address this issue, teachers must use a variety of instructional techniques that combine flashcards with storytelling, role-playing, and contextual learning experiences.

1.8. Designing and Using Flashcards Effectively

1.8.1. Key Principles for Designing Flashcards

The effectiveness of flashcards in vocabulary learning depends largely on their design, which should align with cognitive learning principles to enhance retention and engagement. A well-structured flashcard should combine visual appeal, cognitive simplicity, contextual relevance, and strategic repetition to optimize learning outcomes. A key principle is dual coding, integrating both textual and visual elements to enhance retention. According to Paivio (1990), information presented through multiple verbal and visual channels is more likely to be remembered than information processed through a single modality. For young learners, combining clear images with words reinforces associative learning and aids recall (Mayer, 2014).

Another important aspect is cognitive load management, ensuring that learners are not overwhelmed by too much information. Sweller (1994) suggests that instructional materials should minimize extraneous cognitive demands, allowing learners to focus on essential content. Effective flashcards should present only key information while avoiding unnecessary details so that learners can process the target vocabulary effectively (Mayer & Moreno, 2003). In addition, context plays an important role in vocabulary acquisition. Nation (2013) emphasizes that words learned in meaningful contexts are more likely to be remembered. Instead of presenting individual words, flashcards should include short sentences, phrases, or topic groups, helping learners understand how words function in real-life communication (Webb, 2017).

Furthermore, spaced repetition is essential to consolidate learning over time. Ebbinghaus (1885) demonstrated that systematic review at increasing intervals significantly improves long-term retention. Using flashcards in structured review cycles or using digital platforms that automate repetition schedules helps pupils memorize vocabulary more effectively. Finally, active

engagement enhances the effectiveness of flashcards. Instead of simply reviewing cards passively, pupils should engage in interactive learning activities such as matching exercises, peer quizzes, and storytelling through electronic flashcards. Ellis (2020) emphasizes that active learning strategies deepen cognitive processing, leading to greater long-term retention of language (Schmitt, 2008). By applying these principles—dual encoding, cognitive load management, contextualization, spaced repetition, and active interaction—teachers can design flashcards that not only support vocabulary learning but also promote meaningful language use and long-term memory.

1.8.2. Customization of Flashcards to Suit Learning Objectives

Customizing flashcards to match specific learning objectives is essential to maximize their effectiveness in vocabulary acquisition. The adaptability of flashcards allows educators to tailor content based on pupils' proficiency levels, learning styles, and instructional goals. An important aspect of customization is vocabulary selection, ensuring that the vocabulary presented is relevant to the learners' communicative needs and aligned with the textbook's curriculum. According to Nation (2013), words should be selected based on frequency and usefulness, with a balance between high-frequency words and specialized terminology. For young learners, incorporating thematic vocabulary related to everyday life and school subjects will enhance their ability to use authentic language (Webb, 2020).

Another important customization strategy is multimodal integration, which combines text, images, audio, and interactive elements to accommodate different learning styles. Paivio's (1990) dual coding theory suggests that integrating visual and auditory elements with text enhances retention. For example, digital flashcards can include pronunciation recordings and example sentences to support auditory learners, while interactive elements such as drag-and-drop tasks engage kinesthetic learners (Mayer, 2010). Additionally, embedding contextual clues—such as sample sentences or short dialogues—

reinforces meaning and usage, which is appropriate in both learning and teaching. In Ellis's (2015) research, who emphasized the role of contextual input in language acquisition.

Flashcards should also be differentiated based on the level of the learner to provide appropriate levels of challenge. For beginners, flashcards with simple word-picture associations are effective, while more advanced learners will benefit from phrases, idioms, and phrases that reflect authentic language use (Schmitt, 2008). Adaptive digital flashcard systems, such as spaced repetition software, further personalize learning by adjusting the review schedule based on individual progress.

Furthermore, cultural and linguistic relevance should be considered when designing flashcards for young learners in specific educational contexts. For example, in Vietnam, flashcards combined with familiar lesson units with each topic and everyday experiences can enhance engagement and understanding. By customizing flashcards through careful vocabulary selection, multimodal integration, level-based differentiation, and cultural relevance, educators can create more meaningful and effective vocabulary learning experiences for pupils.

1.8.3. Integration of Flashcards with Other Teaching Tools

Integrating flashcards with other instructional tools enhances vocabulary acquisition by providing a multidimensional learning experience for pupils. Flashcards, while effective when used alone, are more beneficial when combined with additional instructional methods such as storytelling, games, and integrating other electronic flashcard applications. Nation (2013) emphasizes that vocabulary learning is most effective when words are encountered in a variety of contexts, so pairing flashcards with activities that encourage contextual language use is essential.

Another effective flashcard strategy is to incorporate flashcards into storytelling and role-play activities, allowing pupils to encounter new words

in meaningful stories. When Pupils engage in storytelling with visual flashcards, they form stronger connections between words and real-life situations, strengthening both comprehension and recall (Ellis, 2020). Similarly, vocabulary quizzes using dialogues, in which pupils use flashcards as prompts to construct dialogues, promote active language production and enhance vocabulary retention by Webb (2020).

Using gamification techniques enhances vocabulary learning through flashcards by increasing interactivity and motivation. Games such as "Memory Match," "Flashcard Race," and "Guess the Word" used in teaching vocabulary through flashcards promote student engagement while reinforcing word recognition and usage (Schmitt, 2008). Additionally, digital flashcard tools such as Quizlet, Wordwall, and Quizziz use spaced repetition algorithms to customize learning and improve retention. These applications allow learners to correct pronunciation errors, enhance retention, and provide personalized learning pathways for positive growth.

Multimodal approaches, such as combining flashcards with songs, videos, and movement activities, accommodate learners with different cognitive styles. Mayer (2009) suggests that integrating verbal and visual stimuli enhances memory encoding, so pairing flashcards with audio recordings or animations may be beneficial. For younger learners, movement activities such as total physical response can link vocabulary learning to movement, further reinforcing the meaning of words (Asher, 1993).

Finally, cooperative learning approaches integrate flashcards with peer discussions and collaborative tasks that encourage active participation and social interaction. Group activities, such as word association challenges or student-created flashcards, promote deeper processing and promote meaningful communication (Vygotsky, 1978). By taking advantage of a variety of pedagogical tools, educators can maximize the effectiveness of

flashcards, transforming them from isolated vocabulary exercises into dynamic, interactive learning experiences.

1.8.4. Practical Classroom Activities Using Flashcards

The use of flashcards in classroom activities provides an engaging and interactive approach to vocabulary learning, especially for young learners. Effective flashcard-based activities should be designed to encourage active recall, contextual use, and student engagement. Nation (2013) believes that vocabulary acquisition is most effective when learners are repeatedly exposed to words through diverse forms of interaction, typically using flashcards, therefore, structured activities play an important role in optimizing the benefits of flashcards.

A common activity is for teachers to use flashcard exercises or games. In this, pupils are shown a flashcard and have to quickly recall the meaning or pronunciation of the word. This method is particularly useful for strengthening word recognition and automaticity of retrieval (Schmitt, 2008). To increase student engagement with flashcards, teachers can incorporate a time element, such as challenging pupils' speed of memorizing the words they have learned. During the activity, pupils will be divided into two groups competing to memorize vocabulary in the shortest amount of time.

Another activity during the use of flashcards is game "Matching Flashcards", which is another game that applies flashcards to the meaning of words. In which pupils have to match vocabulary with appropriate images or definitions. According to Webb (2020), the importance of multimodal learning is emphasized, and research shows that matching activities can improve vocabulary retention by associating words with visual cues. This game can be adapted to pair or group work to promote collaborative learning.

Flashcard role-playing and storytelling integrate vocabulary into meaningful contexts, helping pupils develop communicative competence. In this activity, pupils draw flashcards and construct a story using the given

words, thus reinforcing the meaning of the words in a natural discourse context (Ellis, 2020). Similarly, in role-playing exercises, pupils act out real-life situations using vocabulary cues from flashcards, which helps pupils both recall and use real-world language.

For kinesthetic learners, Total Physical Response activities can be integrated with flashcards. Asher (1998) suggests that linking movement to language learning increases retention. In this activity, pupils must perform an action related to the vocabulary displayed on the flashcard, making it particularly useful for younger learners who benefit from hands-on engagement.

Additionally, digital flashcard activities using platforms such as Quizlet or Quizziz provide adaptive learning experiences. These applications combine gamification elements, quizzes, and spaced repetition algorithms to reinforce vocabulary retention over time. Teachers can design collaborative tasks where pupils create their own digital flashcards and share them with peers, promoting autonomy and deeper cognitive engagement.

1.8.5. Assessing Student Outcomes Through Flashcard Use

Evaluating the effectiveness of flashcards in vocabulary learning is essential to ensure that pupils make measurable progress. A well-structured assessment framework will assess vocabulary retention, speed of recall, and the ability to use learned words in context. According to Nation (2013), vocabulary assessment should assess not only recognition but also effective use, ensuring that Pupils are able to actively apply newly learned words.

A common assessment method is pre- and post-tests, in which Pupils' vocabulary knowledge is measured before and after using flashcards for a specified period of time. This method allows educators to quantify learning levels and identify areas that need further reinforcement (Schmitt, 2008). In addition to written tests, oral assessments can be conducted by prompting

pupils with flashcards and assessing pupils' pronunciation, fluency, and understanding of context.

Another effective strategy is observational assessment during classroom activities. Teachers can monitor pupils' engagement with flashcards, noting Pupils' accuracy in recall-based games, participation in discussions, and ability to apply vocabulary to communicative tasks (Webb, 2020). This method provides qualitative insights into pupils' learning progress and highlights the effectiveness of different flashcard activities.

Self-assessment and peer assessment can also enhance the assessment process. Encouraging upipls to track their own learning progress using flashcard applications such as Quizlet, Quizziz, or Wordwall can promote metacognitive awareness and self-regulation. Additionally, peer-testing or collaborative flashcard-based activities allow Pupils to test each other's knowledge, reinforcing learning through social interaction.

For a more comprehensive assessment, longitudinal studies could be conducted to examine the long-term retention of vocabulary learned through flashcards. Research by Laufer and Goldstein (2004) showed that spaced repetition and active recall two key principles of using flashcards result in superior long-term retention of vocabulary compared to passive learning strategies. Periodic follow-up assessments can determine whether pupils retain vocabulary over time and whether they can transfer learned words into writing and conversation.

1.9. Motivation and Engagement through Flashcards

1.9.1. The Role of Motivation in Language Learning

Motivation plays a fundamental role in language learning, influencing pupils' willingness to acquire new vocabulary and persevere in their studies. Research has consistently shown that motivation is a key predictor of success in language acquisition, as it determines the amount of effort pupils invest in learning tasks (Dörnyei, 2013). Motivation in language learning is often

classified into intrinsic and extrinsic motivation. Intrinsic motivation refers to the personal enjoyment and satisfaction derived from learning, while extrinsic motivation refers to external rewards, such as grades or teacher rewards such as stickers.

In the context of vocabulary learning, intrinsic motivation can be promoted by making the learning process more engaging and meaningful. When pupils see practical applications of vocabulary in real-life communication, they are more likely to stay interested and persistent in their learning efforts (Ushioda, 2013). On the other hand, extrinsic motivators, such as praise and tangible rewards, can encourage pupils to actively engage in vocabulary-building exercises (Schunk & Zimmerman, 2007).

Self-determination theory posits that autonomy, competence, and relatedness are essential factors in maintaining motivation (Deci & Ryan, 1985). When Pupils feel in control of their learning (autonomy), believe in their ability to master vocabulary (competence), and experience social connections with peers and teachers (relatedness), they are more likely to remain engaged. Flashcards can support these motivational factors by providing pupils with a sense of achievement through progress tracking, a structured learning environment to build competence, and collaborative opportunities to strengthen social bonds (Dörnyei & Ushioda, 2021).

1.9.2. Flashcards as Tools to Increase Learner Engagement

Learner engagement is an important factor in successful vocabulary acquisition, and flashcards have been widely recognized as an effective tool for enhancing learner engagement in language learning. Engagement in learning is often classified into behavioral, emotional, and cognitive engagement (Fredricks, Blumenfeld, and Paris, 2004). Flashcards, when designed and implemented effectively, make vocabulary learning more interactive, enjoyable, and motivating for pupils.

Behavioral engagement refers to pupils' active participation in learning tasks. Flashcards encourage repeated exposure and interaction, as learners regularly review, categorize, and test themselves on vocabulary. Electronic flashcard applications, such as Wordwall, Quizziz, or Quizlet, further increase engagement by incorporating adaptive learning techniques that adjust the level of difficulty based on student performance (Nation, 2013).

Emotional engagement refers to the learner's attitude and enthusiasm for learning vocabulary. Traditional vocabulary exercises can often seem monotonous, but flashcards add an element of variety and playfulness that can make learning more enjoyable. Studies have shown that pupils who use visually appealing flashcards with pictures, colors, or animations demonstrate higher levels of enthusiasm and interest in learning new words (Mayer, 2014).

