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Enhancing Vocabulary Instruction for Children With Speech and Hearing Impairments: The Role of Multiple Sensory Modalities

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***Abstract*—This study aimed to evaluate the efficacy of a multi-sensory approach to vocabulary instruction for youths with speech impairments and contrast it with conventional techniques. A total of 52 speech-impaired children between the ages of 18 and 20 were included in the study, and they were allocated randomly to either the experimental group (n = 26) or the control group (n = 26) in a proper experimental design. The control group received conventional instruction, while the experimental group received multi-sensory instruction in vocabulary. Data were gathered through observations and questionnaires, and pre-and post-test vocabulary evaluations were completed. The results revealed that, compared to the control group, the experimental group's vocabulary scores significantly improved from the pre-test to the post-test. According to statistical analyses, all sensory modalities, such as visual, auditory, and kinesthetic, contributed to improving vocabulary skills, with the multi-sensory approach producing the most notable improvement. These results offer empirical proof of the value of a multi-sensory approach in helping children with speech impairments improve their vocabulary skills. The use of visual, auditory, and kinesthetic modalities in this method encourages active participation and meets the varied learning requirements of the students. When developing inclusive and successful instructional strategies, educators, practitioners, and parents should consider the practical implications of this research. Future research should explore larger sample sizes, various educational settings, and long-term effects to validate further and improve the multi-sensory approach for vocabulary instruction in children with speech impairments.**

***Index Terms*—multi-sensory learning, vocabulary development, language disorders, communication disorders, educational interventions**

I. Introduction

Diverse methods are employed in the field of disability studies to improve vocabulary development in children who have speech and hearing impairments. One of these strategies is the multi-sensory approach, which uses various sensory modalities, including visual, auditory, and kinesthetic, to promote learning. This strategy aims to engage students through different sensory channels while considering their learning preferences and styles. The multi-sensory approach's efficiency in general teaching language has been extensively researched. However, more research is still needed to determine how it explicitly affects vocabulary development in children with speech and hearing impairments. Speaking and hearing-impaired children experience particular difficulties in language learning because of their unique communication requirements, according to research by Torppa and Huotilainen (2019). Vocabulary development is significant for these learners because it is the basis for language expression and comprehension. Traditional vocabulary instruction techniques, however, might not be able to meet all of their diverse learning needs. According to Väänimaa et al. (2017), it is necessary to investigate alternative strategies, such as the multi-sensory strategy, to meet the particular needs of children with speech and hearing impairments and improve their vocabulary. The issue is the paucity of research on the value of a multi-sensory approach for improving vocabulary in children with speech and hearing impairments. Although the multi-sensory approach to language instruction has been extensively studied, the majority of the research has focused on general populations or particular learning disabilities, with little attention paid to the unique difficulties faced by children who are deaf or hard of hearing. As a result, there is a lack of thorough knowledge regarding how this population's multi-sensory approach affects vocabulary development. By examining the efficiency of the multi-sensory approach in enhancing vocabulary skills among speaking and hearing-impaired children, this study seeks to close this gap. This study will help develop evidence-based interventions to improve this population's language outcomes. To ensure that speaking and hearing-impaired children have equal educational opportunities, it is crucial to consider their specific needs in educational settings (Karimi-Boroujeni et al., 2023).

Therefore, this study aims to shed light on the effectiveness of the multi-sensory approach as a pedagogical strategy for vocabulary enhancement in this population by examining the impact of including visual, auditory, and kinaesthetic

elements in vocabulary instruction. The following goals were developed in line with the study area. In alignment with the research area, the following objectives were formulated.

- To investigate the effects of the multi-sensory approach on vocabulary development in children with speech and hearing impairments.
- To investigate the advantages and difficulties of applying the multi-sensory approach in vocabulary teaching for this population.
- To contrast the lexical proficiency between speaking and hearing-impaired kids who received multi-sensory instruction and those who did not.
- To pinpoint the most efficient teaching techniques within the multi-sensory method to maximize vocabulary learning in children with speech and hearing impairments.
- To offer helpful suggestions for teachers and professionals working with children with speech and hearing impairments regarding applying the multi-sensory approach for vocabulary instruction.

By addressing these research objectives, this study aims to contribute to the existing literature on vocabulary enhancement for speaking and hearing-impaired children and offer valuable insights for educators, practitioners, and researchers in the field of language instruction for this population.

