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Effect of Technology-Based Auditory-Kinesthetic Strategy on Reading Comprehension among Primary III Pupils in Kaduna-South, Nigeria

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ABSTRACT

The study focused on the effects of the technology-based auditory-kinesthetic strategy on reading comprehension of Primary III pupils in Kaduna-South, Nigeria. The objective of the study was to determine how the effects of technology-based auditory-kinesthetic instruction improve pupils' reading comprehension for reading speed by fostering critical thinking skills, enhancing text analysis, and enabling personalized reading practices. The study employed a quasi-experimental design of non-equivalent pre-test and post-test control groups. Out of 7,765 pupils, 114 pupils were purposively selected: the experimental group had 56 pupils, and the control group had 58 pupils. Digital Whiteboards (DW), Gesture-Based Learning Platforms (GBLP), and the Real-Time-Reading-Speed Test was used to collect the data. The study used mean and standard deviation to answer the research questions and an independent samples t-test to test the hypotheses. The results showed that the strategy had significantly improved Primary III pupils' reading comprehension for reading speed strategies, critical thinking skills, text analysis engagement, and personalized reading experiences that enhanced reading speed performance. The study recommended further study in comprehension, fluency, vocabulary, professional development and to conduct a study on the technology-based auditory-kinesthetic strategy among rural and urban language learners.

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1. Introduction

Reading comprehension and reading speed are the critical language learning skills that support students' general academic success, especially at the early stage. Students during the primary school years are largely dependent on effective reading instruction and reading materials across the curriculum (Busari, Ross & Berry, 2025). Many second language learners

in Nigeria are struggling to understand reading materials in order to perform well in other subjects. Fadila, Dalimunthe, & Siagian (2024) confirms that rote memorization and passive reading exercises remain fixed in traditional Nigerian reading instruction. This reading instruction fails to fully engage second language learners to take into account their varied learning styles.

In this regard, there is a gap in subject-specific strategies based on the Nigerian primary pupils' learning needs, which significantly respond to the visual, auditory, and kinesthetic instruction in second language learning situations. Most of the previous studies had failed to empirically examine the use of technology-based auditory-kinesthetic strategy in early grade reading instruction in the Nigerian primary school system.

According to Fujita (2024), multisensory teaching methods combine visual, auditory, and kinesthetic learning strategies to greatly improve phonological processing, reading fluency, reading comprehension, and speed. Here, the auditory-kinesthetic learning strategy incorporates both listening and physical movement in learning a concept. This strategy integrates sensory inputs, which will improve memory retention, cognitive processing, enhance learning reading comprehension, improve vocabulary retention, and improve reading skills in order to make learning more effective (Busari, Ross & Berry, 2025). The auditory part involves listening to reading material, while the kinesthetic component engages to promote physical learning activities such as readers' theater with actions, vocabulary charades, walk-and-read stations, and story mapping on the floor that scaffold reading comprehension and speed through actions.

Despite the strong global evidence from the research, it is affirmed that the study on auditory-kinesthetic learning strategy has restricted empirical evidence on how particular components like auditory-kinesthetic learning strategy impacted greatly to improve vocabulary development, reading comprehension, reading speed, and fluency in limited-resource multilingual classrooms, typically in Kaduna-South. Thus, technology-based instruction has integrated auditory and kinesthetic learning in language learning with highly significant effect to enhance reading comprehension and speed performance. Here, digital learning resources such as interactive reading applications provide the second language learners with effective learning strategies to interact with reading comprehension texts through auditory and kinesthetic learning pathways so as to be able to personalize language learning experiences (Liu & Pei, 2021). However, there is insufficient site-specific data that examines how technology-based instruction through auditory-kinesthetic strategy can practically be utilized and implemented in second language settings, especially in low-tech primary schools in Kaduna-South.

The implementation of technology-based instruction will provide a workable solution to enhance vocabulary development, reading comprehension, and speed among primary pupils by building digital pedagogy on language learning (Kaya, 2023). Thus, Kusumawarti, Subiyantoro & Rukayah (2020) confirmed that auditory-kinesthetic instruction had significant effects in enhancing positive reading habits and pupils' performances using interactive reading tools. However, limited local studies have examined the significant effects of integrating auditory-kinesthetic learning strategy with technology-based instruction in multilingual second language settings on primary pupils' reading programs. Thus, this has left

a major research gap in implementing technology-based instruction through auditory-kinesthetic learning strategy.