Cognitive engagement refers to the depth of processing that Pupils apply to learning tasks. Flashcards promote active recall, which is known to enhance memorization by requiring learners to gather information rather than passively recognize it (Karpicke & Roediger, 2008). Additionally, spaced repetition systems (SRS), incorporated into many digital flashcards, optimize learning by presenting words at strategic intervals to enhance long-term retention.

Integrating interactive and gamified elements into digital flashcards further increases engagement by incorporating rewards, competition, and progress tracking, which can motivate pupils to persist in their learning efforts. In the classroom setting, flashcards can be used in peer activities, quizzes, and collaborative games, not only reinforcing vocabulary learning but also building a sense of community and collaboration among learners (Ellis, 2020).

1.9.3. Gamified Approaches to Flashcard Activities

Gamification, defined as the application of game-like elements in non-game contexts (Deterding, Dixon, Khaled, and Nacke, 2011), has attracted considerable attention in educational research as an effective means of

increasing learner motivation and engagement. In the context of vocabulary acquisition, integrating gamification elements into flashcard activities enhances pupils' learning experiences by promoting motivation, encouraging active participation, and reinforcing retention.

A key gamification feature in flashcard learning is point-based reinforcement, in which pupils earn points for correctly recalling vocabulary. These systems tap into extrinsic motivation, as learners strive to accumulate points or unlock new levels, making vocabulary acquisition a more structured and goal-oriented process (Deci and Ryan, 2000). Digital flashcard applications such as Quizlet and Quizziz incorporate sequences, leaderboards, and achievement badges, encouraging learners to engage in continuous and repeated practice (Abramovich, Schunn, & Higashi, 2013).

Another effective gamification method is competition-based learning, in which pupils participate in flashcard-based challenges, individually or in groups. Research shows that friendly competition can enhance vocabulary retention, as learners feel a sense of urgency and excitement, which contributes to better focus and cognitive processing (Burguillo, 2010). Classroom activities such as "flashcard races" or "group vocabulary quizzes" utilize the competitive aspect of learning while promoting collaboration and social interaction (Gee, 2003).

Furthermore, narrative-based gamification can turn flashcard learning into an engaging storytelling experience. Some digital platforms allow pupils to progress through the storyline by correctly answering vocabulary flashcards, making the learning process more immersive. Studies have shown that contextual learning, in which vocabulary is integrated into a meaningful scenario, significantly enhances retention and recall (Sailer, Hense, Mayr & Mandl, 2017).

Using reward and feedback mechanisms in flashcards games also plays an important role in maintaining learner motivation. Immediate feedback in

the form of positive reinforcement, such as digital badges or messages of encouragement, helps pupils stay focused while correcting errors in real time (Kim, 2015). Research has shown that providing adaptive challenges, in which the level of difficulty is adjusted based on the learner's progress, helps pupils maintain their optimal zone of proximal development, preventing both boredom and frustration (Vygotsky, 1978).

1.9.4. Addressing Learner Anxiety Through Interactive Flashcards

Learner anxiety is a significant barrier to language acquisition, especially among young learners, as it affects confidence, motivation, and overall performance (Horwitz, Horwitz, & Cope, 1986). Research on second language acquisition suggests that high levels of anxiety can interfere with vocabulary retention and retrieval, making it necessary to incorporate instructional strategies that create a low-stress learning environment (MacIntyre & Gardner, 1994). Interactive flashcards, especially those that incorporate recording, pronunciation, and interaction features along with peer collaboration and multisensory engagement, have been identified as effective tools for reducing language learning anxiety.

One way that interactive flashcards help reduce anxiety is through self-paced learning. Application platforms such as Quizziz and Quizlet allow learners to progress at their own pace, reducing the pressure and fear of making mistakes in front of their peers (Godwin-Jones, 2017). Self-paced learning with flashcards also provides immediate corrective feedback, allowing pupils to identify and correct errors without fear of public embarrassment (Ellis, 2009).

The multisensory engagement of flashcard-based learning contributes to reduced anxiety levels. Flashcards incorporate images, sounds, and animations that cater to a variety of learning styles, making vocabulary acquisition more engaging and less intimidating (Mayer, 2010). Studies have shown that visual aids and audio-enhanced flashcards help learners associate

words with meaning more effectively, thereby improving confidence in recalling words (Paivio, 1990). Additionally, interactive features such as drag-and-drop matching, fill-in-the-blank exercises, and spaced repetition algorithms reduce cognitive load, allowing learners to process and retain information more effectively (Nation, 2013).

Another anxiety-reducing strategy is collaborative flashcard activities, in which pupils work in pairs or small groups to reinforce vocabulary learning. Peer-supportive learning environments promote social support, allowing pupils to learn from each other while reducing the fear of negative evaluation (Dörnyei, 2006). Classroom activities such as flashcard word games, memory jigsaw puzzles, and storytelling exercises encourage communication and interaction in a fun, stress-free environment, helping pupils develop confidence in using their newly acquired vocabulary.

Furthermore, gamifying flashcard activities has been shown to reduce stress by shifting the focus from performance assessment to interactive learning (Sailer, Hense, Mayr, & Mandl, 2017). Elements such as progress tracking, points-based incentives, and adaptive difficulty levels provide learners with a sense of accomplishment, reducing anxiety associated with traditional assessment methods (Deci & Ryan, 2000). Digital flashcard applications often incorporate adaptive learning algorithms that adjust content based on individual proficiency levels, ensuring that learners are challenged without feeling overwhelmed (Karpicke & Roediger, 2008).

Finally, the positive reinforcement techniques embedded in flashcard-based learning play an important role in reducing learner anxiety. Incentive messages, virtual rewards, and teacher-led motivational support contribute to a more confidence-increasing learning environment. Research shows that learners who receive positive feedback and encouragement are more likely to persist in learning vocabulary because they develop more positive attitudes toward language learning (Oxford, 1990).

1.10. Conceptual Framework

According to the current study on the effectiveness of flashcards in enhancing vocabulary learning in grade 4 pupils at Hung Long 1 Primary School, based on the main theoretical perspectives related to vocabulary acquisition, cognitive learning, and teaching strategies. The conceptual framework is designed to examine the relationship between teaching methods such as: traditional teaching methods, traditional flashcards (paper flashcards) and electronic flashcards in order to base on their effects on pupils' vocabulary learning outcomes, focusing on both short-term acquisition and long-term retention. This study identified flashcards, both traditional flashcards and electronic flashcards as independent variables, while the dependent variables included vocabulary acquisition, vocabulary retention, and engagement of 4th graders at Hung Long 1 Primary School. In addition, the study identified cognitive processing, learning preferences, learning environments, and interactivity of learning tools as mediating variables affecting the effectiveness of flashcards, pupils' level of application and retention, and teachers' teaching strategies and methods as moderating variables that may affect learning outcomes.

The conceptual framework is based on several learning theories that have been established during the study. Paivio's (1990) dual coding theory of information suggests that the combination of verbal and visual elements enhances learning, making flashcards an effective and valuable tool for memorizing vocabulary. Sweller's (1988) cognitive load theory emphasizes the reduction of unnecessary cognitive load during learning to support the use of structured flashcards that simplify information processing. Piaget's (2005) constructivist learning theory emphasizes the importance of active learning and student participation, which is consistent with the interactive nature of flashcards. Furthermore, Ebbinghaus's (1885) theory of Spaced Repetition and

Retrieval provides a solid foundation for the effectiveness of flashcards in strengthening vocabulary retention through repeated exposure.

The relationship between these factors can be conceptualized as follows: instructional methods (flashcards and traditional teaching methods) influence pupils' cognitive processing and engagement, which in turn influence vocabulary acquisition and retention. Moderating factors such as student proficiency and classroom conditions may further shape the results. This conceptual framework provides a structured basis for analyzing the role of flashcards in vocabulary learning, integrating cognitive learning theories and empirical evidence. It serves as a guiding framework for research design and data analysis, ensuring a comprehensive understanding of how flashcards enhance vocabulary learning in primary school pupils.

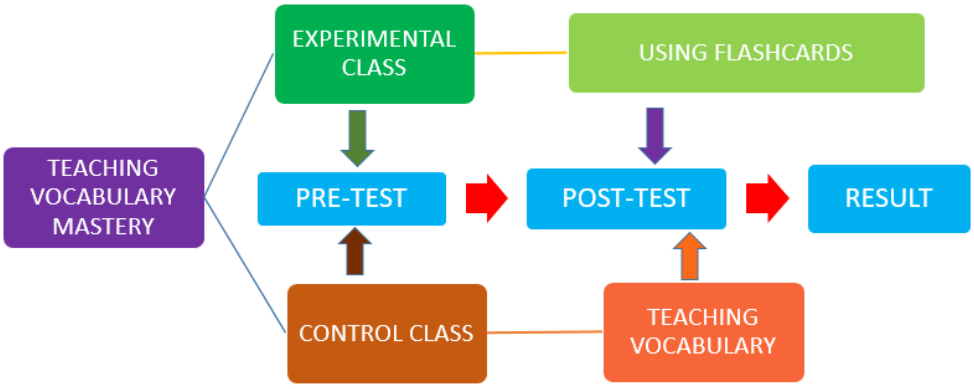


Figure 1.1.Conceptual framework

Educational researchers apply a variety of instructional techniques to help pupils learn English vocabulary more fluently and successfully. Specifically, they use traditional flashcards and electronic flashcards to help pupils learn more vocabulary. In one design, the conceptual framework can be explained as follows: The conceptual framework for this study revolves around comparing the effectiveness of teaching vocabulary fluency using flashcards in an experimental class versus a control class. The experimental

class underwent pre-intervention assessments, participated in flashcard vocabulary learning, and then underwent post-test assessments.

This process involved comprehensive data collection and analysis, using a combination of quantitative and qualitative methods. During this process, the instructional design focused on the use of flashcards to learn vocabulary. The control class, which was not exposed to flashcards, followed the same pre-test and post-test structure. The results from both classes were then analyzed to assess the impact of flashcards on vocabulary mastery, providing insight into the effectiveness of the instructional approach.

Finally, the output aimed to understand the impact of flashcards on vocabulary learning, highlighting both positive and negative aspects. This framework provides a structured approach to evaluating the effectiveness of instructional design and technology integration in enhancing pupils' vocabulary acquisition.

CHAPTER 2: METHODOLOGY

2.1. Research Design

2.1.1 Overview of Qualitative and Quantitative Approaches

In the study, the researcher used an exploratory design to examine the competing effects of flashcards in teaching fourth-grade vocabulary at Hung Long Primary School, which used a mixed methods approach. This system included both quantitative and qualitative exploration strategies that were not included in other methodological options related to measuring the use of flashcards in vocabulary acquisition. The mixed systems study combines the strengths of qualitative and quantitative data to more fully answer the proposed question. The quantitative system will include both pre-and post-tests to measure the effects of flashcards on vocabulary comprehension. This perspective is consistent with Nation's (2001) distinction that, of course, only statistical evidence is important in evaluating educational interventions. Statistical analyses will explore differences in vocabulary acquisition and retention when flashcards are used compared to traditional vocabulary instruction in the study.

In the research process, the study not only relied on statistical data but also took into account the results of interviews with both pupils and teachers. An example of interviews and similar adherence is to provide some context and meaning behind the numbers. According to Creswell (2017), qualitative exploration is often used as an illustrative tool to understand perspectives or explore deeper perspectives on educational processes. Another illustrative example of flashcards in practice used the system to understand the teaching and memorization abilities of teachers and pupils, providing insight into how

flashcards are conceptualized and implemented from within the learning and practice environment.

Furthermore, the choice of a mixed-style design is based on recent findings in education (e.g. Tashakkori & Teddlie 1998) that suggest that it is possible to apply a quantitative-qualitative approach to experimental interventions. This method allows for a comprehensive evaluation of the effectiveness of flashcards because it addresses quantitative issues and prerequisites that must be met. Therefore, this study will provide a comprehensive study based on the combination of all these methods to explore the impact of flashcards on vocabulary memorization at Hung Long 1 Primary School as well as gain a deeper understanding of how pupils perceive and use tools such as flashcards in the learning process.

2.1.2 Justification for the Chosen Research Design

In the research process, the researchers used both qualitative and quantitative methods to address issues related to research methods to improve vocabulary memorization for the fourth graders. The researchers used qualitative research to delve into experiences, perceptions, and behaviors in specific contexts. This is considered one of the useful methods to understand how the fourth graders at Hung Long 1 Primary School use flashcards to learn and memorize vocabulary. It includes techniques such as interviews, classroom observations, and focus group discussions to collect detailed information about learning motivation in the classroom and how pupils interact with flashcards.

In contrast, quantitative research focuses on objective measurement and statistical analysis to identify patterns and trends. This method evaluates the effectiveness of strategies in studying the effects of flashcards on English vocabulary learning. For example, pre- and post-tests can show improvements

in vocabulary retention after implementing a flashcard-based teaching method. Structured surveys assess student satisfaction and engagement, while statistical tools compare different teaching methods and their impact on vocabulary learning.

