

INVESTIGATING HOW MULTIMODAL INPUT ENHANCED RETENTION AND RECALL OF VOCABULARY: A CORPUS-BASED STUDY OF EFL SECONDARY-GRADE LEARNERS

Faiza Afzal
faizaafzal690@gmail.com

MPhil Scholar, Department of English language and literature, University of Sahiwal, Punjab, Pakistan.

Ayesha Zubair
ayeshauos20@gmail.com

MPhil Scholar, Department of English language and literature, University of Sahiwal, Punjab, Pakistan.

Muqaddar Zaka
muqadarzaka@gmail.com

MPhil Scholar, Department of English language and literature, University of Sahiwal, Punjab, Pakistan.

Abstract

Vocabulary is central to English as a Foreign Language (EFL) learning, yet retention and recall remain challenging for EFL learners. This study examines the effectiveness of multimodal input in improving the retention and recall of vocabulary among secondary-grade learners, using a corpus-based methodology. A learner corpus was compiled from official secondary-grade English textbook, which informed vocabulary selection and analysis. The research is grounded on Cognitive Theory of Multimedia Learning (CTML), which emphasize dual-channel processing in multimodal environment (Mayer, 2021) and Usage-Based Learning (UBL), which highlights repeated exposure and contextual use as drivers of lexical development (Ellis et al., 2016). It explores how visual, auditory, and kinesthetic modalities contribute to learning outcomes, and identifies the long-term benefits of employing multimodal strategies in vocabulary acquisition. The data collected from 40 learners of secondary-grade learners divided equally into experimental and control group, and then analysis through SPSS Software. Pre-test, post-test, delayed test, and oral recall test was conducted. This research contributes to the understanding of multimodal learning's impact on vocabulary retention, providing insights into learner practices for enhancing language learning in secondary school learners. The result showed that multimodal input significantly enhanced both immediate retention and delayed recall. These results suggest that combining multimodal pedagogy with corpus-informed selection offers a powerful approach to vocabulary learning and teaching.

Keywords: *Corpus Linguistics, CTML, Multimodal Input, Secondary-Grade Learners, UBL, Vocabulary Retention and Recall*

Corresponding Author: Dr. Abrar Hussain Qureshi (HOD, Department of English language and literature, University of Sahiwal, Punjab, Pakistan.)

Email: abrarqureshi@uosahiwal.edu.pk

1. Introduction

Expanding one's vocabulary is key to language learning, especially when studying English as a foreign language (EFL). Building a solid vocabulary foundation is crucial for young learners to acquire fundamental communication skills and cultivate a passion for language learning that lasts a lifetime (Nation, 2001). Not all learners will benefit from traditional vocabulary teaching techniques, such as memorization and rote learning, particularly young EFL learners who have limited exposure to the language outside the classroom (Webb, 2007). Very little can be communicated without an understanding of grammar rules and functions, but nothing can be communicated at all without a vocabulary (Wilkins, 1972). If the vocabulary is used, even in sentences that are not grammatically correct, foreigners, especially young ones, will still understand the context of the message being conveyed. In other words, both teachers and EFL learners are conscious of the unconscious value of vocabulary in language acquisition. "Learners carry around dictionaries and not grammar books." For example, teaching vocabulary aids and directs learners to communicate and comprehend any foreign language like English (Schmitt, 2010).

Simultaneously, corpus linguistics has provided powerful tools for vocabulary learning by identifying frequency, collocation, and authentic usage patterns (Sinclair, 1991). Corpus-based approaches allow teachers to design vocabulary tasks that reflect real-world language use rather than artificial, advanced-level examples (Boulton & Cobb, 2017). Integrating multimodal input with corpus-informed selection of words can therefore create instruction that is both cognitively effective and linguistically authentic.

The four fundamental abilities of language, speaking, listening, reading, and writing, must be prioritized to master any language; two more are grammar and vocabulary. Therefore, employing various efficient methods and resources in EFL instruction to enhance these abilities, particularly vocabulary acquisition for younger learners, is crucial. A substitute of traditional method for improving vocabulary acquisition in young EFL learners is the multisensory teaching approach or VAK (Visual, Auditory, and Kinesthetic). This method aims to engage learners using a range of sensory modalities, such as visual, auditory, and kinesthetic, while acknowledging that learners have distinct learning preferences and styles (Gardner, 1993). Multisensory teaching can support vocabulary learning through various channels by integrating these sensory components into the learning process, enhancing comprehension and retention.

In EFL classes, vocabulary learning presents substantial difficulties that directly impact learners' performance. Many young EFL learners have difficulty with spelling, pronunciation, contextual usage, and vocabulary retention, which hinders their capacity to communicate ideas clearly. Due to a lack of vocabulary, this problem continues from elementary school through university, obstructing formal academic writing. The issue is

made worse by elements like differences between spoken and written English, confounding homophones, and a lack of resources. Cross-linguistic interference and retrieval issues frequently cause learners to lose new words in their long-term memory. To overcome these obstacles, creative teaching methods and materials are needed to improve vocabulary retention and mastery.