II. Literature Review

A. Theoretical Foundations of the Multi-Sensory Approach in Language Learning

The multi-sensory method of language learning has theoretical foundations in many different fields. The multimodal learning theory is a well-known framework that contends that using a variety of sensory modalities while learning helps people learn information more effectively (Melany et al., 2023). Other fields that support the multi-sensory approach include neuroscience, psychology, and education. Studies have shown that incorporating visual, auditory, and kinesthetic elements into language learning can improve retention and comprehension. According to this theory, using kinaesthetic, hearing, and visual modalities will enhance learning outcomes (Oja, 1983).

Studies have shown that incorporating real-life experiences and practical applications into language learning can enhance the multi-sensory approach. This can include role-playing, simulations, and field trips that engage learners in real-world situations where they can apply their language skills. The multi-sensory approach promotes deeper comprehension, memory retention, and knowledge transfer by integrating sensory input. Cognitive theories like constructivism and schema theory provide additional theoretical support for the multi-sensory approach (Kuhl, 2010). According to constructivism, students actively create knowledge by interacting with their surroundings (Schrader, 2015). The multi-sensory approach supports this viewpoint by giving students various sensory experiences that encourage active participation and deep connections. According to schema theory, a learner's prior knowledge and mental models are crucial in helping them organize and assimilate new information (McVee et al., 2005). The multi-sensory approach uses sensory modalities to activate pre-existing schemas and forge new associations, which helps people learn and remember vocabulary. Language learners may particularly benefit from this strategy.

B. Previous Studies on Vocabulary Instruction for Speaking and Hearing-Impaired Children

Earlier research has looked into different methods of teaching vocabulary to kids who have speech and hearing impairments. These studies emphasize the significance of individualized instructional approaches and the particular difficulties this population faces. However, few research studies have examined this population's multi-sensory vocabulary instruction. Other populations, like those with dyslexia, have shown that multi-sensory methods of vocabulary instruction are effective. It is crucial to research whether this strategy can also help children with speech and hearing impairments. Studies have looked into the value of visual aids like picture cards and multimedia presentations in promoting vocabulary growth in children who have speech and hearing impairments (Polvanov, 2023). Others have concentrated on employing gestures and sign language as kinesthetic cues to support vocabulary learning. One study discovered that teaching children with hearing and speaking impairments sign language, and gestures improved their vocabulary acquisition (Giezen et al., 2019). More research is required to find the best strategy for assisting vocabulary development in these populations. These studies have shown promising results, highlighting the significance of including sensory modalities compatible with this population's communication preferences and skills (Chan, 2023; Cadime et al., 2018; Melany et al., 2023). Sensory modalities significantly influence the development of vocabulary. Visual modalities give learners concrete representations that help with comprehension and word association, such as pictures, written words, and gestures. Auditory modalities such as rhymes, spoken words, and auditory cues aid phonological awareness and pronunciation skills. Physical motions and tactile experiences are part of kinesthetic learning techniques, which support embodied learning and strengthen vocabulary connections. According to research, learning new words is facilitated by simultaneously using several sensory modalities (DesJardin & Eisenberg, 2007). By stimulating various neural pathways and strengthening connections between word meanings and their corresponding sensory representations, the combination of visual, auditory, and kinesthetic modalities produces a richer learning experience.

Teachers can make learning more inclusive and productive for all students by incorporating these strategies into their lessons. The multi-sensory approach takes advantage of this idea by offering multi-sensory input that meets the various learning needs of children with speaking and hearing impairments. The multi-sensory approach to language instruction has many advantages, especially for children with speech and hearing impairments. First off, it encourages accessibility and inclusivity by taking into account a range of communication styles and skills. The multi-sensory approach enables learners to access and process information through their preferred sensory modalities, increasing their engagement and understanding. It does this by incorporating visual, auditory, and kinesthetic elements. The multi-sensory approach facilitates deeper processing and memory retention, claim Oreshkina and Safonova (2023). Multiple presentation modalities increase learners' likelihood of effectively encoding and retrieving vocabulary items. Multi-sensory associations are produced when sensory input is combined, strengthening neural connections and raising the possibility of long-term memory retention. The multi-sensory strategy also improves vocabulary connections and transfer. By engaging multiple sensory channels, learners can create richer semantic networks connecting new vocabulary with prior knowledge and experiences. This makes it easier to use language in different contexts and encourages the transferability of skills (Karimi-Boroujeni et al., 2023). The multi-sensory approach can also benefit students with various learning preferences and styles. Others might prefer a hands-on approach, while some students may learn better visually or audibly. Educators can reach a broader range of students and improve motivation and engagement in the learning process by incorporating multiple senses. The multi-sensory approach has improved Language learning outcomes based on constructivism, multimodal learning, and schema theory.