By combining these methods, we achieve a comprehensive analysis of the problem. Qualitative data provide depth, while quantitative data provide broad applicability and evidence-based validation. This mixed-method approach ensures a comprehensive perspective, helping us identify effective solutions to improve English vocabulary learning in 4th graders. It strengthens the reliability and validity of our findings and addresses the multifaceted nature of the research problem. At Hung Long 1 Primary School, this dual approach is essential to developing strategies that are appropriate to pupils' needs, interests, and educational goals.

2.2. Participants

In the study, the sample will include 100 the fourth graders, in which 45 boy – pupils and 55 girl – pupils, and two experienced teachers of English, along with two experienced teachers from Hung Long 1 Primary School. All participants are volunteers in the study. The target population includes the fourth graders with different vocabulary and word memory abilities. This stage is important because the initial vocabulary knowledge acquired during this stage will largely determine their future academic achievement in school and their level of language proficiency (Biemiller, 2006). In this study, teachers were provided with a list of words to include in vocabulary teaching techniques (flashcards) and how the lessons could be connected to additional vocabulary lessons. Their views are significant in discerning the feasibility and potential effectiveness of an intervention.

In addition, research samples were used, especially in the type of sample that selects the suitability of participants with a particular criterion related to the research purpose (Cohen et al. 2018). This study will select mostly 4th-grade pupils who are attending the targeted classes at Hung Long Primary School. This ensures that the sample is representative of what the average school population might be, and therefore, the research results will have different possible results on the demonstration of the effectiveness of flashcards on their level of memorization.

Furthermore, to make the research results highly reliable and authentic, the study also targets teachers who have experience teaching English and have enough experience with the rules and methods of teaching for 4th-grade programs. The research process is based on the consent from the teachers to use flashcards and report on their use. This was done specifically to obtain some naturalistic examples of flashcard use in educational contexts.

Currently, in the research process, the research samples were only partially drawn from pupils and teachers to use a purposive sampling method to collect data applicable to Hung Long 1 Primary School. This methodological approach to the use of flashcards will allow the research to generate in-depth and context-specific findings on how word annotation features have a potential role in improving vocabulary learning in this age group in relation to 4th graders.

2.3. Research Instrument

For this study on the impact of flashcards in teaching English vocabulary to the fourth graders at Hung Long 1 Primary School, we will use a mixed methods approach to collect rich data on both the intervention (impact) and the participants' findings. The primary measures include

standardized vocabulary tests, teacher and student questionnaires, and classroom observations.

Pupils will take standardized vocabulary tests that are used to measure the learning effects of flashcards. These tests will serve as pre- and post-tests to measure pupils' vocabulary knowledge before and after the intervention. However, standardized tests have been shown to be valid for assessing educational impact (Nation 2001). The tests will be receptive and written tests as well as effective vocabulary tasks to comprehensively assess pupils' vocabulary growth.

Procedure — Qualitative data in this study will be collected through the use of questionnaires that will also be distributed to both Pupils and teachers. A student questionnaire will be prepared to measure pupils' views of flashcards and their elements in terms of acceptance, performance, and overall learning. In this section, we are influenced (Liu et al.2020) to view assessment as an investigation of learners' beliefs beyond T-L activities. The teacher questionnaire will assess the content of flashcards and their integration into instructional activities, the challenges encountered in integrating them, and the perceived benefits. This instrument is necessary to provide a real-life experience of using flashcards from an instructional perspective (Creswell, 2017).

In the future, classroom observations will complement our quantitative and qualitative data, providing us with real-time insights into how teachers implement flashcards with pupils. To measure the use of flashcards in lessons, behaviors used to promote student engagement and observations of other classroom dynamics will be used. This practice is consistent with the views of Tashakkori and Teddlie (2010), who view observational data as an important source for studying educational practices. Observers will follow a structured

observation checklist to assist in recording all behaviors and interactions while maintaining consistency across the data.

To make the study credible, these tools will provide a comprehensive assessment of flashcard vocabulary instruction by pairing quantitative measures of learning outcomes with qualitative data about student and teacher experiences. This study uses these tools to provide a detailed description of the potential effectiveness and impact of flashcards on fourth-grade language learners at Hung Long 1 Primary School.

2.4. Data Collection Analysis

2.4.1. Pre-test

The pretest phase of the data collection process played an important role in ensuring the validity of the research instruments used in this study. Conducted prior to the main data collection process, the pretest aimed to identify potential issues related to the clarity and comprehensibility of the assessment instruments. By administering the pretest to a small group of participants with similar characteristics to the target population, this phase allowed for necessary adjustments to be made before comprehensive data collection.

The pretest involved 100 fourth-grade pupils, including 45 boys and 55 girls, who participated in a receptive vocabulary assessment prior to the flashcard intervention. Participants were selected based on similarity in age, proficiency level, and learning environment. The assessment included a vocabulary test to measure the ability to recognize and recall target words.

Pretest data analysis focused on refining the assessment tools to ensure their appropriateness for the target age group. Expert review and student feedback were combined to improve the clarity and effectiveness of the

vocabulary test. Experts in the field of language education assessed the appropriateness of the test items, ensuring they were aligned with the study objectives. Additionally, student feedback was analyzed to identify ambiguity or difficulty in understanding specific items, leading to necessary revisions.

Findings from the pretest revealed that some test items needed to be reworded to better match the comprehension level of the pupils. Additionally, some minor adjustments were made to ensure that the level of difficulty was appropriate for all pupils participating in the study. These improvements contributed to improved accuracy and efficiency of data collection in the main study.

2.4.2. Post-test

The post-test phase of data collection was conducted after the intervention to assess the impact of using flashcards on pupils' vocabulary learning. The flashcard post-intervention test was intended to assess changes in pupils' vocabulary knowledge after the period of instruction.

A group of 100 primary school pupils (45 boys and 55 girls) who had participated in the pre-test completed the post-test assessment under similar conditions. The vocabulary test administered during this phase was identical to the pre-test, ensuring consistency in measurement and allowing for reliable comparisons of pre- and post-intervention performance.

The post-test data analysis focused on examining pupils' vocabulary learning based on their test responses. The results were used to evaluate the effectiveness of flashcards in facilitating vocabulary learning by determining the differences in performance between the pre- and post-test. Additionally, patterns in student responses were analyzed to determine the impact of instructional methods on various aspects of vocabulary learning.

2.4.3. Questionnaires

The questionnaire used in this study was designed to collect detailed information about pupils' experiences and perceptions of the effectiveness of flashcards in vocabulary learning. The questionnaire was intended to complement the quantitative data collected from the pre- and post-test assessments by providing a qualitative perspective on pupils' engagement, motivation, and perceived effectiveness of the teaching method.

The questionnaire was administered to the same group of fourth-grade Pupils who had participated in the vocabulary tests. The questionnaire consisted of a series of structured questions focusing on key aspects of vocabulary learning, such as ease of word recognition, recall effectiveness and overall learning experience. The questionnaire was designed to be age- and level-appropriate, ensuring that pupils were able to understand and respond accurately to each item. To facilitate responses, a five-point Likert scale was used, allowing pupils to indicate their level of agreement with various statements related to vocabulary learning.

Analysis of the questionnaire responses provided valuable qualitative data that complemented the test results. Patterns in student responses were examined to identify common themes related to their engagement with flashcards, their perceived benefits, and any challenges they encountered while learning with either traditional or electronic flashcards. These insights contribute to a more comprehensive understanding of the role of flashcards in vocabulary acquisition and provide informed recommendations for future teaching practices.

The questionnaire also provided a deeper understanding of pupils' attitudes toward visual learning aids, as well as their preferences for different vocabulary learning methods. By identifying the factors that contribute to

student motivation and engagement, the study was able to highlight effective teaching strategies that can be applied in primary English education. In addition, the questionnaire results helped to explore pupils' confidence in learning new words and their perceptions of the usefulness of flashcards and electronic flashcards in addition to classroom instruction.

By incorporating a questionnaire into the data collection process, the study ensured a more comprehensive assessment of the effectiveness of flashcards in primary English education. The qualitative findings, combined with the quantitative test results, provided a comprehensive view of the impact of visual learning tools on vocabulary development. These combined methods allowed for a thorough investigation of pupils' learning experiences and supported the study's objectives of enhancing vocabulary instruction in primary schools.

2.4.4. Interviews

The interview phase of data collection was designed to gather in-depth information about pupils' and teachers' experiences and perceptions regarding the use of flashcards in vocabulary learning. This qualitative approach was intended to complement the findings from the pre-test, post-test, and questionnaire by capturing both pupils' and teachers' reflections on the instructional approach.

A sample of pupils from the main study group was selected to participate in semi-structured interviews. The selection criteria ensured a representative sample, reflecting diverse learning experiences and different levels of vocabulary acquisition. The student interview questions were designed to explore pupils' engagement with flashcards, perceived benefits, challenges encountered, and overall learning experiences.

In addition to the student interviews, teachers implementing flashcard-based vocabulary instruction were also interviewed. These interviews aimed to understand their views on the effectiveness of flashcards in enhancing vocabulary acquisition, their observations of pupils' reactions to the method, and any pedagogical challenges they encountered.

During the interviews, pupils were encouraged to express their thoughts freely while the interviewer facilitated the discussion using open-ended questions. The interactive nature of the interviews allowed for deeper exploration of pupils' perspectives, providing insights that quantitative methods could not fully capture. Similarly, teachers were asked to elaborate on their teaching strategies, adjustments made during implementation, and assessments of student progress.

Analysis of the interview data included identifying recurring themes and patterns in both student and teacher responses. Key areas of focus included pupils' attitudes toward flashcards as a learning tool, their perceived effectiveness in improving vocabulary recall and recognition, and any difficulties they encountered during learning. For teachers, the analysis examined their views on the role of flashcards in vocabulary instruction, the benefits observed in student learning, and recommendations for optimizing flashcard implementation.

By incorporating interviews with both pupils and teachers into the data collection process, the study provided a more comprehensive view of the impact of flashcards on vocabulary learning. The insights gained from these interviews complemented the quantitative data and provided informed recommendations for enhancing vocabulary instruction activities for primary school pupils.

2.5. Data Analysis Method

2.5.1. Quantitative Analysis Method

The quantitative data analysis in this study aimed to evaluate the impact of flashcard use on pupils' vocabulary acquisition through statistical methods. The data collected from the pre- and post-tests were systematically processed to ensure accuracy and reliability. Prior to analysis, the raw data underwent a thorough cleaning process, which included identifying and resolving missing values, detecting potential outliers, and ensuring consistency in recorded responses. This step was essential to maintain the integrity of the data set and avoid misinterpretation of the findings.

Descriptive statistics were used to provide a general summary of pupils' vocabulary performance. Key measures such as mean score, standard deviation, and frequency distribution were calculated to describe the central tendency and dispersion of the data. These statistical measures allow for a comprehensive understanding of pupils' vocabulary knowledge before and after the intervention, providing insight into general patterns of learning progress. Visualizing the data using tables and graphs further explains trends in student performance over time.

To assess whether the differences in vocabulary acquisition between the pre- and post-tests were statistically significant, we conducted a paired-sample t-test. This test was chosen because it is particularly effective in determining whether the observed improvements in pupils' vocabulary scores were due to the instructional intervention or due to random variation. The results of the paired-sample t-test provide empirical evidence of whether flashcards had a significant impact on pupils' vocabulary learning outcomes. Furthermore, to strengthen the analysis, effect sizes were calculated using Cohen's d, which quantifies the magnitude of improvement. Larger effect

sizes would indicate a stronger effect of flashcard-based instruction on vocabulary memorization and recall.

In addition to measuring general improvements, the study analyzed specific aspects of vocabulary learning, such as word recognition and recall accuracy. This was done by categorizing test items into different levels of difficulty and assessing whether pupils showed more significant improvement on easier or more difficult vocabulary items. Differential analyses provided additional insight into how flashcards affect different cognitive processes involved in vocabulary acquisition.

Reliability analyses were conducted to ensure that the assessment instruments used in the pre- and post-tests yielded consistent and reliable results. Internal consistency was tested by calculating Cronbach's alpha, a statistical measure of the reliability of test items. Higher Cronbach's alpha values would indicate that the vocabulary test items were measuring the same underlying construct with a high degree of consistency. Additionally, item-total correlation analysis was conducted to identify any weak test items that may not be contributing effectively to the measurement of vocabulary acquisition.

To validate the quantitative findings, a triangulation approach was adopted, integrating the questionnaire and interview data with statistical results. This methodological integration provided a more comprehensive understanding of pupils' experiences with flashcard-based vocabulary learning. While the quantitative data indicated measurable improvements, the qualitative insights helped contextualize pupils' perceptions and engagement, ensuring that the findings were not only statistically significant but also pedagogically meaningful.

Furthermore, inferential statistical techniques were considered to explore potential correlations between pupils' background variables (such as prior English proficiency) and their level of vocabulary growth. By conducting regression analysis, the study examined whether external factors influenced pupils' vocabulary learning outcomes. This additional layer of analysis contributed to a more nuanced interpretation of the quantitative results, allowing for a deeper understanding of the conditions under which flashcards are most effective.