Using visual, auditory, and kinesthetic modalities to improve vocabulary acquisition, the multisensory learning approach is very successful in teaching vocabulary to young EFL learners. Multisensory methods, like lip and hand kinesthetic exercises, associate visual cues with different associations (Shams and Seitz, 2008). The Orton Method, which helps learners with processing issues by using the senses of seeing, hearing, and feeling to process information efficiently (Flynn, 2005). Through the use of motor activities, kinesthetic modalities serve as a "glue" to connect information to the brain. This method strengthens neural pathways by integrating language components and their sounds through concurrent visual, auditory, and motor activities. Learning letters, for instance, involves learners tracing, writing, and vocalizing the sound, connecting the symbol and the physical production of the sound. This technique greatly expands vocabulary. This approach is a useful teaching tool for EFL teachers and learners since it greatly improves vocabulary recognition and retention.

Visual aids like flashcards or pictures, for instance, can assist young learner in connecting new words to tangible objects, and the addition of music or movement exercises can enhance the learning experience and help learners remember it (Simmons & Singleton, 2008). Besides the potential advantages of the multisensory teaching approach, more research is required to determine how effective it is in the particular setting of teaching English as a foreign language to young learners and long-term retention. To address this gap, this research explores the impact of multisensory instruction for young EFL learners on vocabulary learning, retention, and general language competency. This study intends to offer important insights into the real-world application of multisensory teaching techniques in the study's EFL classroom by investigating the experiences and viewpoints of learners.

According to certain earlier studies, the multisensory approach, or VAK, plays a critical role in the learning process, particularly about the senses, and as a result, vocabulary acquisition is highly significant and successful. Additionally, EFL young learners rely heavily on their senses to process information and data while they are learning. Young EFL learners benefit from this multisensory approach by developing more cognitive connections, language skills, and vocabulary. Because there are more ways for students to trigger and retrieve the information from their cognitive learning center, it is accessible to them. Since each sense contributes to the development of EFL young learners'

vocabulary, using all of the senses can help students retain information as much as possible.

This study aims to bridge multimodal learning and corpus linguistics in the context of secondary-grade Pakistani learners. It examines whether multimodal input improves vocabulary retention and recall compared to the text-only method, using a corpus of secondary-grade English textbook as the source for word selection and the baseline for learner analysis.

1.1. Statement of Problem

Although learning vocabulary is an essential part of learning English as a foreign language (EFL), traditional vocabulary teaching approaches frequently fall short in terms of effectively involving young learners (Webb, 2007). The varied learning preferences and styles of young EFL learners may not be adequately accommodated by rote memorization and passive learning techniques (Gardner, 1993). Therefore, it is necessary to investigate different strategies that can improve vocabulary learning in this group. By involving learners in a varied sensory modalities, the multisensory teaching approach has demonstrated promise in enhancing vocabulary learning and retention. (Dunn & Dunn, 1993). Research on the precise effect of multisensory instruction on vocabulary learning outcomes for EFL learners is lacking, though. Thus, this study purpose to provide insights that can guide more effective teaching practice in EFL education by examining how multisensory approach enhance vocabulary learning for EFL learners in the EFL classroom and long term retention. Corpus technique used very little researches are on the integration of both multimodal input and corpus linguistics.

2. Literature Review

Words are integral for communication. The heart of language comprehension and use is lexicon (Hunt & Belanger, 2005). Vocabulary leaning is essential for language learners, especially for EFL learners to improve language comprehension, communication, and academic performance. Learners' learning preferences and that how this effect teaching effectiveness in higher education, learning outcomes improve when instructional method aligned with learners' preferences. Flexible and learner-centered teaching methods essential to enhance learners' learning (Murphy et al. (2004). Multimodal language learning methods are necessary to learn language and retain for long-term retention. Many studies highlight the combining effect of multimodal inputs (visual, auditory, and kinesthetic) enhance word recall ability and retention. Multimodal input learning methods significantly impacts learners' cognitive processing of language learning by relying on various sensory channels and cognitive pathways to improve brain's capacity to absorb and retain new information for long time period (Giannakos & Cukurova, 2023). By applying various inputs such as visual (images, flashcards, videos), auditory (sound, song, music, storytelling), and kinesthetic experience (role play, gestures, interactive games),

these all activate multiple regions of the brain to enhance language learning and retention ability of learners (Emerson et al., 2020). This research is grounded in the Cognitive Theory of Multimedia Learning (Mayer, 2021) and the Usage-Based Learning Theory (Ellis et al., 2016).

According to CTML, Multimodal input assumes that presenting vocabulary through more than one mode facilitates deeper processing and better retention. It builds on the promise that learners process information through dual channels: auditory/verbal and visual/pictorial. Human working memory has limited capacity; therefore, instructional materials should be designed to avoid cognitive overload and maxim retention. Applied to vocabulary instruction, CTML suggests that learners remember words more effectively when exposed to multimodal input. This dual coding strengthens memory traces, making recall more reliable. Learners exposed to video-based vocabulary lessons performed significantly better on retention tests than those taught with text alone (Plass & Pawar, 2020). Similarly multimodal glosses (text+audio+image) enhanced both short-term and long-term retention in EFL learners. This advocate the efficient distribution of cognitive load helps learners learn language in chunks (Sweller, 1988). This not only enables learners to learn vocabulary but also enhances learners' listening, speaking, and reading abilities by creating a more engaging educational environment (Gilakjani et al., 2011; Widyaningrum et al., 2022). These findings align with CTML's principle of multimedia effect, which asserts that learners learn more deeply from words and pictures than from words alone.