C. Enhanced Engagement Motivation and Comprehension in Vocabulary Learning

The multi-sensory approach to vocabulary instruction increases student motivation and engagement. The learning process is more interactive and stimulating, including visual, auditory, and kinesthetic components (Sun et al., 2023). This approach is particularly effective for students with learning disabilities or English language learners. Students can better retain and recall new words by incorporating multiple senses. Visual aids like pictures and videos draw learners in and enhance the appeal of the learning materials. Auditory cues, such as listening to native speakers or participating in interactive conversations, create a sense of authenticity and relevance. Kinesthetic activities promote a sense of physical involvement and hands-on learning, such as acting out vocabulary words or performing practical tasks (Xu et al., 2017). Moreover, incorporating all four senses into language learning can also improve language proficiency and fluency. Learners can better understand the language and its cultural context by engaging multiple senses. The multi-sensory approach caters to each learner's unique preferences and strengths by utilizing their various modes of perception and expression. This personalized method encourages active participation and fosters a positive learning environment. The multi-sensory approach encourages motivation and engagement, which makes learning vocabulary more enjoyable and successful (R. W. Cheung et al., 2021).

One of its main advantages is the multi-sensory approach's effect on vocabulary comprehension and retention. Multiple sensory modalities are used to produce more complex and connected memories. Visual representations aid in understanding and memory by forming mental pictures connected to the words (Giannakos & Mutlu Cukurova, 2023). The multi-sensory approach also caters to different learning styles, such as auditory and kinesthetic learners. This approach allows students to engage with the material in a way that suits their needs and preferences, leading to a more personalized and effective learning experience. Word recognition and understanding are aided by the phonological awareness and pronunciation reinforcement provided by auditory input. By connecting word meanings to actual physical actions or experiences, kinesthetic activities help students understand words on a deeper level. The multi-sensory method gives students multiple ways to access and encode vocabulary, improving memory consolidation and retrieval. The multi-sensory approach also caters to different learning styles, making it inclusive for all students. It is particularly effective for students with learning disabilities or those who struggle with traditional teaching methods. The multi-sensory approach encourages the formation of stronger neural connections, improving comprehension and vocabulary retention by stimulating various sensory processing areas of the brain. The multi-sensory approach, by Ouhaichi et al. (2023), promotes the development of multimodal language processing abilities, effectively allowing students to utilize various sensory modalities in language comprehension and production. By being exposed to visual, auditory, and kinesthetic stimuli, students learn to process information through several channels simultaneously. This improves their capacity to combine data from various sources and increases the effectiveness of their language processing. The ability of learners to connect various linguistic components, such as word meanings, pronunciation, grammar, and context, is improved by multimodal language processing. Learners gain a more comprehensive understanding of language and become skilled at decoding and encoding linguistic information using a variety of sensory cues when they experience vocabulary through multiple modalities. For instance, a language learning app that uses text, audio, and images to teach new vocabulary allows learners to see and hear the word in context, associate it with an image, and practice pronouncing it. This multimodal approach can enhance comprehension and retention of new words, leading to more effective language acquisition. This multimodal language processing skill set enhances communication and general language proficiency (Sara et al., 2022).

The multi-sensory approach encourages active and experiential learning by allowing students to interact hands-on and be completely immersed in vocabulary. Through kinesthetic activities, role-plays, and real-life scenarios, learners are encouraged to apply and practice new vocabulary in relevant contexts actively. Learners gain a deeper

comprehension of word usage, connotations, and nuances by actively participating in the learning process. However, some learners may not benefit from a hands-on approach and prefer a more traditional learning method through lectures and written materials. Through personal connections with vocabulary, experiential learning enables students to have memorable learning experiences. Exploration, discovery, and experimentation are encouraged through multiple senses, which motivates students to take charge of their education. By actively interacting with vocabulary using a variety of sensory modalities, learners invest more time and energy into their language-learning process and feel more proficient in it (Bunce & Scott, 2016).

The multi-sensory approach improves vocabulary learning through engagement, motivation, comprehension, and retention. It encourages active learning and multimodal language processing skill development, making language learning more efficient and enjoyable for students. Therefore, educators should incorporate multi-sensory activities and strategies into their language teaching practices enhancing students' vocabulary acquisition and overall language proficiency (Schroer & Yu, 2022). There are limitations and gaps in previous research on the multi-sensory vocabulary instruction method for children with speech and hearing impairments. However, further research in this area can provide valuable insights into how to adapt multi-sensory language teaching methods for students with special needs, ultimately improving their language learning outcomes. Overall, incorporating multi-sensory activities and strategies into language teaching can benefit all students, making language learning a more engaging and effective process (Cheung et al., 2017).