Through this rigorous quantitative analytical framework, this study sought to provide empirical evidence of the effectiveness of flashcards as a vocabulary instruction tool in primary English education. By using a combination of descriptive and inferential statistical methods, reliability assessment, and data triangulation, the study ensured that its findings were both statistically robust and practically relevant for educational applications.

2.5.2. Qualitative Data Analysis

Qualitative data analysis aimed to explore pupils' and teachers' perceptions, experiences, and attitudes towards the use of flashcards in vocabulary learning. Data were obtained from pupils' open-ended questionnaire responses and semi-structured interviews conducted with both Pupils and teachers. These sources provided valuable insights into the effectiveness of flashcards, student engagement, and challenges encountered during learning.

Thematic analysis was used to examine the qualitative data, ensuring that emerging patterns and key themes were systematically identified. The first step in the analysis process involved familiar rising with the data, where interview transcripts were transcribed verbatim and open-ended questionnaire responses were carefully reviewed. This initial stage allowed for a

comprehensive understanding of the data and facilitated the identification of recurring ideas.

After familiarizing themselves with the data, open coding was conducted, in which meaningful segments of the data were labeled with codes that captured their essence. These codes represented various aspects of pupils' learning experiences, such as their engagement with flashcards, perceived effectiveness of the method, and any difficulties encountered in memorizing vocabulary. Through an iterative process, these codes were grouped into broader categories, resulting in the identification of key themes that reflected common experiences and perspectives.

A prominent theme that emerged from the analysis was pupils' engagement and motivation in learning vocabulary through flashcards. Many pupils expressed that the visual appeal and interactive nature of flashcards made learning more fun and engaging. Some described how repeated exposure to words through flashcards helped to consolidate their memory, while others highlighted the ease with which words could be associated with images. However, differences in engagement were noted, with some pupils finding the method less effective when dealing with abstract vocabulary or complex word meanings.

Another major theme was the perceived benefits of flashcards in vocabulary acquisition. Pupils often reported improvements in word recognition and recall, attributing their improvement to the structured and repetitive nature of using flashcards. Teachers also observed increased engagement and enthusiasm in pupils during vocabulary lessons, particularly when flashcards were incorporated into interactive activities. Despite these benefits, some pupils reported difficulties with long-term retention, suggesting that flashcards alone may not be sufficient for deeper vocabulary learning.

Challenges in using flashcards also emerged as an important theme. Some pupils found it difficult to remember words that did not have clear visual representations. Others reported that relying solely on flashcards to learn vocabulary resulted in passive memorization rather than meaningful comprehension. Teachers echoed these concerns, emphasizing the need for diverse instructional strategies to complement the use of flashcards. They suggested that integrating flashcards with contextual learning activities, storytelling, and sentence construction exercises could enhance pupils' ability to apply newly learned vocabulary to real-world contexts.

To ensure the credibility of the qualitative findings, triangulation was conducted by comparing student and teacher responses to identify consistent themes. In addition, a comparative analysis was conducted to examine variations in views based on factors such as age, language proficiency, and previous exposure to flashcard-based learning. The qualitative data provided a nuanced understanding of how flashcards influence pupils' vocabulary acquisition, highlighting both their strengths and limitations.

The final stage of the analysis involved synthesizing the themes into a coherent narrative that aligned with the study's research objectives. The findings provide valuable insights into the role of flashcards in vocabulary learning and provide informed recommendations for optimizing their use in primary English education. By systematically analyzing the views of pupils and teachers, the study contributed to a deeper understanding of effective vocabulary instruction and the importance of incorporating a variety of learning strategies to support language development.

2.5.3. Reliability and Validity Method

Ensuring the reliability and validity of data is fundamental in conducting rigorous research, as it ensures the accuracy, consistency, and

trustworthiness of the findings. In this study, a variety of strategies were used to enhance both the reliability and validity of the data collected from both quantitative and qualitative sources. Since the study included pre-tests, post-tests, questionnaires, and interviews, it was essential to employ systematic procedures to minimize bias, enhance measurement accuracy, and ensure that the findings accurately reflect the experiences of pupils and teachers regarding the use of flashcards in vocabulary learning.

Reliability in research refers to the consistency and stability of measurement results across different occasions and contexts. To enhance the reliability of the quantitative data, a pilot test was conducted prior to the main study to ensure that the pre-test, post-test, and questionnaire items were clear, unambiguous, and appropriately structured for primary school pupils. The internal consistency of the questionnaire was measured using Cronbach's alpha, which assesses the degree of association between items within each construct. A Cronbach's alpha value ≥ 0.8 indicates strong internal reliability, ensuring that the questionnaire reliably measures pupils' perceptions of the use of flashcards. Furthermore, test-retest reliability was tested by administering the same test to a small group of pupils at two different times. Results were compared to determine the stability of the assessment instruments over time, ensuring that changes in performance were due to learning progression rather than inconsistencies in test design. In addition to quantitative measures, reliability was also maintained in the collection and analysis of qualitative data. To enhance the reliability of the interview findings, a structured interview protocol was developed, ensuring that all participants received similar questions in a consistent manner. Interviews were recorded and transcribed verbatim to avoid misinterpretation of responses. Furthermore, an inter-coder reliability test was conducted, in which multiple researchers independently coded segments of the qualitative data and compared their coding results. This process ensured that the identified themes were not

influenced by personal biases and truly reflected the experiences of pupils and teachers.

Validity in research refers to the extent to which an instrument measures what it is intended to measure and whether the findings accurately reflect reality. In this study, content validity was established by consulting with language teaching experts and primary school educators to ensure that the items in the questionnaire and test materials were consistent with the research objectives. Their feedback was used to refine the wording of the items, eliminate ambiguous questions, and ensure that the instruments comprehensively covered key aspects of vocabulary learning through flashcards. Additionally, construct validity was assessed by analyzing the factor structure of the questionnaire to ensure that each set of items accurately represented the intended constructs, such as engagement, efficacy, and challenges associated with using flashcards.

To enhance the validity of the qualitative data, multiple data sources were compared to verify consistency and ensure reliability. Data collected from different methods, including questionnaires, interviews, and observation notes, were cross-checked to confirm the consistency of the findings. This approach helped to verify the consistency of the findings across multiple methods, reducing the risk of bias and enhancing the trustworthiness of the study. Additionally, member checking was conducted, in which selected participants were asked to review the interview transcripts and preliminary findings to confirm that their responses were recorded and interpreted accurately. This process ensured that the qualitative analysis remained faithful to the participants' perspectives and minimized the possibility of misinterpretation by the researcher.

External validity, or the generalizability of the findings, was also considered in this study. While the study focused on a specific primary school context, efforts were made to ensure that the findings were applicable to similar educational contexts. The participant selection process was carefully designed to include pupils with different proficiency levels and learning backgrounds, providing a more representative sample of primary school learners. Additionally, the study's data collection procedures and methods were transparently documented to allow for replication in future studies, further enhancing the reliability and validity of the findings.

2.6. Ethical Considerations

Ethical considerations are central to conducting research involving human participants, ensuring that their rights, well-being, and privacy are protected throughout the research process. This study, which examined the use of flashcards in vocabulary learning in primary school pupils, adhered to strict ethical guidelines to maintain integrity and accountability. The study focused on key ethical principles, including voluntary participation, informed consent, confidentiality, data protection, and minimization of potential harm.

A fundamental ethical aspect of this study was obtaining informed consent from all participants. Prior to data collection, pupils were provided with a clear and age-appropriate explanation of the purpose, procedures, and expected outcomes of the study. They were informed that participation was completely voluntary and that they could withdraw from participation at any time without facing any negative consequences. As the study involved young learners, special care was taken to ensure that pupils fully understood their participation and that participation was based on their willingness to contribute and not any form of coercion or obligation.

Confidentiality was strictly maintained, although their information was recorded on the questionnaire, their information was kept confidential due to the nature of the study, which involved direct interactions with participants via the questionnaire. While participant names were recorded, all data collected was treated with strict confidentiality, ensuring that personal information was not disclosed outside the research team. The study followed responsible data management practices by securely storing responses and restricting access to authorized individuals. The data collected was used for research purposes only and no personally identifiable information was included in any published reports or shared findings.

Minimizing potential harm to participants was another important ethical priority. The study was designed to create a comfortable and supportive environment for pupils, ensuring that no coercion, discomfort, or pressure was placed on them during the study. The questionnaire was carefully constructed to include neutral and non-intrusive questions, preventing any form of psychological or emotional discomfort. Pupils participating in the study were encouraged to respond freely without fear of judgment or consequences. Additionally, the study ensured that no academic pressure was placed on pupils based on their responses and that all participants were treated with respect regardless of their vocabulary performance.

Transparency and fairness were maintained throughout the study. All participants were given equal opportunities to contribute to the study, ensuring that no group was favored over another. Data collection was conducted in a fair manner and no external factors influenced participants' responses. To prevent researcher bias, interactions with Pupils were neutral and no leading questions were used that could direct pupils to specific responses.

The integrity and trustworthiness of the study was enhanced through careful and objective analysis of the data. The study adhered to academic and ethical standards by ensuring that findings were reported accurately and without manipulation. Ethical considerations also extended to the dissemination of results, where confidentiality was maintained despite non-anonymous participation. Findings were shared responsibly with relevant educational stakeholders, such as teachers and school administrators, to contribute to improved pedagogy without invading individual privacy.

Cultural sensitivity was also considered an essential ethical aspect of the study. As participants came from diverse educational backgrounds, care was taken to ensure that the research procedures were inclusive and did not inadvertently disadvantage any pupils. The questionnaire and interactions were designed to be culturally appropriate and accessible to all pupils.

Prior to commencing the study, we sought ethical approval from relevant academic and institutional bodies. This approval process ensured that all research procedures were consistent with established ethical guidelines for conducting research involving children in educational settings. The study design, data collection methods, and participant protections were carefully reviewed to confirm that ethical standards were met.

CHAPTER 3: RESULTS AND DISCUSSIONS

3.1. Pupils' Initial Memory Capacity and Challenges Before The Flashcard Intervention

3.1.1. Pre-test

To verify whether the score distribution followed a normal pattern, the study used the preliminary scores of the Experimental Group (EG) and Control Group (CG) which were examined and visually depicted through a (Q-Q) Plot. Figure 3.1 illustrates that the data points for both groups align with a straight line, indicating a normal distribution of scores.

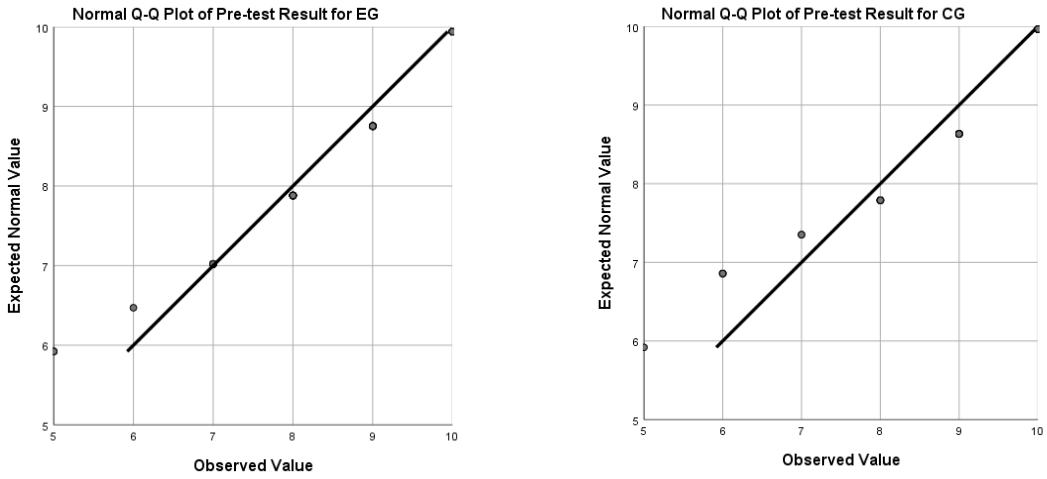


Figure 3.2.Normal Q-Q plots for pretest_EG and pretest_CG

The pre-test scores in EG and CG are given in Table 3.1. The experimental group, consisting of 50 participants, exhibited a mean pre-test score of 8.0800 (SD= 1.53649, SEM= 0.21729). In contrast, the control group also 50 participants, displayed a mean pre-tets score of 8.1600 (SD=1.39401, SEM=0.19714)

Table 3.1. Pre-test scores of EG and CG

Group Statistics

	CLASS	N	Mean	Std. Deviation	Std. Error Mean
Pre_test_results	Experimental class	50	8.0800	1.53649	.21729
	Control class	50	8.1600	1.39401	.19714

Comparing the mean pre-test scores between the two groups, it is clear that the control group started with a higher mean score of 8.1600, while the experimental group had a slightly lower mean pre-test score of 8.0800. This suggests that, on average, participants in the control group started the study with higher performance levels than those in the experimental group.

The standard deviations of both groups were relatively close, with the control group showing a value of 1.39401 and the experimental group showing a slightly higher standard deviation of 1.53649. This suggests a similar amount of variation or dispersion of scores around the mean within each group.