The usage-based learning theory (Ellis, 2019) posits that language learning is fundamentally shaped by exposure, frequency, and the meaningful use of language. Corpus linguistics, which involves the systematic analysis of authentic language data, has become an influential tool in applied linguistics. In vocabulary instruction, corpora enable teachers and learners to explore how words are used in real context, identify collocation, and examine register difference. Vocabulary knowledge emerges not simply from memorizing lists but from repeated encounters with words in authentic contexts. According to this view, learners gradually abstract patterns from input and form constructions that link form and meaning. The role of data-driven learning (DDL) in vocabulary instruction found that learners who explored concordance lines developed stronger collocational awareness and retained words better than using traditional dictionaries (Lee & Warschauer, 2020)

Learners who face difficulties and challenges in textual information, visual and auditory elements work as cognitive relief to improve their comprehension and memory retention (Sadoski & Paivio, 2013). Visual and auditory have also been proven to enhance the reading productivity of struggling readers (Hibbing & Rankin Erickson, 2003). Multimodal techniques, including images, sound, and physical gestures in combined form,

make learning vocabulary more manageable (Mayer & Morenos, 2010). Kinesthetic activities such as role-playing, tracing letters while vocalizing, and matching words engage motor memory, which acts as “glue” that binds visual and auditory input. Multimodal strategies can improve both short-term and long-term retention by offering more varied cognitive ways for information processing, according to research on vocabulary learning (Paivio, 2014). Visual elements such as images, flashcards, videos, diagrams, and infographics are essential for learners’ better understanding and retention (Behnke, 2016). These activities reduce cognitive load and enhance long-term retention of vocabulary. In practical applications, visual aids such as pictures or videos combined with auditory elements like pronunciation guides and kinesthetic activities such as role-playing have been shown to significantly improve vocabulary learning (Moreno & Mayer, 2007).

Auditory input is used to enhance learners' fluency and accuracy in spoken context. By using songs, rhymes, images, hand-on activities, and role-playing stories to plan a well-balanced language input more causally and naturally, vocabulary is presented in context and chunks (Lundberg, 2007). Auditory input in the form of songs and music in language classrooms helps children practice vocabulary in rhythmic form by having fun (Akcan, 2010). Hearing words helps learners to internalize pronunciation, and stress patterns and foster better retention (Nation, 2001). The musical activities enhanced memory retention, engagement, and word recall in young learners. This make environment friendly and stress free learner’s learn without any stress and cognitive load (Coyle & Gracia, 2014).

Kinesthetic learning involved physical activities. Studies have demonstrated that kinesthetic methods such as Total Physical Response, role-playing improve vocabulary retention (Asher, 1969). EFL learners who engaged in multisensory activities including role-playing and games have improved vocabulary recall as compared to those who exposed only traditional text-based methods. Kinesthetic activities can offer a deeper level of engagement, and auditory input—like hearing word pronunciation or contextual usage—helps with language processing additionally, because the brain processes and stores information through multiple channels, combining these modalities has been demonstrated to improve vocabulary recall (Moreno & Mayer, 2007).

The use of Multimodal input in language learning enhances engagement, foster positive perception and influence learners’ attitudes. In vocabulary learning, multimodal input such as combing images, videos, flashcards, and interactive activities actively engaged learners in learning process (Fredricks et al., 2004). Learners also shows positive perception and attitudes towards multimodal inputs, these techniques are more engaging than traditional methods of vocabulary learning like memorization and word lists. These shows that learners’ feel more confident and less anxious when they are engaging in multimodal activities. Existing studies have explored the individual impact of each sensory modality, there is lack of research how these modalities interact in a combined learning

environment and the long-term effect of multimodal vocabulary instruction on learners. This study aims to fill this gap by investigating the contribution of each modality and exploring the sustained benefits of multimodal learning strategies.

3. Research Methodology

3.1. Research Design

A mixed-method is used to collect data in the form of pre-test, post-test, delayed test, and oral recall test design to investigate how multimodal input enhances vocabulary retention and recall among secondary-grade learners. Survey Questionnaire was used to collect students' perceptions, engagement, and attitudes toward multimodal and traditional learning styles. An experimental approach was used to compare vocabulary retention and recall ability between two groups (Control and experimental). This study takes approximately 8 weeks. The participants were 40 secondary-grade learners from an urban public school. They are divided into two equal groups of 20 students each: control and experimental. Their age ranges from 15 to 17 years. They have similar levels of English language proficiency.

3.2. Corpus Development

A corpus of secondary-grade textbooks has been developed. A list of 20 more frequent words is built to teach learners which repeated in their textbook. The text was digitalized and analyzed using AntConc 3.5 to generate a frequency list and collocation. Target vocabulary was selected based on frequency, relevance, and curriculum objectives.

3.3. Instructional Materials

A list of 50 academic and high-utility words will be selected for instruction, using three criteria. Words will be selected from the British National Corpus (BNC), ensuring they fall within the top 2000 frequency bands (Nation, 2013). They will be drawn from the learners' English text book to ensure curricular alignment. Words that can be easily represented in multimodal form (images, audio, video). Experimental group will be provided with textual Input through written definition and example sentence. Auditory Input provide by Native-speaker pronunciation and audio example. While Visual Input through an image for illustrating meaning. The control group will be taught the same words through textual definitions, L1 (Urdu) translations, and example sentences from the textbook.