Therefore, the present study intends to find out the effects of innovative approaches in addressing pupils' reading comprehension challenges by examining the effects of technology-based instruction using the auditory-kinesthetic learning strategy on reading comprehension and speed. Lastly, this study attempts to significantly contribute to inclusive second language teaching practices worldwide, which particularly offer contextually relevant information on cost-efficient options of digital language resources that can enhance primary school pupils' reading performance outcomes in diverse and limited digital resource-constrained classroom settings.

Many second language and multilingual learners have limited exposure to learning the English language through digital resources in order to support their productive and receptive skills (Rao, 2024). This gap has provided essential evidence for teaching English as a second language in under-resourced learning settings where poor access to high-quality digital resources and effective language instruction were inconsistent. There is a problem of implementing technology-based instruction through an auditory-kinesthetic learning strategy to teach primary III pupils reading comprehension for reading speed. This is a seriously challenging issue of inadequate digital language resources, electricity failure, and unstable internet access designed to support the program. It is also found that many second language teachers are not professional in handling technology integration into teaching and learning through auditory-kinesthetic design due to the inadequacy of second language teachers' training in multisensory language instruction. This could not lead the second language teachers to effectively measure pupils' reading comprehension progress in terms of fluency, speed, and vocabulary development through technology-based instruction. It is realized that many pupils have serious challenges in reading comprehension, vocabulary development, and reading speed and fluency efficiently due to overreliance on conventional reading instructional approaches in the diverse language learning situation, which leads to slow learning progress, especially among multilingual Kaduna-South second language learners (Peng, 2024). As a result of effective technological integration in language education, therefore, the study attempts to explore the issues of auditory and kinesthetic learning integration into digital language resources to enhance reading comprehension for reading speed among Primary III pupils in Kaduna South (Oladele, 2024).

1.1 Research Questions

1. What is the effect of technology-based instruction in improving critical thinking skills using auditory-kinesthetic learning strategy on teaching reading comprehension for reading speed?
2. What is the effect technology-based instruction in enhancing text analysis using auditory-kinesthetic learning strategy on teaching reading comprehension for reading speed?
3. What is the effect of technology-based instruction in providing personalized reading practice using auditory-kinesthetic learning strategy on teaching reading comprehension for reading speed?

1.2 Research Hypotheses

1. There is no significant effect in technology-based instruction on improving critical thinking skills using auditory-kinesthetic learning strategy on teaching reading comprehension for reading speed.
2. There is no significant effect in technology-based instruction on enhancing text analysis using auditory-kinesthetic learning strategy on teaching reading comprehension for reading speed.
3. There is no significant effect in technology-based instruction on providing personalized reading practice using auditory-kinesthetic learning strategy on teaching reading comprehension for reading speed.

2. Literature Review

Application of technology-based instruction through auditory-kinesthetic strategy is provided to be effective in enhancing critical thinking skills during reading comprehension and speed exercises. In a study carried out by Hazaymeh & Khasawneh (2025) on second English language learners, they discovered that the auditory-kinesthetic strategy significantly improved students' reading comprehension and fluency. The findings of the study provided a positive connection between students' comprehension skills and reading fluency skills favorably by integrating auditory-kinesthetic strategy in teaching the concept. In a similar vein, Pabito & Santos (2023) applied technology-based through auditory-kinesthetic strategy with fourth-graders facing reading challenges. The strategy has led to significant improvements in pupils' reading comprehension and speed performances. Thus, the study underscored how auditory-kinesthetic strategy enhances pupils' language learning motivation, problem-solving and critical thinking skills.