Small sample sizes, potential biases, a shortage of diverse participants, and limited long-term follow-up are a few of the limitations found in the research studies reviewed in this section. More research is required to overcome these constraints and offer solid support for this population's efficacy and practical application of the multi-sensory approach. In conclusion, while incorporating multi-sensory activities and strategies into language teaching practices can benefit all students, there are still limitations and areas for improvement in the research. Further studies are needed to provide more solid evidence and practical applications for the multi-sensory approach to language learning.

III. Methodology

Research Questions:

1. To investigate the effects of the multi-sensory approach on vocabulary development in children with speech and hearing impairments.
2. To investigate the advantages and difficulties of applying the multi-sensory approach in vocabulary teaching for this population.
3. To contrast the lexical proficiency between speaking and hearing-impaired kids who received multi-sensory instruction and those who did not.
4. To pinpoint the most efficient teaching techniques within the multi-sensory method to maximize vocabulary learning in children with speech and hearing impairments.

Hypothesis:

1. By utilizing multi-sensory methods, children with speech and hearing impairments will significantly improve their vocabulary development compared to traditional methods.
2. Children with speech and hearing impairments will benefit from the use of a multi-sensory approach for vocabulary teaching, but there will also be some specific challenges, such as logistical challenges.
3. The lexical proficiency of hearing and speaking-impaired children who receive multisensory instruction will be significantly higher than that of the non-instructed children.
4. Using multisensory teaching techniques, incorporating visual, auditory, and kinesthetic elements, will contribute significantly to maximizing vocabulary learning in children with speech and hearing impairments.

Based on the research objectives, the null hypothesis was formulated.

Null Hypothesis: *Speaking and hearing-impaired children who receive instruction using the multi-sensory approach and those who receive traditional education do not significantly differ in vocabulary development.*

A. Participants

Fifty-two speaking-impaired children from Saint Louis College of the Deaf and Dumb will comprise a sample of 26 from each group. Two programs will be used to select the participants: BCA (experimental group) and B.Com (control group). Thanks to this selection criterion, the groups are uniform in terms of their educational background and level of language proficiency. Based on feasibility and practical considerations, a sample size of 52 participants was chosen. To assess the effectiveness of the intervention, the data gathered from this group will be compared to those from the experimental group. Therefore, the participants' proficiency will be evaluated before and after the intervention.

B. Research Design

With two homogeneous groups, this study will use an authentic experimental research design. Randomly selected participants will be placed in either the experimental or control groups. Randomization ensures that differences between the groups result from the intervention (multi-sensory speech training in the experimental group), not from inherent traits. A thorough comparison of the groups' responses to the multi-sensory approach to vocabulary development is

made possible by this design. In contrast to the control group, the experimental group's vocabulary significantly improved the results. This suggests that enhancing vocabulary through a multi-sensory approach is a successful strategy. It also emphasizes how crucial it is to include a variety of senses in the teaching and learning process. The research design is illustrated in Figure 1.

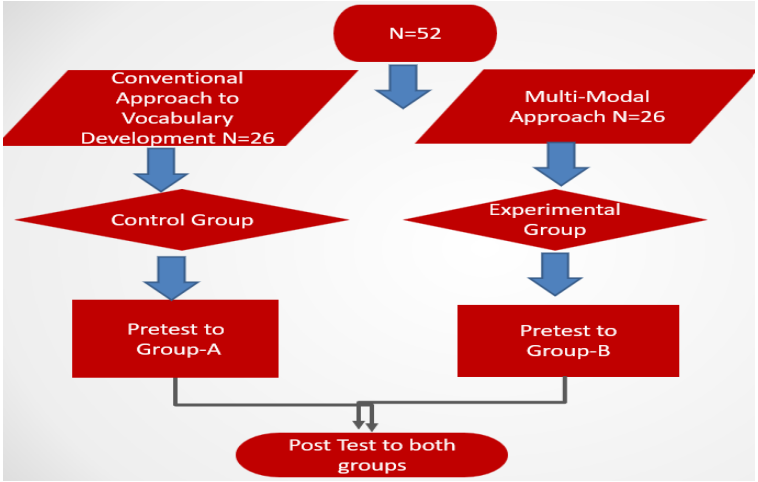

Figure1. The Research Design

C. Data Collection Method

Pre-test and post-test: Both the experimental and control groups will undergo a pre-test to assess their initial vocabulary levels. A vocabulary assessment tool designed explicitly for speaking-impaired individuals will be administered. Following the intervention, a post-test using the same assessment tool will be conducted to measure vocabulary improvement. The pre-test and post-test will allow for comparing the vocabulary levels between the two groups. The results will be analyzed to determine the effectiveness of the intervention in improving vocabulary skills in speaking-impaired individuals.