When looking at the standard error of the mean, we see relatively low values for both groups: 0.19714 for the control group and 0.21729 for the experimental group. A low standard error indicates a precise estimate of the sample mean, suggesting that these means are likely to be close to the true population mean.

Therefore, the control group started with a higher average pretest score than the experimental group. The standard deviation and standard error indicate a reasonable degree of variability and precision in estimating the population mean for

both groups. Independent samples t-tests were conducted to compare the pretest scores between the control and experimental groups in Table 3.2.

Table 3.2. Pre-test results of Independent Sample T-Test

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Pre_test_results	Equal variances assumed	.422	.517	-1.977	98	.051	-.58000	.29340	-1.16224	.00224
	Equal variances not assumed			-1.977	97.086	.051	-.58000	.29340	-1.16230	.00230

Examining the independent samples test results, Levene's Test for Equality of Variances shows an F-value of 0.422 with a significance value of 0.517. Since the significance value is greater than 0.05, the assumption of equal variances is met. Consequently, the analysis proceeds with the row for "Equal variances assumed."

The t-test reveals a t-value of -1.977 with 98 degrees of freedom (df) and a significance value of 0.051. While this p-value is slightly above the conventional threshold of 0.05, it suggests a marginal difference in the pre-test scores between the two groups. The mean difference is -0.5800, indicating that the experimental group had a lower average score compared to the control group. The 95% confidence interval for the mean difference ranges from -1.16224 to 0.00224, which includes zero, further supporting the lack of a statistically significant difference between the groups.

The standard error of the mean difference is 0.29340, indicating a moderate level of precision in estimating the difference between group means. Overall, while the control group demonstrated a slightly higher mean pre-test score than the experimental group, this difference is not statistically significant at the 0.05

level, suggesting comparable baseline performance levels between the two groups.

3.2. Pupils' Initial Memory Capacity and Challenges After The Flashcard Intervention

3.2.1. Post-test

Similar to the pre-test assessment, a normality test was employed to analyze the distribution of post-test scores for both the CG and EG in Figure 3.2. The Q-Q Plot results indicated that the data from each group formed a straight line. Consequently, it was concluded that the post-test scores for both groups exhibit a normal distribution.

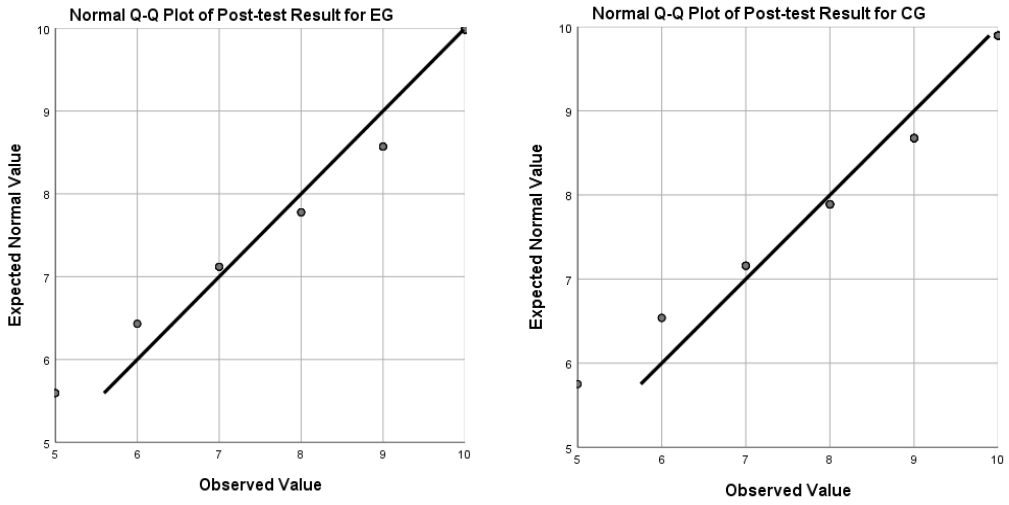


Figure 3.3. Normal Q-Q plots for Post-test_EG and Post-test_CG

The mean score indicates the central tendency of the data. In the post-test, Table 3.3 showed that the "Control" group had a higher mean post-test score (8.8200) compared to the "Experimental " group (8.1000). This suggests that, on average, participants in the Control group performed better in the pre-test.

Table 3.3. Post-test scores of EG and CG

Group Statistics

	CLASS	N	Mean	Std. Deviation	Std. Error Mean
Post_test_results	Experimental class	50	8.4000	1.70533	.24117
	Control class	50	8.8200	1.32002	.18668

The table illustrates the descriptive statistics for the posttest results in the experimental and control groups. The average score for the experimental group was 8.1000, while the control group had a slightly higher average score of 8.8200, suggesting that participants in the control group outperformed those in the experimental group on average.

The standard deviation reflects the variation in scores within each group. The experimental group had a higher standard deviation of 1.70533 compared to 1.32002 in the control group, indicating greater variation in performance in the experimental group. This indicates a wider distribution of posttest scores in the experimental group.

The standard error of the mean, which estimates how much the sample mean is expected to deviate from the true population mean, was smaller in the control group (0.18668) than in the experimental group (0.24117). This difference shows slightly higher accuracy in estimating the mean value of the control group compared to the experimental group.

Tabel 3.4 Post-test results of Independent Sample T-Test

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Post_test_results	Equal variances assumed	4.565	.035	-2.361	98	.020	-.72000	.30498	-1.32522	-.11478
	Equal variances not assumed			-2.361	92.207	.020	-.72000	.30498	-1.32570	-.11430

The t-statistic is -2.361 with 98 degrees of freedom under the assumption of equal variances. Additionally, when equal variances are not

assumed, the t-statistic remains the same (-2.361), but the degrees of freedom are adjusted to 92.207. The associated two-tailed p-value is 0.020, which is below the 0.05 threshold for statistical significance.

Levene's Test for Equality of Variances has an F-statistic of 4.565 with a significance value (Sig.) of 0.035, indicating that the assumption of equal variances is violated as the p-value is below 0.05. Therefore, the results for the row "Equal variances not assumed" should be interpreted.

The mean difference between the groups is -0.72000, with a standard error of 0.30498. The 95% confidence interval for the mean difference ranges from -1.32570 to -0.11430. Since this confidence interval does not include zero, it suggests that there is a statistically significant difference in post-test scores between the two groups.

3.3. Questionaire

3.3.1. The Effectiveness and Engagement Level of Flashcards

The reliability of the questionnaire and the structure related to the effectiveness and engagement of flashcards compared to traditional vocabulary teaching methods are shown in Table 3.5.

Table 3.5. Reliability of the questionnaire and construct

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.831	.832	6

The reliability of the questionnaire and the constructs related to the effectiveness and engagement in vocabulary learning of 4th grade pupils are shown in the table.

The Cronbach's Alpha value of 0.831 indicates a high level of internal consistency between the items, indicating that the questionnaire is reliable in assessing the proposed solutions. This shows that the items measure the same underlying concept related to the effectiveness and engagement of flashcards in vocabulary learning.

Furthermore, this reliability supports the validity of the questionnaire in capturing pupils' views on its effectiveness and engagement. It ensures that the findings can provide meaningful insights into strategies to enhance English vocabulary learning at the primary level.

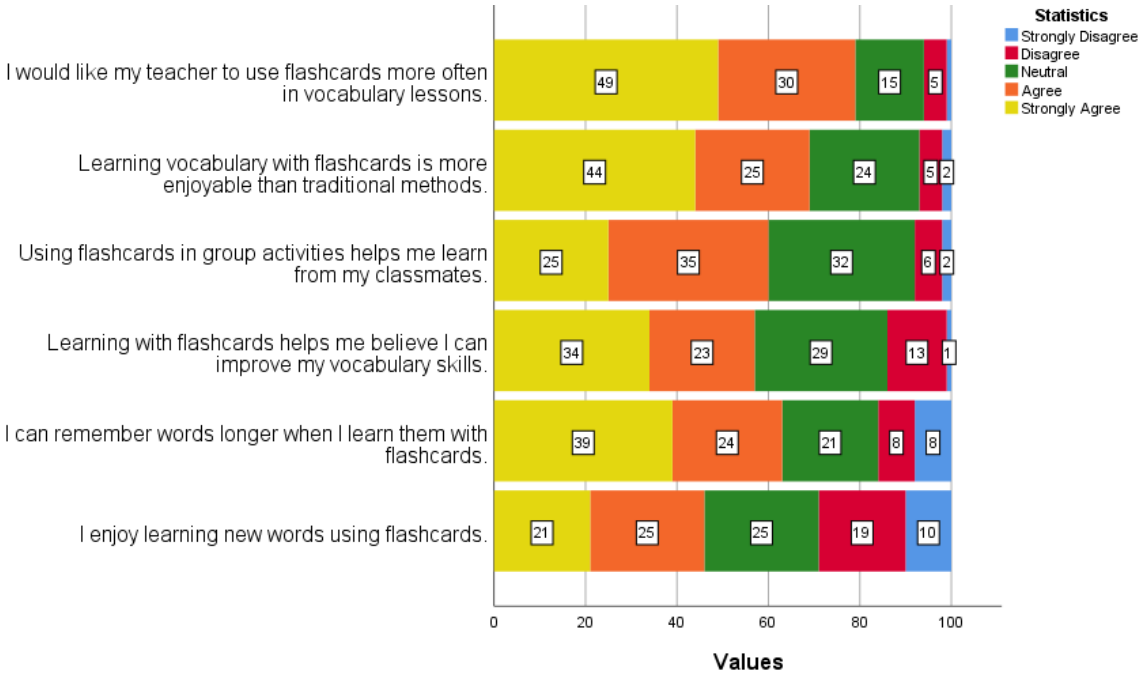


Figure 3.4. The effectiveness and engagement level of flashcards

The majority of respondents, with 49% agreeing and 15% strongly agreeing, expressed a desire for their teachers to use flashcards more often in

vocabulary lessons. This suggests that pupils find flashcards beneficial and would like them to be incorporated more often in their learning.

A significant proportion of respondents, with 44% agreeing and 24% strongly agreeing, believe that learning vocabulary using flashcards is more enjoyable than traditional methods. This suggests that flashcards contribute to a more engaging and interactive learning experience than conventional vocabulary teaching methods.

A significant proportion of respondents, with 32% agreeing and 6% strongly agreeing, said that using flashcards in group activities helps them learn from their classmates. However, 35% remained neutral, suggesting that while many pupils see value in collaborative learning using flashcards, some may not find it effective or may need additional support.

In terms of improving vocabulary, 29% of respondents agreed and 13% strongly agreed that learning with flashcards helped them believe they could improve their vocabulary skills. With 34% remaining neutral, this suggests that while a large number of pupils found flashcards useful, others may need additional encouragement or other approaches to build their confidence in acquiring vocabulary.

In terms of memorization, 39% of respondents agreed and 8% strongly agreed that they could remember words longer when learning them with flashcards. However, 24% remained neutral, implying that while flashcards aid some people's memorization, others may need additional reinforcement strategies.

Finally, 25% of respondents agreed and 10% strongly agreed that they prefer to learn new words using flashcards. With 25% remaining neutral and 10% disagreeing, this suggests that while flashcards are generally well received, some pupils may have different preferences for vocabulary learning methods.

3.3.2. Effectiveness of Electronic Flashcards in Improving Vocabulary Acquisition.

The reliability of the questionnaire and constructs related to the effectiveness of electronic flashcards in improving English vocabulary learning are shown in Table 3.6.

Table 3.6. Reliability of the questionnaire and construct

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.855	.853	6

The reliability of the questionnaire and constructs related to the effectiveness and engagement of flashcards for the fourth graders is shown in the table.

The Cronbach's alpha value of 0.855 indicates a high level of internal consistency between the items, indicating that the questionnaire is reliable in assessing the proposed solutions. This suggests that the items measure the same underlying concepts related to the effectiveness and engagement of flashcards for the fourth graders.

Furthermore, this reliability supports the validity of the questionnaire in capturing pupils' views on the proposed engagement levels. It ensures that the findings can provide meaningful insights into strategies to enhance vocabulary memorization for primary school pupils.