Eulerich, Masli, Pickerd & Wood, (2022) opined technology-based using auditory-kinesthetic strategy as a read-aloud device with eye tracking that incorporate auditory and kinesthetic reading feedback. For Eulerich, Masli, Pickerd & Wood (2022), this digital resource has significant impacts in a 24% reading comprehension performances progress most especially for second language learners with reading comprehension challenges. It is realized that technology-based instruction through auditory-kinesthetic strategy has fostered pupils with deeper reading engagement with texts. According to Latifaj, Shabani & Latifaj (2023), the field of text analysis has also greatly benefited from auditory-kinesthetic techniques, which points out the significant application of using technology-based through auditory-kinesthetic strategy in teaching phonics to bilingual beginning readers. This study confirmed that the auditory-kinesthetic strategy has effectively tackled reading comprehension and speed challenges, which are related to decoding and fluent reading skills. Moreover, technology-based instruction has actively engaged students with dynamic learning styles in order to enhance their learning ability to analyze and comprehend given texts in depth. In addition, the use of technology-based instruction through auditory-kinesthetic strategy for early language learners has a link to improving pupils' text analysis skills. This skill will enhance pupils' reading comprehension and speed by using multisensory instruction through auditory-kinesthetic strategy to more effectively comprehend textual information in order to make it easier for them to grasp and process written information.

Kalyani (2024) highlights the significant role of technology-based instruction through auditory-kinesthetic strategy in supporting personalized learning that is designed for

students' unique learning needs. Thus, Kalyani (2024) opines that the effect of digital reading resources on pupils' reading comprehension has engaged pupils with technology-based instruction to significantly improve reading comprehension and speed performance. Thus, the app has significantly improved second language learners' reading literacy skills, critical thinking skills, and ability to analyze the text through interactive language activities and audio-visual instructional materials. This emphasized the significance of integrating auditory-kinesthetic strategy to enhance second language learning through diverse linguistic learning styles. The study varies in different aspects of technology-based teaching even though it shares some common findings. Kalyani (2024) explored how digital language resources can be utilized to teach reading comprehension according to students' skill levels. It is argued that personalized learning of reading comprehension is very important to enhance understanding of word meanings. In contrast, Quimsing & Ortega-Dela Cruz (2024) looked at technology-based instruction, which suggests that integrating auditory-kinesthetic strategy simultaneously improved students' reading comprehension ability and new word retention.

For Faza & Lestari (2025), the concept of self-regulated learning is the key outcome of digital language resources interventions. The study posits that technology-based instruction attempts to improve second language learners' reading comprehension abilities to organize, monitor, and evaluate their learning processes. This stresses the idea of teaching second languages using metacognitive approach and digital resources into reading comprehension and speed instruction. Moreover, Faza & Lestari (2025) examined the effects of technology-based instructions to enhance reading comprehension of the early grade second-language learners. This has proved that technology-based fostered self-regulated learning by providing immediate feedback and personalized learning pathways. This supports the idea that auditory-kinesthetic strategy simultaneously individualizes reading instruction and supports pupils to take control of their reading comprehension performances. In this regard, auditory-kinesthetic strategy simultaneously has personalized pupils' reading comprehension and speed practices in which technology-based reading instruction enhances vocabulary, words retention and pronunciation practice through auditory-kinesthetic strategy simultaneously.

2.1 Theoretical Framework

This study is built based on the Paivio (2014)'s Dual Coding Theory which supported the study of technology-based instruction through auditory-kinesthetic learning strategy in teaching reading comprehension for reading speed. The theory suggested that the integration of auditory and kinesthetic learning strategy helps learners to process language through verbal and non-verbal means of communication. This theory supports that auditory-kinesthetic learning strategy strengthens learners to develop their memory, activate their cognitive learning pathways, facilitate better retention, and improve analysis of text. The theory also aligns with the objectives of the study which attempts to improve learners' critical thinking skills, text analysis, and personalized reading practice through application of auditory-kinesthetic learning strategy in teaching reading comprehension for reading speed.

2.2 The Conceptual Framework

The study focuses on teaching reading comprehension for reading speed through the use of technology-based auditory-kinesthetic learning strategies. Application of language digital resources to engage multisensory pathways in the reading process is known as technology-based instruction. According to Balalle (2024), technology-based instruction improves