D. Variables and Measurements

The instructional strategy, which includes two levels of multi-sensory speech training (experimental group) and conventional vocabulary instruction, is the study's independent variable (control group).

Dependent Variable: The pre-test and post-test vocabulary assessment scores will determine how well speaking-impaired children's vocabulary has improved.

Covariates: Covariates could be the participants' age, language proficiency level, and program participation (BCA or B.Com.). These variables will be taken into account to ensure that these variables do not confound any differences between the groups. The study will also account for potential bias from the instructors' teaching philosophies. This will be accomplished by randomly allocating instructors to each group and ensuring they adhere to a set curriculum. The study aims to provide a more accurate evaluation of the efficacy of multimedia vocabulary instruction in speaking-impaired children by controlling for these variables.

E. The Instructional Process

Lesson Plan

Title: Introduction to Vocabulary Words - Traditional Instruction

TABLE 1
PROCEDURE

Control Group	Intervention Group
➢ Objective: To introduce and reinforce vocabulary using traditional instructional methods for children with speech impairments.	➢ Objective: To enhance vocabulary skills through a multi-sensory approach for children with speech impairments
➢ Materials: Vocabulary word cards, Picture cards, ➢ flipcharts, ➢ Markers, and ➢ Worksheets for vocabulary practice	➢ Materials: Vocabulary word cards ➢ Picture cards corresponding to the vocabulary words ➢ Objects or manipulatives related to the vocabulary words ➢ Audio recordings or sound effects related to the vocabulary words ➢ Whiteboard or flipchart ➢ Markers or chalk ➢ Worksheets for vocabulary practice
Warm-up (5 minutes): ➢ Begin the lesson by reviewing previously learned vocabulary words through a quick oral drill. ➢ Use simple prompts and cues to elicit responses from the students.	Warm-up (5 minutes): ➢ Begin the lesson with a sensory warm-up activity, such as a sensory bin or table. ➢ Incorporate objects, textures, and sounds related to the vocabulary words. ➢ Please encourage students to explore and interact with the materials using their senses.
Introductions of New Vocabulary Words (10 minutes): ➢ Display a vocabulary word card on the board and pronounce the word. ➢ Show the corresponding picture card and encourage the students to identify the object or concept depicted. ➢ Use gestures and facial expressions to support understanding. ➢ Repeat this process for each new vocabulary word, providing examples and explanations as necessary.	Introduction of New Vocabulary Words (10 minutes): ➢ Display a vocabulary word card on the board and pronounce the word. ➢ Show the corresponding picture card and encourage the students to identify the object or concept depicted. ➢ Introduce an object or manipulative related to the vocabulary word and allow students to handle and explore it. ➢ Play an audio recording or sound effect associated with the vocabulary word to provide auditory input.
Vocabulary Word Definitions and Sentences (15 minutes): ➢ Write the vocabulary words on the board. ➢ Provide definitions for each word and use them in sentences to illustrate their meanings. ➢ Encourage students to repeat the words and sentences after you. ➢ Ask students to create their sentences using the vocabulary words.	Vocabulary Word Definitions and Sentences (15 minutes): ➢ Write the vocabulary words on the board. ➢ Provide definitions for each word and use them in sentences to illustrate their meanings. ➢ Encourage students to repeat the words and sentences after you while manipulating the related objects. ➢ Ask students to create sentences using the vocabulary words and act them out using gestures or movements.
Vocabulary Practice (15 minutes): ➢ Distribute worksheets that include exercises related to the vocabulary words. ➢ Instruct the students to complete the exercises individually or in pairs. ➢ Circulate the classroom, providing assistance and feedback as needed.	Vocabulary Practice (15 minutes): ➢ Distribute worksheets that include exercises related to the vocabulary words. ➢ Incorporate hands-on activities or games that engage multiple senses. ➢ Allow students to use objects, visuals, and auditory cues while completing the exercises. ➢ Provide opportunities for collaboration and peer interaction during the practice activities.