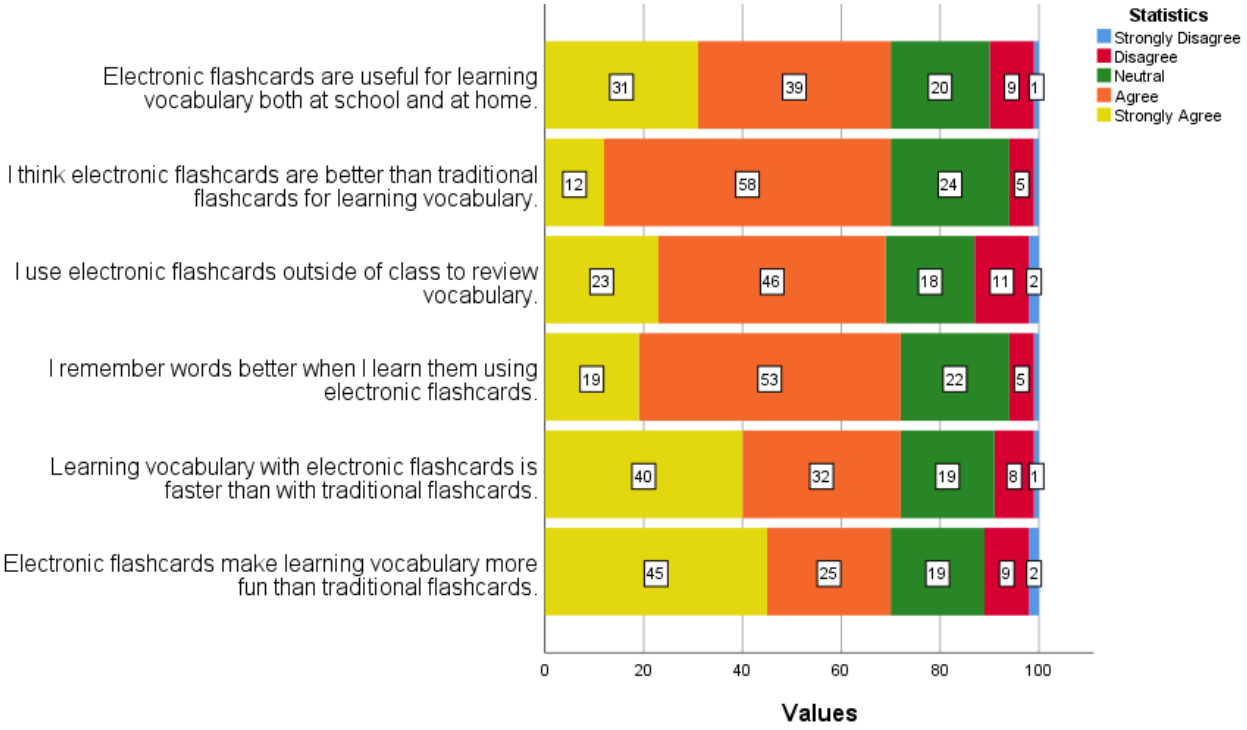


Figure 3.5. Effectiveness of electronic flashcards

The majority of respondents, with 39% agreeing and 20% strongly agreeing, said that e-flashcards are useful for learning vocabulary both at school and at home. This suggests that digital tools play a supportive role in vocabulary acquisition both inside and outside the classroom.

A significant proportion of respondents, with 58% agreeing and 24% strongly agreeing, believe that e-flashcards are better than traditional flashcards for learning vocabulary. This suggests that many pupils prefer digital methods over traditional methods for learning vocabulary.

A significant proportion of respondents, with 46% agreeing and 18% strongly agreeing, use electronic flashcards outside the classroom to review vocabulary. However, 23% disagreed, stating that while many pupils find digital flashcards useful, others may not engage with them outside of school.

In terms of vocabulary retention, 53% agreed and 22% strongly agreed that they remembered words better when using electronic flashcards. This highlights the effectiveness of digital flashcards in supporting long-term vocabulary retention.

When it comes to learning speed, 40% agreed and 32% were neutral that learning vocabulary using electronic flashcards was faster than traditional flashcards. This shows that while a large number of pupils consider digital flashcards to be a more effective tool, some are still uncertain about their advantages over traditional methods.

Finally, 45% of respondents agreed and 25% were neutral, while 19% strongly agreed that electronic flashcards make learning vocabulary more fun than traditional flashcards. This indicates that digital tools contribute positively to pupils' engagement and interest in vocabulary learning.

3.4. Interviews

To assess the impact of flashcards on vocabulary learning, we conducted structured interviews with pupils from both the experimental group (EG) and the control group (CG), as well as two teachers at Hung Long 1 Primary School. The interviews focused on assessing the effectiveness and interactivity of flashcards in vocabulary instruction and exploring pupils' and teachers' perspectives on their use in the classroom.

3.4.1. Effectiveness and interactivity of flashcards

Some pupils in the experimental group (EG) expressed enthusiasm for this learning method. One student commented, "I like using flashcards because they help me remember words more easily, especially when there are pictures." Another student said, "Playing vocabulary games with flashcards makes learning fun and I don't feel like I'm just memorizing words." These

responses suggest that flashcards enhance vocabulary acquisition by engaging pupils in interactive learning activities.

Several Pupils in the EG also highlighted the benefits of group activities involving flashcards. One student explained, “I like using flashcards with my friends because we can test each other and this helps me remember words better.” Another student said, “When I play a flashcard puzzle, I feel like I learn faster than just reading words from a book.” These insights suggest that flashcards not only support individual learning but also encourage collaborative learning, making vocabulary practice more engaging.

However, some pupils pointed out challenges when using flashcards. One student shared, “Sometimes I remember words when I see a flashcard, but then I forget them if I don’t practice them.” Another student commented, “I like flashcards, but I also want to learn new words through songs and videos to make learning more fun.” These comments suggest that while flashcards are effective for short-term retention, additional reinforcement strategies are needed for long-term vocabulary acquisition.

Pupils in the control group (CG), who learned vocabulary using the traditional method without flashcards, gave mixed responses. One student said, “Learning vocabulary from books is sometimes boring because we just read and write the words.” Another student commented, “I find it hard to remember words when we just copy them into our notebooks.” These responses highlight the limitations of traditional vocabulary teaching methods in maintaining pupils’ interest and retention.

Despite these challenges, some pupils in the CG reported that writing exercises helped them memorize words. One student commented, “Writing words over and over again helps me remember them, but it takes a long time and can be tiring.” Another student said, “I like reading stories to learn new

words, but I think using pictures is also helpful." These views suggest that while some pupils benefit from traditional methods, incorporating visual aids such as flashcards can further enhance vocabulary learning.

Teachers also acknowledged the effectiveness of flashcards in improving vocabulary retention and student engagement. One teacher commented, "Pupils in the experimental group seemed more motivated and interested in learning new words than those in the control group." Another teacher shared, "Flashcards help pupils focus on key vocabulary and reinforce knowledge through repetition and interaction." These responses suggest that flashcards contribute to a more dynamic and engaging learning environment.

However, teachers also pointed out challenges in using flashcards regularly. One teacher mentioned: "Preparing flashcards is time-consuming, especially for multiple units, so it is helpful to have ready-made materials." Another teacher emphasized the importance of variety in teaching methods, stating: "Flashcards are very effective, but they should be combined with other activities such as storytelling or tools such as electronic flashcards to support different learning styles."

3.4.2. Effectiveness of e-flashcards in improving vocabulary acquisition

Pupils in the experimental group (EG), who used e-flashcards to learn vocabulary, expressed enthusiasm about their experience. Many pupils found the digital flashcards engaging and helpful in memorizing new words. One student shared, "I like e-flashcards because they have pictures and sounds that help me understand the words better." Another student noted, "When I see the word and hear its pronunciation at the same time, I can remember the word more easily and develop my pronunciation skills." These responses suggest

that the combination of visual and auditory elements in e-flashcards enhances vocabulary acquisition.

Some pupils also highlighted the interactive features of digital flashcards. One student explained, “I like using e-flashcards because they have quizzes and games that make learning more fun.” Another student added, “Sometimes I practice at home using my phone, which helps me review words before class.” These insights suggest that e-flashcards provide opportunities for independent learning and reinforcement outside of the classroom.

However, some pupils in the EG pointed to challenges with using e-flashcards. One student stated, “I like using them, but sometimes I focus more on the game than on learning the vocabulary.” Another student noted, “Not everyone has a phone or computer at home, so practicing outside of school is more difficult.” These responses highlight potential issues of distraction and accessibility associated with digital learning tools.

Pupils in the control group (CG), who studied vocabulary without e-flashcards, provided mixed feedback about their learning experiences. Some pupils expressed curiosity about digital flashcards, with one saying, “I think it would be easier to learn new words if I could hear them and see the pictures on the screen.” Another student commented, “Sometimes reading from a textbook isn’t very interesting, so using an app might be helpful.” These comments suggest that pupils recognize the potential benefits of technology-assisted learning, even if they have never used digital flashcards themselves.

However, other pupils in the CG preferred more traditional learning methods. One student explained, “I like writing words in my notebook because it helps me remember them better.” Another student shared, “Reading and repeating words in a book works for me, so I don’t think I need an app.” These

views indicate that while digital flashcards can be beneficial, individual pupils' learning preferences vary.

Teachers acknowledged the benefits of e-flashcards in vocabulary instruction. One teacher commented, "Pupils using e-flashcards seem more focused and confident when learning new words." Another teacher noted, "E-flashcards support audio and visuals, which help pupils with pronunciation and understanding." These responses suggest that e-flashcards enhance vocabulary learning by incorporating multimedia elements that support comprehension and retention. Despite these benefits, teachers also pointed to challenges in implementing e-flashcards. One teacher mentioned, "Not all pupils have access to Internet-enabled devices at home, so it can be difficult to ensure equal learning opportunities." Another teacher emphasized the need for balance, stating, "E-flashcards are helpful, but they should be used alongside traditional methods to support different learning styles." These insights highlight the importance of integrating technology with other teaching methods to maximize its effectiveness.

3.5. Discussions

The findings of this study highlight the effectiveness of flashcards in enhancing vocabulary acquisition in primary school pupils. By comparing the pre- and post-test results, it is clear that pupils exposed to flashcards significantly improved their vocabulary recall. The observed improvement is consistent with previous research, which has highlighted that flashcards serve as an effective tool for enhancing word recognition and recall, especially for young learners who benefit from visual and interactive learning strategies (Nation, 2001; Schmitt, 2008).

Furthermore, student perceptions gathered through the evaluation questionnaire revealed a generally positive attitude towards the use of flashcards. Many pupils find flashcards engaging and helpful in associating

words with their meanings, supporting the argument that visual aids enhance cognitive processing and retention (Ellis & Beaton, 1993). This finding suggests that flashcards not only aid vocabulary learning, but also contribute to student motivation by making learning more interactive and enjoyable. Since primary school pupils often struggle with abstract language concepts, the use of flashcards provides a concrete and accessible approach to vocabulary acquisition (Harmer&Thornbury, 2012).

In addition to improving vocabulary learning, the findings of the study suggest that flashcards have the potential to reshape language teaching practices by promoting more student-centered learning. Traditional teaching methods, which often rely on rote memorization and passive learning, can be supplemented or even replaced by interactive approaches such as flashcards (Griffiths, 2003). This shift would support a more dynamic and participatory classroom environment, where pupils actively engage with learning materials rather than passively receiving information.

Furthermore, the study sheds light on the specific learning context at Hung Long 1 Primary School. As noted in the study, pupils at this school have limited opportunities to be exposed to English outside the classroom due to economic constraints and minimal parental involvement in their language learning. This contextual factor highlights the importance of optimizing classroom instruction to maximize vocabulary acquisition. Given the adaptability and effectiveness of flashcards in structured learning environments, they provide a viable strategy to support pupils in such contexts (Webb, 2007).

Although the results show clear benefits, this study has certain limitations. First, the study focused only on vocabulary acquisition and did not explore other language skills such as grammar, pronunciation, or speaking ability. In addition, the study did not take into account the ability to retain

vocabulary long after the learning period. In addition, the study was limited in scope, mainly to 4th grade pupils at Hung Long 1 Primary School, and did not target higher or lower grades on a broader scale. Future research could expand the scope by examining the impact of flashcards on broader language abilities and assessing their effectiveness over an extended period of time (Laufer & Hulstijn, 2001).

CONCLUSION AND SUGGESTION

1. Conclusion

The findings of this study indicate that flashcards play an important role in improving vocabulary acquisition in Grade 4 pupils at Hung Long 1 Primary School. The results from pre- and post-tests showed significant improvements in pupils' vocabulary retention, suggesting that flashcards help pupils memorize through repeated exposure and active recall. The use of visual aids and interactive elements in flashcards supports cognitive processing, allowing pupils to form stronger word associations and memorize vocabulary more effectively.

Pupils' perceptions further highlight the effectiveness of flashcards in vocabulary learning. Through the survey and testing process, many pupils reported that flashcards made their learning more engaging and interesting, increasing their motivation and engagement in classroom activities. The structured and repetitive nature of flashcards allows Pupils to review and consolidate vocabulary in a more dynamic, self-directed way than traditional rote memorization methods.

In addition, educational researchers have observed challenges associated with the use of flashcards. Some pupils have used electronic flashcards that incorporate images and audio to make learning more visual, suggesting that technology-enhanced flashcards may be more beneficial. Furthermore, individual learning differences suggest that while flashcards are effective for many pupils, they may not fully meet the needs of all learners. Adjustments to instructional strategies, including integrating flashcards with other teaching methods, may be necessary to optimize their impact.

The findings of the study provide insights into the role of flashcards as a vocabulary teaching tool in primary education. Their contribution to vocabulary retention and student engagement highlights their potential for wider application in language teaching. Future research could explore how flashcards

can be combined with other learning techniques to enhance long-term vocabulary acquisition and support the diverse needs of learners.

2. Suggestion

The findings of this study highlight the effectiveness of flashcards in improving vocabulary acquisition in primary school pupils. Based on these results, the researchers make several recommendations to enhance the use of flashcards in vocabulary instruction and optimize their benefits for vocabulary learning.