3.4. Instruments

Several instruments were used in this experimental study: Vocabulary test which consists of a Pre-test (to assess initial knowledge), an Instruction phase (2-4 weeks period, intervention period), Post-test (5 week, at the end of the instruction phase), Delayed test (after 7 week), and Oral recall test (after 8 weeks).

3.5. Data Collection Procedures

The data was collected from secondary-grade learners. This experimental study was conducted in eight weeks. To assess the initial vocabulary knowledge of learners that they learned during their study, a Pre-test in the form of fill-in-the-blanks and multiple-choice items was administered. 20 items were on the vocabulary test, every item carried 02 marks ($02 \times 20 = 40$). After taking the Pre-test, interventions were applied to both groups (control and experimental). The control group was treated with traditional teaching-learning styles like text-based, rote memorization, and word lists; the experimental group was treated with multisensory input like visual (image, flashcards), auditory (listening to the pronunciation of words), and kinesthetic (role-playing, matching words). This process continued for three weeks along with regular vocabulary classes. To assess learners' vocabulary retention a post-test was conducted that consisted of the same items that were learned during the learning phase. To assess long-term vocabulary retention, a delayed test was conducted 1 week later without any additional words, with the same items that were taught during the intervention. An oral recall test was conducted to measure how well learners recall vocabulary in a spoken context. This study was conducted in the form of a group where each learner had a chance to talk, and based on their accuracy, they were awarded scores. Quantitative data were analyzed by IBM SPSS Statistics version 23.

3.6. Data Analysis

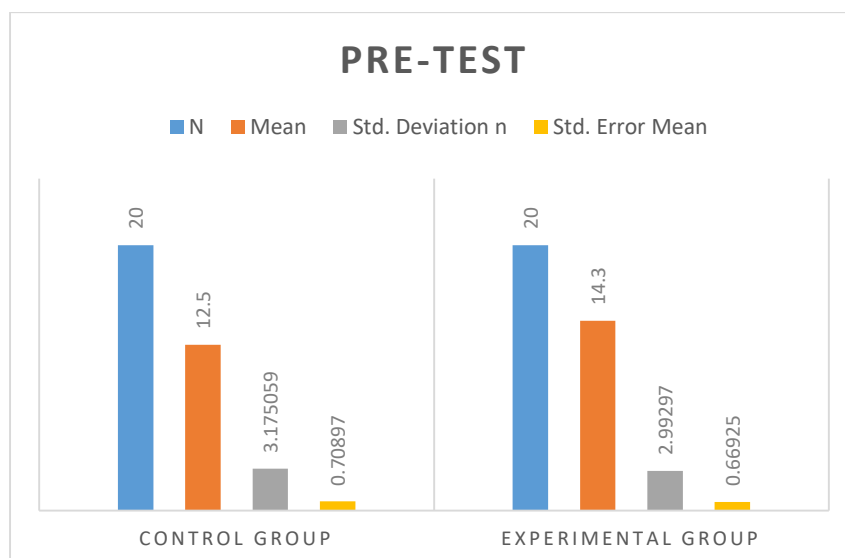
A detailed statistical analysis was conducted to examine the impact of multimodal input on vocabulary retention and recall in secondary-grade learners. The statistical analysis includes comparisons between the multimodal learning group and the traditional learning group in terms of vocabulary retention and recall. The Corpus is used to get data, and the corpus helps to make a list of high-frequency words that are relevant to the learner's level and academic needs.

3.7. Analysis of Vocabulary Retention Pre-test and Post-tests

First, take a vocabulary test from learners to assess their initial knowledge about vocabulary, which is a pre-test before any intervention. And then intervention of multimodal methods for the experimental group and traditional text-based methods for the control group take a test from secondary-grade learners.

1. How does multimodal input (visual, auditory, and kinesthetic) impact the retention of new vocabulary words in secondary-grade learners?

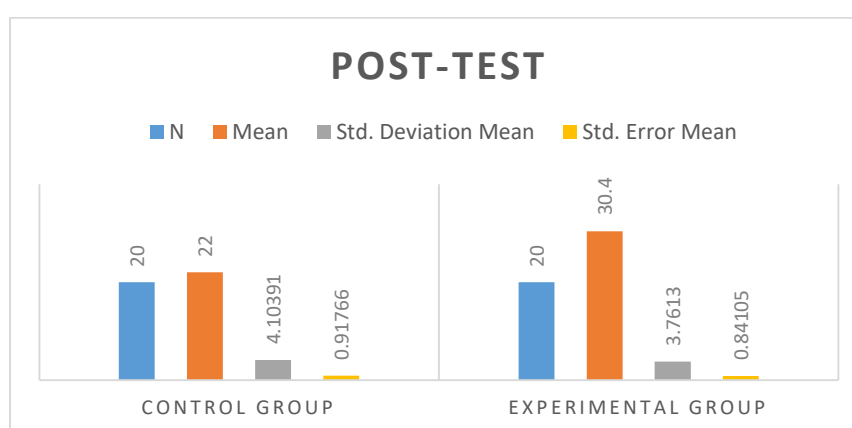
In this part, a t-test was used to see whether the vocabulary scores of the control and experimental groups were significantly different. It was necessary to determine whether the experimental and control groups were equivalent at the beginning of the experiment. Pre-test mean for retention test, Control group: M: 12.50 SD: 3.170 SEM: 0.7089; Experimental group: M: 14.30 SD: 2.992 SEM: 0.6695 which showed no significant difference between control and experimental group.