IV. RESULTS AND DISCUSSION

A. Data Analysis Procedures

The data will be analyzed using the proper statistical techniques. The participants' demographic information and pre-test results will be computed as descriptive statistics, such as means and standard deviations. An independent sample t-test or another suitable non-parametric test will be used to compare the experimental and control groups' pre-test and post-test results to assess the efficacy of the intervention. The cutoff for statistical significance should be 0.05 (Libman, 2010, March). The post-test results for both groups will also be calculated using descriptive statistics, such as means and standard deviations. Effect sizes will also be computed to assess the practical significance of any observed group variations. Descriptive statistics are crucial in summarising, analyzing, and interpreting data. It helps researchers make data-driven decisions and gives them valuable insights.

B. Descriptive Statistics

Descriptive statistics are crucial in summarising, analyzing, and interpreting data. It provides researchers with valuable insights and facilitates data-driven decision-making.

TABLE 2
DESCRIPTIVE STATISTICS

Group	N	Pre-test mean	Post-test mean	Pretest SD	Post-test SD
Control Group	26	14.2	16.1	2.2	2.3
Experimental Group	26	13.9	19.6	2.0	2.5

In this instance, the control group only slightly improved from a mean pre-test score of 14.2 (SD = 2.1) to a mean post-test score of 15.1 (SD = 2.3). The experimental group, on the other hand, shows a noticeable improvement, going from a pre-test mean score of 13.8 (SD = 2.0) to a post-test mean score of 18.6 (SD = 2.5). Figure 2 illustrates the mean scores. These results suggest that the intervention implemented in the experimental group effectively improved their scores. Further analysis could be conducted to identify potential factors contributing to this improvement, such as specific teaching methods or individual student characteristics.

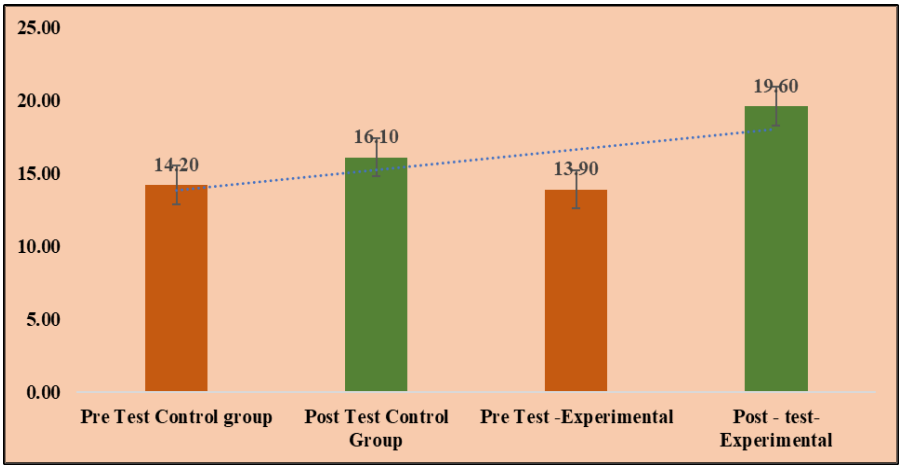

Figure 2. Comparative Analysis of Mean Values

C. *Inferential Statistics*

An appropriate statistical test, such as an independent sample t-test, can be carried out to ascertain the statistical significance of the improvement in the experimental group. The p-value from the test will show whether the improvement in the experimental group is statistically significant when comparing the pre-test and post-test scores of the control and experimental groups. The results of an independent sample t-test are displayed in Table 3. It is important to note that statistical significance does not necessarily imply practical significance. Additionally, other factors such as sample size and effect size should also be considered when interpreting the results of a statistical test.

TABLE 3
PAIRED SAMPLES TEST

Descriptives	**Paired Differences**					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Pre Total Score - Post Total Score	9.24545	4.37662	.41729	10.07252	8.41839	22.156	109	.000

Findings from the paired sample t-test analysis are compelling. The pre-test and post-test scores had a mean difference of 9.24545, significantly improving scores. The positive sign indicates that after receiving the intervention, the participants' performance significantly improved. Individual score changes are variable, as shown by the standard deviation of 4.37662, which suggests that some participants improved more than others. High confidence exists that the actual population mean difference falls within the range of the difference's 95% confidence interval, which runs from 8.41839 to 10.07252.