During the process of teaching new words, teachers should incorporate flashcards into daily vocabulary lessons to provide pupils with regular exposure to new words. Combining flashcards with interactive activities like matching games, storytelling, and group exercises can increase student engagement and strengthen vocabulary retention. Furthermore, integrating flashcards into lesson plans in a structured way can help ensure consistent practice and prevent passive learning.

The use of electronic flashcards should be encouraged to supplement traditional paper-based methods. Modern technology platforms that offer interactive features such as audio pronunciation, animation, and adaptive learning schedules can further support vocabulary acquisition. Providing pupils with access to mobile or online flashcard applications can enable self-paced learning outside of the classroom and enhance long-term retention.

Teacher training programs should include effective strategies for using flashcards in vocabulary instruction. Workshops and professional development sessions can equip educators with creative techniques to maximize the benefits of flashcards and integrate them effectively into their teaching activities. Teachers should also be encouraged to adapt flashcard activities to accommodate different learning styles, ensuring that all pupils benefit from their use.

Future research should explore the long-term effects of flashcards on vocabulary memory and their effectiveness at different proficiency levels. Expanding the scope of research to include the impact of flashcards on other language skills such as pronunciation, speaking, and writing could provide a more comprehensive understanding of their role in language learning. Additionally, comparative studies between traditional flashcards and electronic flashcards could provide insights into which approach yields the most significant learning outcomes.

Parental involvement in vocabulary learning should be promoted by encouraging the use of flashcards at home through various supporting applications such as Quizziz, Quizlet, Wordwall, etc. Providing parents with simple instructions on how to support their children's vocabulary practice through flashcards can reinforce learning outside the classroom and contribute to increased vocabulary retention. Schools can work with parents by hosting workshops or sharing recommended flashcard-based activities that enable pupils to actively learn vocabulary at home effectively.

These recommendations are intended to enhance the effectiveness of flashcards in vocabulary instruction, ensuring that they serve as engaging and practical tools for young learners. By combining structured implementation, technology integration, teacher training, further research, and parent support, flashcards can continue to play a valuable role in improving vocabulary acquisition in primary education.

REFERENCES

Aba, L. (2019). Flashcards as A Media in Teaching English Vocabulary. *AL-Lisan: Jurnal Bahasa (e-Journal), 4*(2), 170-179.

Abramovich, S., Schunn, C., & Higashi, R. M. (2013). Are badges useful in education?: It depends upon the type of badge and expertise of learner. *Educational Technology Research and Development, 61*, 217-232.

Asher, J. J. (1993). Learning another language through actions. *(No Title)*.

Baddeley, A. (2019). Working memory and conscious awareness. In *Theories of memory* (pp. 11-28). Psychology Press.

Balsells, A. S. (2005). Task-based language learning and teaching.

Barcroft, J. (2015). Lexical input processing and vocabulary learning.

Basoglu, E. B., & Akdemir, O. (2010). A comparison of undergraduate students' English vocabulary learning: Using mobile phones and flash cards. *Turkish Online Journal of Educational Technology-TOJET, 9*(3), 1-7.

Beck, I. L., McKeown, M. G., & Kucan, L. (2013). *Bringing words to life: Robust vocabulary instruction*. Guilford Press.

Boers, F., Dang, T. C. T., & Strong, B. (2017). Comparing the effectiveness of phrase-focused exercises: A partial replication of Boers, Demecheleer, Coxhead, and Webb (2014). *Language Teaching Research, 21*(3), 362-380.

Burguillo, J. C. (2010). Using game theory and competition-based learning to stimulate student motivation and performance. *Computers & education, 55*(2), 566-575.

Cameron, L. (2001). Teaching languages to young learners. *Cambridge UP*.

Carpenter, S. K., Cepeda, N. J., Rohrer, D., Kang, S. H., & Pashler, H. (2012). Using spacing to enhance diverse forms of learning: Review of recent research and implications for instruction. *Educational Psychology Review*, *24*, 369-378.

Carlisle, J. F. (2010). Effects of instruction in morphological awareness on literacy achievement: An integrative review. *Reading research quarterly*, *45*(4), 464-487.

Cepeda, N. J., Vul, E., Rohrer, D., Wixted, J. T., & Pashler, H. (2008). Spacing effects in learning: A temporal ridgeline of optimal retention. *Psychological science*, *19*(11), 1095-1102.

Clark, J. M., & Paivio, A. (1991). Dual coding theory and education. *Educational psychology review*, *3*, 149-210.

Curcic, M., Andringa, S., & Kuiken, F. (2019). The role of awareness and cognitive aptitudes in L2 predictive language processing. *Language Learning*, *69*, 42-71.

Cobb, T. (2007). Computing the vocabulary demands of L2 reading.

Craik, F. I., & Lockhart, R. S. (1972). Levels of processing: A framework for memory research. *Journal of verbal learning and verbal behavior*, *11*(6), 671-684.

Creswell, J. W., & Creswell, J. D. (2017). *Research design: Qualitative, quantitative, and mixed methods approaches*. Sage publications.

Deterding, S., Dixon, D., Khaled, R., & Nacke, L. (2011, September). From game design elements to gamefulness: defining" gamification". In *Proceedings of*

the 15th international academic MindTrek conference: Envisioning future media environments (pp. 9-15).

Dörnyei, Z., & Ushioda, E. (2021). *Teaching and researching motivation*. Routledge.

Dornyei, Z. (2013). *The psychology of second language acquisition*. Oxford University Press.

Dörnyei, Z. (2006). Individual differences in second language acquisition. *AILA review*, *19*(1), 42-68.

Dunlosky, J., Rawson, K. A., Marsh, E. J., Nathan, M. J., & Willingham, D. T. (2013). Improving students' learning with effective learning techniques: Promising directions from cognitive and educational psychology. *Psychological Science in the Public Interest, 14*(1), 4–58.

Dziuban, C., Graham, C. R., Moskal, P. D., Norberg, A., & Sicilia, N. (2018). Blended learning: the new normal and emerging technologies. *International journal of educational technology in Higher education*, *15*, 1-16.

Ebbinghaus, H. (1885). Über das gedächtnis: untersuchungen zur experimentellen psychologie. *Duncker & Humblot*.

Ebner, M., & Holzinger, A. (2007). Successful implementation of user-centered game based learning in higher education: An example from civil engineering. *Computers & education*, *49*(3), 873-890.

Ellis, N. C., & Beaton, A. (1993). Psycholinguistic determinants of foreign language vocabulary learning. *Language learning*, *43*(4), 559-617.

Ellis, R. (1997). Second language acquisition. *The United States: Oxford*, *98*.

Ellis, R. (2009). Implicit and explicit knowledge in second language learning, testing and teaching. *Multilingual Matters*.

Ellis, R., & Shintani, N. (2013). *Exploring language pedagogy through second language acquisition research*. Routledge.

Ellis, R. (2015). *Understanding second language acquisition 2nd edition*. Oxford university press.

Fredricks, J. A., Blumenfeld, P. C., & Paris, A. H. (2004). School engagement: Potential of the concept, state of the evidence. *Review of educational research*, *74*(1), 59-109.

Folse, K. (2004). Vocabulary myths: Applying second language research to classroom teaching. *Ann arbor, MI: the university of Michigan press*.

Gass, S. M., Behney, J., & Plonsky, L. (2020). *Second language acquisition: An introductory course*. Routledge.

Gee, J. P. (2003). What video games have to teach us about learning and literacy. *Computers in entertainment (CIE)*, *1*(1), 20-20.

Graves, M. F. (2006). *The vocabulary book: Learning and instruction* (2nd ed.). Teachers College Press.

Griffiths, C. (2003). Patterns of language learning strategy use. *System*, *31*(3), 367-383.

Godwin-Jones, R. (2017). Smartphones and language learning.

Harmer, J., & Thornbury, S. (2012). How to teach Vocabulary.

Hennessy, S., Haßler, B., & Hofmann, R. (2015). Challenges and opportunities for teacher professional development in interactive use of technology in African schools. *Technology, pedagogy and education*, *24*(5), 1-28.

Hiebert, E. H., & Kamil, M. L. (2005). *Teaching and learning vocabulary: Bringing research to practice*. Routledge.

Horwitz, E. K., Horwitz, M. B., & Cope, J. (1986). Foreign language classroom anxiety. *The Modern language journal*, *70*(2), 125-132.

Hulstijn, J. H., & Laufer, B. (2001). Some empirical evidence for the involvement load hypothesis in vocabulary acquisition. *Language learning*, *51*(3), 539-558.

Kang, S. H. (2016). Spaced repetition promotes efficient and effective learning: Policy implications for instruction. *Policy Insights from the Behavioral and Brain Sciences*, *3*(1), 12-19.

Kang, S. H., Lindsey, R. V., Mozer, M. C., & Pashler, H. (2014). Retrieval practice over the long term: Should spacing be expanding or equal-interval?. *Psychonomic bulletin & review*, *21*, 1544-1550.

Karpicke, J. D., & Roediger III, H. L. (2008). The critical importance of retrieval for learning. *science*, *319*(5865), 966-968.

Karpicke, J. D., & Bauernschmidt, A. (2011). Spaced retrieval: absolute spacing enhances learning regardless of relative spacing. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *37*(5), 1250.

Karpicke, J. D., & Blunt, J. R. (2011). Retrieval practice produces more learning than elaborative studying with concept mapping. *Science*, *331*(6018), 772-775.

Karpicke, J. D., & Roediger III, H. L. (2008). The critical importance of retrieval for learning. *science*, *319*(5865), 966-968.

Kim, B. (2015). Gamification. *Library Technology Reports*, *51*(2), 10-18.

Kornell, N., & Bjork, R. A. (2008). Learning concepts and categories: Is spacing the "enemy of induction"?. *Psychological science*, *19*(6), 585-592.

Kornell, N., & Bjork, R. A. (2009). A stability bias in human memory: overestimating remembering and underestimating learning. *Journal of experimental psychology: General*, *138*(4), 449.

Kotilainen, L., & Kurhila, S. (2020). Orientation to language learning over time: A case analysis on the repertoire addition of a lexical item. *The Modern Language Journal*, *104*(3), 647-661.

Küpper-Tetzel, C. E., Kapler, I. V., & Wiseheart, M. (2014). Contracting, equal, and expanding learning schedules: The optimal distribution of learning sessions depends on retention interval. *Memory & cognition*, *42*, 729-741.

Laufer, B., & Hulstijn, J. (2001). Incidental vocabulary acquisition in a second language: The construct of task-induced involvement. *Applied linguistics*, *22*(1), 1-26.

Laufer, B., & Goldstein, Z. (2004). Testing vocabulary knowledge: Size, strength, and computer adaptiveness. *Language learning*, *54*(3), 399-436.

Liu, S., & Da, J. (2020). Technology in Chinese language teaching. *The Palgrave Handbook of Chinese Language Studies*, 1-41.

MacIntyre, P. D., & Gardner, R. C. (1994). The subtle effects of language anxiety on cognitive processing in the second language. *Language learning*, *44*(2), 283-305.

Mayer, R. (2022). The future of multimedia learning. *J. Appl. Instr Des*, *10*(423.10349).

Mayer, R. E. (Ed.). (2005). *The Cambridge handbook of multimedia learning*. Cambridge university press.

Mayer, R. E. (2010). Techniques that reduce extraneous cognitive load and manage intrinsic cognitive load during multimedia learning.

Mayer, R. E. (2014). -Based Principles for Designing Multimedia Instruction. *Copyright and Other Legal Notices*, 59.

Mayer, R. E. (2024). The past, present, and future of the cognitive theory of multimedia learning. *Educational Psychology Review*, *36*(1), 8.

Nagy, W., & Townsend, D. (2012). Words as tools: Learning academic vocabulary as language acquisition. *Reading research quarterly*, *47*(1), 91-108.

Nakata, T. (2011). Computer-assisted second language vocabulary learning in a paired-associate paradigm: A critical investigation of flashcard software. *Computer Assisted Language Learning*, *24*(1), 17-38.

Nation, I. S., & Nation, I. S. P. (2001). *Learning vocabulary in another language* (Vol. 10, pp. 126-132). Cambridge: Cambridge university press.

Nation, I. S. P., & Webb, S. (2011). *Researching and analyzing vocabulary*. Heinle Cengage Learning.

Nation, P., & Coxhead, A. (2013). Vocabulary learning and teaching. *The Routledge encyclopedia of second language acquisition*, 682-686.

Nation, P. (2018). Reading a whole book to learn vocabulary. *ITL-International Journal of Applied Linguistics*, *169*(1), 30-43.

Nelson, D. L., Reed, V. S., & Walling, J. R. (1976). Pictorial superiority effect. *Journal of experimental psychology: Human learning and memory*, *2*(5), 523.

Nuryani, N., & Fadloeli, O. (2021). The Utilization of Flash Cards in Teaching English To Young Learners. *PROJECT (Professional Journal of English Education)*, *4*(2), 156-162.

Oxford, R. L. (1990). Language learning strategies: What every teacher should know. *(No Title)*.

Paivio, A. (1990). *Mental representations: A dual coding approach*. Oxford university press.