Graph. 1

Independent sample t-test Statistics showed that with 95% degree of confidence ($p > 0.05$) there existed no significant difference between the control and the experimental group. As a result, both groups were equal in their vocabulary knowledge before to the experiments.

In graph 2, a t-test was used to determine the difference after using intervention (multimodal tools and traditional text-based method). Post-test means for retention test, Control group: M: 22.0 SD: 4.103 SEM: 0.917; Experimental group: M: 30.4 SD: 3.761 SEM: 0.841 showed significant difference between the control and experimental groups.



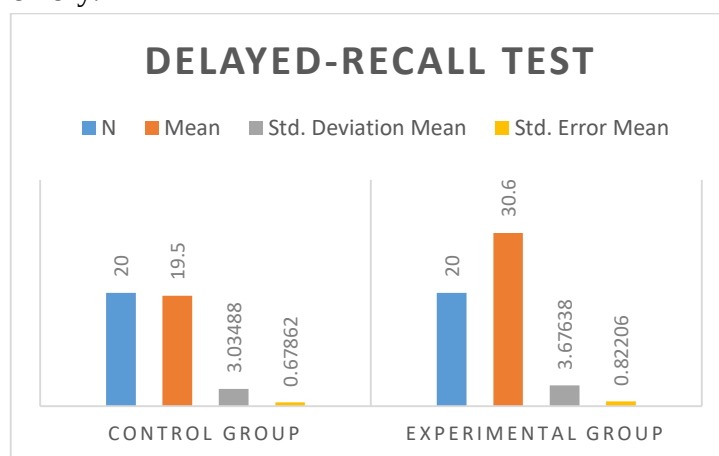
Graph.2

Independent sample t-test Statistics showed that with 95% degree of confidence ($p < 0.05$) there existed significant difference between the control and the experimental group. Result showed that multimodal input impact the retention of new vocabulary as compared to traditional methods. The multimodal group performed significantly better in terms of vocabulary retention, suggesting that the integration of visual, auditory, and kinesthetic input enhances students' ability to retain new vocabulary over time.

3.8. Analysis of Vocabulary Delayed-Recall Test

1. To what extent does the combination of different modalities enhance vocabulary Delayed recall in secondary-grade learners compared to traditional text-based learning methods?

According to graph 3, the average delayed-recall test mean of control group was calculated as 19.50 ± 3.0348 , and the experimental group as 30.60 ± 3.6763 . A large value of difference was seen between means of the control and the experimental groups in the delayed-recall test. This showed that experimental group have significantly higher value than the control group. Experimental group learner recall vocabulary for long time period. This showed that multimodal inputs help brain of learner to overcome cognitive load and store in long-term memory.



Graph 3

The table 1, showed that the delayed-recall scores of the experimental and the control group was statistically significant in favor of the experimental group with a 95% degree of confidence ($p < 0.05$).

Students in the multimodal group out performed those in the traditional group in delayed-recall tasks, demonstrating that multimodal input aids in better vocabulary recall, which may be attributed to the engagement of multiple sensory pathways during learning.

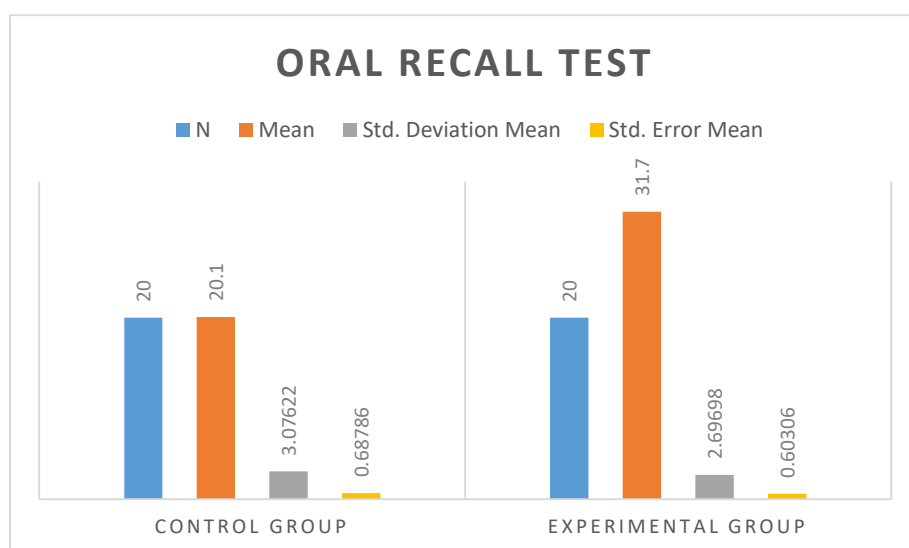
Variance	F	Sig.	T	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
								Lower	Upper
Equal variances assumed	0.38	0.541	-10.413	38	0.000	-11.1	1.06598	-13.25797	-8.94203
Equal variances not assumed			-10.413	36.684	0.000	-11.1	1.06598	-13.26051	-8.93949

Table 1

3.9. Oral recall test

1. Does the use of multimodal input lead to better recall of vocabulary during oral assessments in secondary-grade learners?