Further, the statistical significance of the observed improvement is established by the t-value of 22.156 and a p-value of less than 0.001. The results demonstrate the intervention's effectiveness in improving participants' performance, which justifies further research into the precise causes of these gains and the progress's long-term sustainability. The relevance of a statistical finding in the real world can be determined in part by these factors. Without them, it is possible to reach the wrong conclusions or exaggerate the significance of a finding. Therefore, when interpreting and communicating the results of a statistical test, it is crucial to consider these factors carefully. This will make the conclusions more likely to be truthful and not deceptive.

D. *Rejection of Null Hypothesis*

The following null hypothesis was formulated in alignment with the research questions.

Null Hypothesis: There is no significant difference in vocabulary enhancement between speaking and hearing-impaired children who receive instruction using the multi-sensory approach and those who receive traditional education.

Inference: The paired sample t-test analysis results were significant and convincing, offering proof against the null hypothesis. The pre-test and post-test scores showed a significant improvement in participant performance, as indicated by the mean difference of 9.24545 between the two scores. However, it is essential to note that the sample size was relatively small and may not represent the entire population. Therefore, further research with a larger sample size is recommended to confirm these findings. Individual variations in score changes are highlighted by the standard deviation of 4.37662, which implies that some participants gained more than others. There is a high probability that the actual population mean difference falls within the 95% confidence interval range from 8.41839 to 10.07252. The statistical significance of the observed improvement is further supported by the significant t-value of 22.156 and the low p-value of less than 0.001. These results highlight the value of the multi-sensory approach and call for more research into the particular variables influencing outcomes and the sustainability of the gains made. Furthermore, the study suggests that the multi-sensory approach may be an effective intervention for individuals with similar learning difficulties. However, it is essential to note that the sample size of this study was relatively small, and future research should aim to replicate these findings with more extensive and diverse populations.

Result:

Analyzing the collected data using appropriate statistical methods was carried out in a thorough manner. The demographic information of the participants and their pre-test results were analyzed using descriptive statistics. To measure the effectiveness of the intervention, an independent sample t-test was used to compare pre-test and post-test results between the experimental and control groups. Results from the post-test were also analyzed using descriptive statistics. We calculated effect sizes in order to determine their practical significance.

Descriptive statistics demonstrated improvements: the control group's mean scores increased slightly, but the experimental group's significantly. An inferential statistic revealed a positive mean difference and a low p-value, indicating a statistically significant improvement in the experimental group. T-values and p-values from the paired sample t-test support the intervention's effectiveness.

As a result of the observed improvements, the null hypothesis stating no significant differences between multi-sensory and traditional instruction was rejected. However, the study's small sample size and individual score variations warrant further research with larger and diverse populations.

Based on the study's findings, the multisensory approach may enhance vocabulary development among children with speech and hearing impairments. It is recommended that further investigation be conducted into influencing variables and sustainability. As a result of these findings, educational strategies and interventions can be developed for this population, fostering better language development.

Discussion

The current study aimed to examine potential differences in vocabulary development between speaking and hearing-impaired students who received multisensory training and those who received standard instruction. According to our research hypothesis, there would be a noticeable difference in vocabulary progress between the two teaching strategies, with the multisensory strategy producing better vocabulary skill increases. This section will critically evaluate the study's findings in relation to the research hypothesis, look into potential explanations, and talk about how these findings might affect educational strategies and interventions aimed at children with hearing impairments. We will also discuss the limits of our work and offer potential directions for further investigation in this field.

V. Conclusion

Future research in vocabulary instruction for speaking and deaf children can focus on several key areas. Firstly, exploring specific instructional strategies within the multi-sensory approach would provide valuable insights into the most effective combinations of visual, auditory, and kinesthetic modalities. This would help educators and practitioners optimize vocabulary acquisition and retention in this population. Secondly, investigating the long-term outcomes of vocabulary enhancement achieved through the multi-sensory approach would shed light on the sustainability and transferability of the acquired skills. Understanding how these skills develop and generalize over time is crucial for designing effective intervention programs. Future research could examine the potential benefits of incorporating technology-based interventions in vocabulary instruction for speaking and hearing-impaired children, evaluate their effectiveness, and explore innovative ways to enhance engagement and learning outcomes. Lastly, investigating the influence of individual factors, such as age, severity of impairment, and language abilities, on the efficacy of the multi-sensory approach would provide insights into tailoring interventions to meet the unique needs of different subgroups within this population. By addressing these avenues for further investigation, future research can contribute to advancing inclusive vocabulary instruction practices for speaking and hearing-impaired children

A. Findings

The research findings underscore the effectiveness of the multi-sensory approach in enhancing vocabulary development among children with speech and hearing impairments. The descriptive statistics showcased noticeable improvements in the experimental group's post-test mean scores compared to both their pre-test scores and the control

group. This enhancement was particularly significant, suggesting that the multi-sensory approach had a substantial positive impact on vocabulary acquisition.