learners' engagement and retention by facilitating individualized and interactive learning experiences. Here, technology-based instruction through auditory-kinesthetic learning strategy is an important language learning instruction that enhances reading comprehension ability and speed among primary school pupils (Samarasekera, Nyoni, Amaral, & Grant, 2022). In this regard, technology-based instruction can be used to enhance pupils' cognitive abilities by integrating refined learning conditions. This anchored the Gardner's (1983) in Mehiri (2020), Multiple Intelligence Theory that supports engaging multiple learning pathways. It is obviously noted that Nigerian pupils demonstrate strengths in musical-rhythmic and bodily-kinesthetic domains (Nwankwoala, 2021). In support of Paivio's Dual Coding Theory, this suggested that linguistic information is usually processed through multiple channels to create stronger memory traces and enhance reading comprehension and vocabulary retention (Noor-ul-Ain & Pervaiz, 2023), while Vygotsky's sociocultural perspective pointed out that there is importance of cultural context in language learning. In second language learning, the auditory pathway includes digital phonemic awareness resources, which improve second language learners' decoding accuracy (Naeem & Khan, 2024); paced audio reading materials are particularly beneficial for multilingual learners (Bruggink, Swart, van der Lee & Segers, 2022); and prosodic modeling technologies are used to enhance second language learners' rhythm and intonation awareness (Yang, & Yan, 2022). In respect to kinesthetic strategy, second language learning has encompassed gesture-based comprehension to improve information recall in a language classroom (Bruggink, Swart, van der Lee & Segers, 2022); rhythmic reading activities influence Nigeria's cultural traditions (Yahi, 2024); and interactive manipulation through digital interfaces (Charitonidou, 2022).

Thus, technology-based instruction through auditory-kinesthetic learning strategies enhances reading comprehension performance by developing automaticity using cognitive resources for comprehension (Fujita, 2024); by improving working memory through distributed language processing (Henry, Christopher, Chiat & Messer, 2022); by increasing engagement with interactive technologies (Getenet & Tualaulelei, 2023); and by developing metacognitive strategies for reading comprehension monitoring (Fadilah, Ridwan, Putri, & Prayoga, 2021). Therefore, second language teachers are required to more effectively use auditory-kinesthetic strategy to support second language learners in developing their reading fluency, speed, and reading comprehension, especially in diverse multilingual classroom settings (Wang & Fang, 2022). Thus, the integration of all technology-based instruction through auditory-kinesthetic strategy will improve second language learners' cognitive ability in order to enhance reading comprehension and speed performance.

3. Research Methodology

3.1 Research Design

The study employed a quasi-experimental design of non-equivalent and non-randomized pre-test, post-test control groups. This design was suitable for investigating a technology-based auditory-kinesthetic learning strategy within the actual language classroom, where random assignment has become difficult and challenging to implement. The design allowed the researcher to provide a balance between two groups (the experimental group and the control group). The population of the study was made up of 7,765 Primary III pupils from 36 public primary schools within the Kaduna South Local Government Area of the state. The study selected 114 primary III pupils of the two groups using a purposive sampling technique.

The study used purposive sampling to assign experimental and control groups because only specific Primary III pupils were purposefully selected based on accessibility and availability of the digital resources. A total of 56 pupils were placed in the experimental group, while 58 pupils were assigned to the control group. Data collection for this study was conducted using technology-based auditory-kinesthetic instruments: the Digital Whiteboards (DW), the Gesture-Based Learning Platform (GBLP), and the Real-Time-Reading-Speed Test.

The Digital Whiteboards (DW) were used to measure pupils' critical thinking skills and text analysis, while Gesture-Based Learning Platforms (GBLP) were used to evaluate pupils' reading comprehension, reading speed, and personalized reading practices. The Read-Time-Reading-Speed Test was used to measure pupils' ability in reading speed and comprehension, which offered a comprehensive, detailed performance analysis and compared the performance of the participants in order to establish benchmarks. The researcher carried out a pilot test with 10 Primary III pupils of LGEA Kagoro Road Primary School in order to ensure the reliability and validity of the research instruments for effective data collection. The results of the test found a Cronbach's alpha of 0.82 for DW and 0.79 for GBLP. This proved actual internal consistency and test reliability.

For the data analysis, the study used descriptive statistics (mean and standard deviation) to answer the research questions. While an independent samples t-test was used to test the hypotheses, which attempted to compare the experimental and the control groups' pre-test and post-test scores. Despite the limitations, the non-random selection of the Primary III pupils had limited the generalization of the major findings to other populations since the small sample size of 114 pupils out of 7,765 reduced the statistical influence. There is possible implementation bias that occurred in the course of this study due to the second language teacher's proficiency and pupils' familiarity with technology-based auditory-kinesthetic instruments.