This test was conducted to determine oral recall test ability. In this test asked learners to pronounce word, if they pronounced then award them marks. This activity perform in group discussion. This test showed recall ability of learners of both groups. The control group mean was calculated as 20.10 ± 3.0762 , and the experimental group as 31.70 ± 2.6969 . The difference between mean of both groups showed better recall of vocabulary during oral assessment in secondary-grade learners.



Graph 4

The table below showed that the oral-recall scores of the experimental and the control group was statistically significant in favor of the experimental group with a 95% degree of confidence ($p < 0.05$). The Levene's test of equality of variance indicate that the F-significance value is greater than 0.05 hence we will take value of "equal variance assumed". As it is evident from the table that the two tailed significance value is 0.00 which is smaller than 0.05 $t(38)$, C.I -13.4519 to -9.7481 with 95% confidence interval of difference.

Learners in the multimodal group outperformed those in the traditional group in both oral and written recall tasks, demonstrating that multimodal input aids in better vocabulary recall, which may be attributed to the engagement of multiple sensory pathways during learning.

Variance	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
								Lower	Upper
Equal variances assumed	0.095	0.76	-12.68	38	0.000	-11.6	0.91479	-13.4519	-9.7481

Equal variances not assumed			- 12.68	37.361	0.000	-11.6	0.91479	-13.45294	- 9.74706
--------------------------------------	--	--	------------	--------	-------	-------	---------	-----------	--------------

This table show that in the oral-recall test, there is significant difference between both groups control and experimental group. Multimodal intervention helps learners to recall vocabulary words with accurate pronunciation as compared to traditional method in which word list and memorization learning styles is used.

Table 2

3.10. Engagement and Perception

1. How do secondary-grade learners perceive multimodal input regarding engagement and effectiveness in learning new vocabulary?

Questionnaire Survey were conducted to gather qualitative data on learners' perception of their learning experience, including how engaged they felt and which method they found most helpful. Likert-scale question were used to quantify engagement (ranging from 1= "strongly agree" to 5= "strongly disagree". Descriptive statistics were used to analyze the survey responses, and a **chi-square test** was conducted to examine the relationship between learner's engagement and learning methods (multimodal vs traditional).

3.11. Multimodal Group:

85% learners feeling "engaged" or "very engaged" in the vocabulary lesson. 75% of learners said they found the visual aid most helpful in remembering vocabulary. 85% of learners reported that kinesthetic activities helped them to recall vocabulary words better than traditional methods. 75% of learners said that auditory aids helped them to pronounce words accurately. 90% of learners reported that multimodal learning is more engage able than traditional learning methods.

3.12. Traditional Group

50%of learners reported feeling "engaged" or "very engaged". 55% of learners reported that textbook-based lessons were sufficient for learning new vocabulary. 45% said that they were frustrated with the repetitive nature of written exercises.

The **chi-square test** for engagement showed a significant association between the type of methods and learners engagement ($\chi^2 = 10.5$, $p < 0.05$), meaning that learners in the multimodal group were significantly more engaged than those in the traditional group.

The high level of engagement investigated by the multimodal group suggests that the use of diverse sensory modalities increase learner interest and motivation, which in turn may lead to better retention and recall. In contrast, the traditional group showed lower engagement level, indicating that more interactive and varied teaching methods might better for vocabulary learning.

3.13. Long-term retention

To test long term retention of vocabulary after 7-weeks period, with no additional vocabulary words. A final test was conducted 8 weeks after initial vocabulary instruction to measure long-term retention. This test included both recognition and recall tasks, similar to the original post-lesson test. A **repeated-measure analysis of variance (ANOVA)** was conducted to compare long-term retention between the multimodal and traditional groups. The multimodal group retained 75% of the vocabulary words over a 8-weeks period while the traditional group retained 50% of the vocabulary words over same period of time.

The **ANOVA** results showed a statistically significant difference in long-term retention between both groups (**F (4.16) = 10.2, p<0.05**). The multimodal experimental group showed significantly better long-term retention of vocabulary, this suggest that multimodal input exposure reinforce and support memory over time.

4. Discussion and Conclusion

The findings from this study support that multimodal input significantly enhances vocabulary retention and recall in secondary-grade learners. The combination of visual, auditory, and kinesthetic activities caters to a variety of learning styles, increasing engagement and reinforcing vocabulary learning. The positive response from learners regarding their engagement with multimodal learning suggests that this approach can be a more effective alternative to traditional methods, especially for learners who struggle with conventional, text-heavy instruction. Therefore, it examined the test results and the difference between the two groups of learners a group taught vocabulary items through multimodal techniques and the other group taught the same vocabulary items through the traditional methods.

Thus, the study investigated the answers to the research questions. T-test was used to analyze the data from the vocabulary tests. T-test results of the pre-test of both groups showed that the existing vocabulary knowledge of the target new words was not statistically significant. An improvement was observed in both of the groups after the intervention. According to the t-test results of the post-test of both groups, the experimental group got higher mean scores than the control group. This difference between the groups was thought to be statistically significant. This showed a substantial improvement in the experiment group's ability to learn the target words through multimodal learning styles. The differences between the experimental and the control group were observed according to the t-test results of delayed and oral recall test and they were all thought to be statistically significant. As a summary, the performance of the subjects in the experimental group was significantly higher than that of the control group. The findings of the study confirmed that the multimodal input is more beneficial than traditional for vocabulary learning. In short teaching with various ways help learners to learn actively and engaged them.