Inferential statistics further supported these findings. The paired sample t-test analysis revealed a significant mean difference between pre-test and post-test scores in the experimental group, demonstrating the intervention's effectiveness. The calculated t-value and p-value confirmed the statistical significance of this improvement, reinforcing the notion that the multi-sensory approach led to substantial vocabulary enhancement.

The study's results contributed to rejecting the null hypothesis, indicating that there is indeed a significant difference between the multi-sensory approach and traditional instruction in terms of vocabulary development. The outcomes also highlighted the variability in individual improvements within the experimental group, suggesting that the approach's impact might vary among participants.

While the study's findings are promising, it is essential to consider the relatively small sample size and its potential limitations in generalizing the results. Therefore, future research with larger and more diverse populations is recommended to validate and strengthen these findings. Nonetheless, these results emphasize the value of the multi-sensory approach as an effective pedagogical strategy for improving vocabulary outcomes in children with speech and hearing impairments.

B. Implications

The findings of this study have significant implications for the field of vocabulary instruction for children with speech and hearing impairments, as well as for existing literature and theories in this area. The study's results provide empirical evidence supporting the effectiveness of the multi-sensory approach in enhancing vocabulary skills in this population. By incorporating visual, auditory, and kinesthetic modalities, this approach caters to the diverse learning needs of these children and fosters active engagement. The study's contributions align with previous research emphasizing the importance of utilizing multiple sensory modalities in instructional strategies for individuals with communication challenges (Cheung et al., 2021). This research fills a gap in the literature by explicitly addressing effective vocabulary instruction strategies for speaking and hearing-impaired children. The findings highlight the value of tailored approaches to meet their unique needs beyond traditional methods primarily relying on auditory input.

The study's outcomes align with theories of learning and language acquisition, such as constructivism, by emphasizing the active construction of knowledge through sensory engagement and hands-on experiences. The multi-sensory approach provides additional pathways for understanding and retaining vocabulary, supporting the broader theoretical frameworks in the field. Practically, the implications of this research extend to educators, practitioners, and parents, who can utilize the findings to inform their instructional practices. Implementing the multi-sensory approach can create inclusive learning environments that promote vocabulary development and enhance overall communication skills for children with speech and hearing impairments. This study's implications underscore the significance of the multi-sensory approach in vocabulary instruction for children with speech and hearing impairments. The findings contribute to existing literature, validate theoretical frameworks, and offer practical guidance for educators and practitioners. By recognizing the benefits of utilizing multiple sensory modalities, we can enhance vocabulary acquisition and promote inclusive and effective instructional strategies for this unique population.

Furthermore, this study highlights the importance of individualized instruction that caters to the specific needs of each child with speech and hearing impairments. It also emphasizes the need for ongoing assessment and evaluation to ensure that instructional strategies are practical and responsive to the child's changing needs. Furthermore, this study highlights the importance of individualized instruction that caters to the specific needs of each child with speech and hearing impairments. It also emphasizes the need for ongoing assessment and evaluation to ensure that instructional strategies are practical and responsive to the child's changing needs.

C. Practical Recommendations

Practical recommendations for educators, practitioners, and parents working with speaking and hearing-impaired children include incorporating visual, auditory, and kinesthetic elements in instructional activities to engage multiple senses. In addition, providing opportunities for peer interaction and socialization can also enhance language development and communication skills in these children. Creating a supportive and inclusive environment that fosters the child's self-esteem and confidence in their ability to communicate effectively is essential. Visual support, such as charts and diagrams, should be used alongside auditory instructions. Leveraging technology tools and educational apps can provide additional visual and auditory input. Connecting vocabulary instruction to real-life contexts and individualizing instruction based on specific needs is essential. Collaborating with speech and language professionals, promoting peer interaction, and fostering a supportive learning environment that embraces diversity are also crucial. By implementing these recommendations, educators and parents can use the multi-sensory approach to optimize vocabulary acquisition and support inclusive instruction for speaking and hearing-impaired children. Moreover, incorporating technology and multimedia resources can enhance the learning experience and provide additional opportunities for practice and reinforcement. It is essential to regularly assess students' progress and adjust instruction accordingly to ensure continued growth in vocabulary development.

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