Paivio, A. (2014). *Mind and its evolution: A dual coding theoretical approach*. Psychology press.

Pavičić Takač, V. (2008). *Vocabulary learning strategies and foreign language acquisition*. Multilingual Matters.

Piaget, J. (2005). *The psychology of intelligence*. Routledge.

Redifer, J. L., Bae, C. L., & Zhao, Q. (2021). Self-efficacy and performance feedback: Impacts on cognitive load during creative thinking. *Learning and Instruction*, *71*, 101395.

Richards, J. C. (2002). *Methodology in language teaching: An anthology of current practice*. Cambridge University Press.

Richards, J. C., & Rodgers, T. S. (2014). *Approaches and methods in language teaching*. Cambridge university press.

Roediger, H. L., & Butler, A. C. (2011). The critical role of retrieval practice in long-term retention. *Trends in cognitive sciences*, *15*(1), 20-27.

Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American psychologist*, *55*(1), 68.

Sadoski, M., & Paivio, A. (2013). *Imagery and text: A dual coding theory of reading and writing*. Routledge.

Saettler, P. (2004). *The evolution of American educational technology*. IAP.

Sagarra, N., & Alba, M. (2006). The key is in the keyword: L2 vocabulary learning methods with beginning learners of Spanish. *The modern language journal*, *90*(2), 228-243.

Sailer, M., Hense, J. U., Mayr, S. K., & Mandl, H. (2017). How gamification motivates: An experimental study of the effects of specific game design elements on psychological need satisfaction. *Computers in human behavior*, *69*, 371-380.

Saputri, N. A., & Prasetyarini, A. (2024). Teaching Vocabulary Using Flashcards in EFL Classroom in Indonesia and Malaysia.

Schmitt, N. (2014). Size and depth of vocabulary knowledge: What the research shows. *Language Learning*, 64(4), 913-951.

Schmitt, N. (2000). *Vocabulary in language teaching*. Cambridge University Press.

Schmitt, N. (2008). Instructed second language vocabulary learning. *Language teaching research*, *12*(3), 329-363.

Schmitt, N. (2010). *Researching vocabulary: A vocabulary research manual*. Springer.

Schmitt, N., & Schmitt, D. (2020). *Vocabulary in language teaching*. Cambridge university press.

Schunk, D. H., & Zimmerman, B. J. (2007). Influencing children's self-efficacy and self-regulation of reading and writing through modeling. *Reading & writing quarterly*, *23*(1), 7-25.

Skinner, B. F. (1957). Verbal behavior. *Appleton-Century-Crofts/INC*.

Skinner, B. F. (1961). The science of learning and the art of teaching.

Snow, C. E. (2010). Academic language and the challenge of reading for learning about science. *science*, *328*(5977), 450-452.

Spada, N., & Lightbown, P. M. (2006). *How languages are learned*. Oxford University Press.

Stahl, S. A., & Nagy, W. E. (2007). *Teaching word meanings*. Routledge.

Sun, Y., & Dong, Q. (2004). An experiment on supporting children's English vocabulary learning in multimedia context. *Computer assisted language learning*, *17*(2), 131-147.

Sweller, J. (1988). load during problem solving: 职 On/earn/ng. *Cognitive Science*, *12*(2).

Sweller, J. (2011). Cognitive load theory and E-learning. In *Artificial Intelligence in Education: 15th International Conference, AIED 2011, Auckland, New Zealand, June 28–July 2011 15* (pp. 5-6). Springer Berlin Heidelberg.

Tahir, S. N. B. M., Manap, M. R., & Ramli, N. F. M. (2023). Strategies Used by Malaysian ESL Primary School Teachers in Vocabulary Teaching. *European Proceedings of Educational Sciences*.

Tashakkori, A. (1998). *Mixed methodology: Combining qualitative and quantitative approaches*. Sage.

Tondeur, J., Van Braak, J., Ertmer, P. A., & Ottenbreit-Leftwich, A. (2017). Understanding the relationship between teachers' pedagogical beliefs and technology use in education: A systematic review of qualitative evidence. *Educational technology research and development*, *65*, 555-575.

Ushioda, E. (Ed.). (2013). *International perspectives on motivation: Language learning and professional challenges*. Springer.

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes* (Vol. 86). Harvard university press.

Webb, S. (2017). *How vocabulary is learned*. Oxford University Press.

Webb, S. A., & Chang, A. C. S. (2012). Second language vocabulary growth. *RELC journal*, *43*(1), 113-126.

Wilkins, D. A. (1972). *Linguistics in language teaching* (Vol. 111). London: Edward Arnold.

APPENDICES

APPENDIX 1. PUPILS' SCORES OF PRE-TEST AND POST-TEST

No	Experimental Group	Pre-tets	Post-test
01	Student 1	9	8
02	Student 2	8	9
03	Student 3	5	6
04	Student 4	6	8
05	Student 5	9	10
06	Student 6	7	9
07	Student 7	7	10
08	Student 8	8	8
09	Student 9	9	10
10	Student 10	10	9
11	Student 11	10	9
12	Student 12	9	7
13	Student 13	8	8
14	Student 14	7	10
15	Student 15	7	10
16	Student 16	10	10
17	Student 17	10	9
18	Student 18	10	8
19	Student 19	8	10
20	Student 20	8	7
21	Student 21	7	7
22	Student 22	6	9

23	Student 23	7	7
24	Student 24	5	5
25	Student 25	6	6
26	Student 26	8	8
27	Student 27	9	9
28	Student 28	10	10
29	Student 29	10	10
30	Student 30	10	10
31	Student 31	5	9
32	Student 32	7	9
33	Student 33	8	10
34	Student 34	10	8
35	Student 35	10	8
36	Student 36	9	8
37	Student 37	8	10
38	Student 38	6	10
39	Student 39	7	10
40	Student 40	8	9
41	Student 41	8	10
42	Student 42	9	8
43	Student 43	10	10
44	Student 44	10	9
45	Student 45	5	7
46	Student 46	7	10
47	Student 47	9	9
48	Student 48	8	10

49	Student 49	10	9
50	Student 50	10	10

APPENDIX 2. SURVEY QUESTIONAIRE

Dear pupils,

We are conducting a study to understand your thoughts and experiences with using flashcards to learn vocabulary at Hung Long 1 Primary School. Your participation is very important as it will help us improve how vocabulary is taught. The questionnaire is designed to gather your feelings and opinions about using flashcards compared to traditional teaching methods.

Please read each statement carefully and choose the response that best describes your opinion or experience. Please tick (✓) the answer that you find most appropriate. And you can choose only **ONE** answer. ***1- Strongly Disagree, 2 -Disagree, 3-Neutral, 4-Agree, 5- Strongly Agree.***

Thank you for your participation!

Part A. Personal information

Full name: …….

Class: ……..

Gender (Male/Female):……

Put a tick (✓) on your answer.

Do you learn vocabulary with flashcards? Yes ☐ No ☐

Have you ever used flashcards or electronic flashcards? Yes ☐ No ☐

Do you think flashcards are effective in learning vocabulary? Yes ☐ No ☐

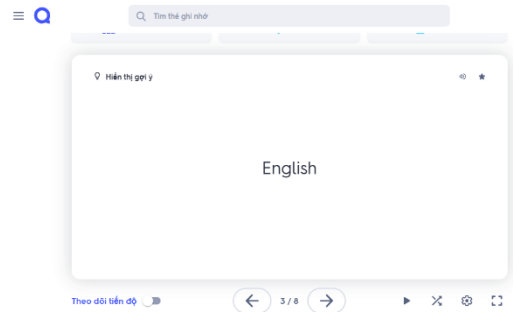
Part B. Questionaire content

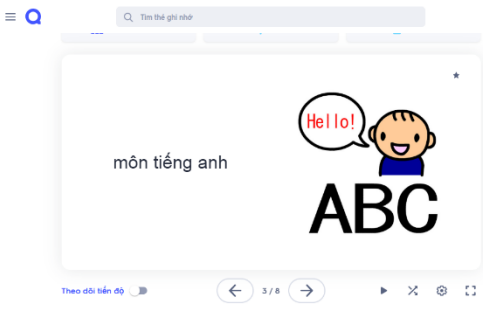
SURVEY QUESTIONAIRES

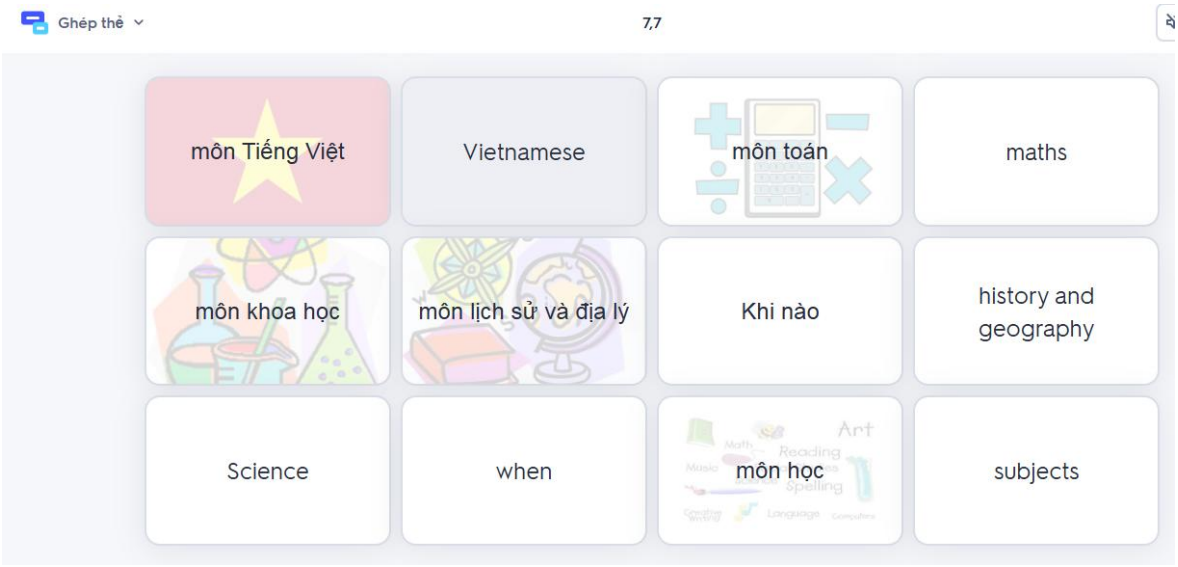
Part I. THE EFFECTIVENESS AND ENGAGEMENT LEVEL OF FLASHCARDS	***Strongly Disagree***	***Disagree***	**Neutral**	**Agree**	**Strongly Agree**
I enjoy learning new words using flashcards.					
I can remember words longer when I learn them with flashcards.					
Learning with flashcards helps me believe I can improve my vocabulary skills.					
Using flashcards in group activities helps me learn from my classmates.					
Learning vocabulary with flashcards is more enjoyable than traditional methods.					
I would like my teacher to use flashcards more often in vocabulary lessons.					
Part II. Effectiveness of Electronic Flashcards in Improving Vocabulary Acquisition.	***Strongly Disagree***	***Disagree***	**Neutral**	**Agree**	**Strongly Agree**

Electronic flashcards make learning vocabulary more fun than traditional flashcards.					
Learning vocabulary with electronic flashcards is faster than with traditional flashcards.					
I remember words better when I learn them using electronic flashcards.					
I use electronic flashcards outside of class to review vocabulary.					
I think electronic flashcards are better than traditional flashcards for learning vocabulary.					
Electronic flashcards are useful for learning vocabulary both at school and at home.					

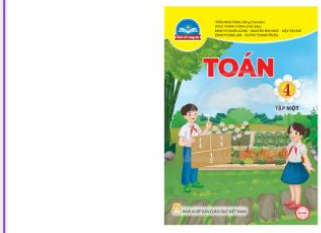
APPENDIX 3. ELECTRONIC FLASHCARDS







APPENDIX 4. TRADITIONAL FLASHCARDS



MATH

ENGLISH

APPENDIX 5. INTERVIEWS

Interview Questions for Pupils

1. How do you feel about learning vocabulary using flashcards? Do you find them enjoyable or helpful?
2. Do you think flashcards help you remember new words better compared to other learning methods? Why or why not?
3. What types of flashcards do you prefer—traditional paper flashcards or digital flashcards? Can you explain why?
4. How often do you review vocabulary with flashcards outside of class? Do you think this practice helps you improve?
5. What challenges do you face when using flashcards to learn new vocabulary? How do you overcome them?
6. If you could improve the way flashcards are used in your lessons, what changes would you suggest?

Interview Questions for Teachers

1. How effective do you think flashcards are in helping pupils learn and retain vocabulary? What improvements have you noticed in pupils?
2. What are the main advantages of using flashcards in vocabulary instruction compared to other teaching methods?
3. What challenges do you face when integrating flashcards into your lessons? How do you address these challenges?
4. Do you prefer using traditional paper flashcards or digital flashcards in your teaching? Why?
5. In your experience, how do pupils respond to learning with flashcards? Do all pupils benefit equally from this method?
6. What recommendations would you make for improving the use of flashcards in English vocabulary instruction?