The results also highlight the importance of providing varied sensory experiences in language learning. By exposing learners' towards through multiple sensory channels, the brain can create stronger and more diverse connections, making vocabulary recall more efficient. These findings are consistent with the CTML, which posits that dual use of instruction verbal/auditory, pictorial/visual are enhances learning and memory (Mayer, 2021).

Further research is needed to explore the specific modalities that are most effective for different types of learners, as well as to examine the long-term effects of multimodal vocabulary instruction beyond the classroom setting. Additionally, future studies could investigate how multimodal learning strategies can be adapted for learners with varying language proficiency levels.

4.1. Challenges and Limitations

The limitations of this study are that the sample size ($n = 40$) limits the generalizability of results, treatment lasted only 8 weeks; longer exposure may yield stronger effects, and the corpus was relatively small, focusing on 20 words; a larger dataset would provide more robust insights.

To conduct this experimental study researcher faced many challenges like required sample and lack of resources. Countries like Pakistan, they have no digital tools for learning. Firstly, Researcher faced difficulty in the selection of required participants all learners are not feelings satisfied because they do not know the use of digital tools. Secondly, lack of resources institute have no projector researcher use flashcards, laptop and cell phone for visual and auditory intervention during treatment. Finally, was lack of time as annual exam is near students have stress of exam so they did not ready to give their enough time. This study is just about vocabulary retention and recall this is its limitation. Further research is needed to explore the specific modalities that are most effective for different types of learners, as well as to examine the long-term effects of multimodal vocabulary instruction beyond the classroom setting. Future study will investigate multimodal input across different age groups and proficiency levels. Using eye-tracking or neurocognitive measures to better understand cognitive load in multimodal vocabulary learning. Expanding corpus analysis to explore how multimodal input affects discourse-level structures (e.g., cohesion, argumentation).

References

- Akcan, S. (2010). Enriching second language instruction for young learners: Teaching practices for primary school children. *Handbook for teaching foreign languages to young learners in primary schools*, 67-87.
- Asher, J. J. (1969). The total physical response approach to second language learning. *The modern language journal*, 53(1), 3-17. <https://doi.org/10.2307/322091>

- Behnke, Y. (2016). How textbook design may influence learning with geography textbooks. *Nordidactica: Journal of Humanities and Social Science Education*, (2016: 1), 38-62. Retrieved from <https://urn.kb.se/resolve?urn=urn:nbn:se:kau:diva-46962>
- Boulton, A., & Cobb, T. (2017). Corpus Use in Language Learning: A Meta-Analysis. *Language Learning*, 67(2), 348–393. <https://doi.org/10.1111/lang.12224>
- Coyle, Y., & Gracia, R. G. (2014). Using songs to enhance L2 vocabulary acquisition in preschool children. *ELT Journal*, 68(3), 276–285. <https://doi.org/10.1093/elt/ccu015>
- Dunn, R. S., & Dunn, K. J. (1993). *Teaching secondary students through their individual learning styles: Practical approaches for grades 7-12*. Allyn & Bacon.
- Ellis, N. C. (2019). Essentials of a Theory of Language Cognition. *The Modern Language Journal*, 103(S1), 39–60. <https://doi.org/10.1111/modl.12532>
- Ellis, N. C., Römer, U., O'Donnell, M. B., & Schlepppegrell, M. J. (2016). *Usage-Based Approaches to Language Acquisition and Processing: Cognitive and Corpus Investigations of Construction Grammar*. Wiley. <https://books.google.com.pk/books?id=Ypq9jwEACAAJ>
- Emerson, A., Cloude, E. B., Azevedo, R., & Lester, J. (2020). Multimodal learning analytics for game-based learning. *British Journal of Educational Technology*, 51(5), 1505–1526. <https://doi.org/10.1111/bjet.12992>
- Flynn, F. J. (2005). Having an Open Mind: The Impact of Openness to Experience on Interracial Attitudes and Impression Formation. *Journal of Personality and Social Psychology*, 88(5), 816–826. <https://doi.org/10.1037/0022-3514.88.5.816>
- 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. <https://doi.org/10.3102/00346543074001059>
- Gardner, H. (1993). *Multiple intelligences: The theory in practice*. Basic Books/Hachette Book Group.
- Giannakos, M., & Cukurova, M. (2023). The role of learning theory in multimodal learning analytics. *British Journal of Educational Technology*, 54(5), 1246–1267. <https://doi.org/10.1111/bjet.13320>
- Gilakjani, A. P., Ismail, H. N., & Ahmadi, S. M. (2011). The Effect of Multimodal Learning Models on Language Teaching and Learning. *Theory and Practice in Language Studies*, 1(10), 1321–1327. <https://doi.org/10.4304/tpls.1.10.1321-1327>
- Hibbing, A. N., & Rankin-Erickson, J. L. (2003). A picture is worth a thousand words: Using Visual images to improve comprehension for middle school struggling readers. *Reading Teacher*, 56(8), 758-770.

- Hunt, A., & Beglar, D. (2005). A framework for developing EFL reading vocabulary. *Reading in a Foreign Language*, 17(1), 23–59. <https://doi.org/10.64152/10125/66601>
- Lee, H., Warschauer, M., & Lee, J. H. (2020). Toward the Establishment of a Data-Driven Learning Model: Role of Learner Factors in Corpus-Based Second Language Vocabulary Learning. *The Modern Language Journal*, 104(2), 345–362. <https://doi.org/10.1111/modl.12634>
- Lundberg, G. (2007). Developing teachers of young learners: in-service for educational change and improvement. *Teaching modern languages to young learners: Teachers, curricula and materials*, 21-34.
- Mayer, R. E. (1997). Multimedia learning: Are we asking the right questions? *Educational Psychologist*, 32(1), 1–19. https://doi.org/10.1207/s15326985ep3201_1
- Mayer, R. E. (2005). Cognitive theory of multimedia learning. *The Cambridge handbook of multimedia learning*, 41(1), 31-48.
- Mayer, R. E. (2011). Does styles research have useful implications for educational practice? *Learning and Individual Differences*, 21(3), 319–320. <https://doi.org/10.1016/j.lindif.2010.11.016>
- Mayer, R. E. (2021). Cognitive Theory of Multimedia Learning. In R. E. Mayer & L. Fiorella (Eds.), *The Cambridge Handbook of Multimedia Learning* (3rd ed., pp. 57–72). Cambridge University Press. <https://doi.org/10.1017/9781108894333.008>
- Mayer, R. E., & Moreno, R. (2010). Techniques That Reduce Extraneous Cognitive Load and Manage Intrinsic Cognitive Load during Multimedia Learning. In J. L. Plass, R. Moreno, & R. Brünken (Eds.), *Cognitive Load Theory* (1st ed., pp. 131–152). Cambridge University Press. <https://doi.org/10.1017/CBO9780511844744.009>
- Moreno, R., & Mayer, R. (2007). Interactive Multimodal Learning Environments: Special Issue on Interactive Learning Environments: Contemporary Issues and Trends. *Educational Psychology Review*, 19(3), 309–326. <https://doi.org/10.1007/s10648-007-9047-2>
- Murphy, R. J., Gray, S. A., Straja, S. R., & Bogert, M. C. (2004). Student Learning Preferences and Teaching Implications. *Journal of Dental Education*, 68(8), 859–866. <https://doi.org/10.1002/j.0022-0337.2004.68.8.tb03835.x>
- Nation, I. S. P. (2022). *Learning Vocabulary in another Language* (3rd Ed.). Cambridge University Press. <https://doi.org/10.1017/9781009093873>
- Nation, I. S., & Nation, I. S. P. (2001). *Learning vocabulary in another language* (Vol. 10, pp. 126-132). Cambridge: Cambridge university press.
- Paivio, A. (1991). Dual coding theory: Retrospect and current status. *Canadian Journal of Psychology/Revue Canadienne de Psychologie*, 45(3), 255.

- Paivio, A. (2014). *Mind and Its Evolution: A Dual Coding Theoretical Approach*. Taylor and Francis.
- Plass, J. L., & Pawar, S. (2020). Toward a taxonomy of adaptivity for learning. *Journal of Research on Technology in Education*, 52(3), 275–300. <https://doi.org/10.1080/15391523.2020.1719943>
- Sadoski, M., & Paivio, A. (2013). *Imagery and text: A dual coding theory of reading and writing* (Second edition). Routledge. <https://doi.org/10.4324/9780203801932>
- Schmitt, N. (2008). Review article: Instructed second language vocabulary learning. *Language Teaching Research*, 12(3), 329–363. <https://doi.org/10.1177/1362168808089921>
- Schmitt, N. (2010). *Researching vocabulary: A vocabulary research manual*. Springer.
- Shams, L., & Seitz, A. R. (2008). Benefits of multisensory learning. *Trends in cognitive sciences*, 12(11), 411-417.
- Simmons, F. R., & Singleton, C. (2008). Do weak phonological representations impact on arithmetic development? A review of research into arithmetic and dyslexia. *Dyslexia*, 14(2), 77–94. <https://doi.org/10.1002/dys.341>
- Sinclair, J. (Ed.) (1991). *Corpus, Concordance, Collocation*. Oxford, UK: Oxford University Press.
- Sweller, J. (1988). Cognitive Load during Problem Solving: Effects on Learning. *Cognitive Science*, 12(2), 257–285. https://doi.org/10.1207/s15516709cog1202_4
- Webb, S. (2007). The Effects of Repetition on Vocabulary Knowledge. *Applied Linguistics*, 28(1), 46–65. <https://doi.org/10.1093/applin/aml048>
- Widyaningrum, L., Rizal, D., & Prayogo, A. (2022). Multimodal Project-Based Learning in listening and speaking activities: Building environmental care? *EduLite: Journal of English Education, Literature and Culture*, 7(2), 209. <https://doi.org/10.30659/e.7.2.209-223>
- Wilkins, D. A. (1972). Linguistics in Language Teaching. *Journal of the International Phonetic Association*, 2(1), b1–b4. <https://doi.org/10.1017/S0025100300000372>