3.2 Procedure of Data Collection

The following steps were used to observe the procedure of data collection using the Digital Whiteboards (DW) and Gesture-Based Learning Platforms (GBLP) to assess pupils' performance in using technology-based instruction through auditory-kinesthetic learning strategy on reading comprehension for reading speed. The researcher used Digital Whiteboards (DW) and Gesture-Based Learning Platforms (GBLP) to measure pupils' improvement of critical thinking skills, text analysis, and personalized reading practice in reading comprehension for reading speed while using auditory-kinesthetic learning strategy.

At the preliminary stage of the assessment of the instruments, the researcher used the Digital Whiteboards (DW) instrument to measure pupils' critical thinking skills and text analysis. He also used a Gesture-Based Learning Platform (GBLP) instrument to assess pupils' reading comprehension performance, reading speed performance, and personalized reading practices. The researcher selected the relevant whiteboard resource to present the lesson. He also provided the digital whiteboard that supports text annotation and interactive reading exercises. The researcher uploaded reading passages on the whiteboard by inserting interactive text features to facilitate the text analysis. He included audio narration for auditory support and formulated multiple-choice and short-answer questions to facilitate critical thinking. The researcher uploaded the passages and set up time for reading passages. He used gesture to monitor pupils' eye-tracking, finger-scrolling speed, and head movement

while reading in order to facilitate critical thinking skills. He measured how long it takes each pupil to complete reading a passage and tracked oral reading speed to facilitate personalized reading practices. The researcher observed how pupils interact with the text in order to facilitate critical thinking skills and text analysis. He recorded reading speed levels to facilitate personalized reading practices and saved each pupil's reading session for further analysis.

3.3 Data Analysis

Descriptive statistics were used to answer the research questions, while an independent t-test was used to test and analyze the hypotheses.

4. Results

This section presents results and discussions of the findings based on the research questions and hypotheses stated. The experimental group and the control groups' performance scores were analyzed to answer the research questions using descriptive statistics (mean and standard deviation). While an independent samples t-test was used to test the hypotheses at the 0.005 level of significance. Therefore, the mean scores of the two groups (the experimental group and the control group) were used to determine the performance of the experimental group while receiving technology-based auditory-kinesthetic treatment and the performance of the control group taught using conventional teaching methods.

4.1 Answering Research Questions

This presents the responses of the research questions one to three in which they were subjected to descriptive statistics-mean and standard deviation.

4.1.1 Research Question 1:

What is the effect of technology-based instruction in improving critical thinking skills using auditory-kinesthetic learning strategy on teaching reading comprehension for reading speed? To determine the effect of technology-based instruction in improving critical thinking skills using auditory-kinesthetic learning strategy on teaching reading comprehension for reading speed, the Read-Time-Reading-Speed Test was administered and the results were presented in Table 1.

Table 1: TBMI with AKLS to Improve Critical Thinking

Groups	N	Mean	Std.Dev	Mean Difference	Standard Error Mean
Experimental	56	27.06	14.96	10.43	6.53
Control	58	16.63	8.43		

Results from Table 1 revealed that is an impact of technology-based instruction in improving critical thinking skills using auditory-kinesthetic learning strategy on teaching reading comprehension for reading speed of primary III pupils of Kaduna South LGA. The mean performance score for the experimental group was (M = 27.06, SD = 14.96) which is greater than that of the control group at (M = 16.63, SD = 8.43). The mean difference between the experimental and control groups was at 10.43. Therefore, this proved that technology-based instruction through application of auditory-kinesthetic learning strategy in teaching reading comprehension for reading speed has significantly improved primary III pupils' critical thinking skills.

4.1.2 Research Question 2:

What is the effect technology-based instruction in enhancing text analysis using auditory-kinesthetic learning strategy on teaching reading comprehension for reading speed? To determine the effect technology-based instruction in enhancing text analysis using auditory-kinesthetic learning strategy on teaching reading comprehension for reading speed, the Read-Time-Reading-Speed Test was administered and the results were presented in Table 2.

Table 2: TBMI in Enhancing Text Analysis Using AKLS

Groups	N	Mean	Std.Dev	Mean Difference	Standard Error Mean
Experimental	56	28.64	4.91	2.51	2.36
Control	58	26.13	2.55		

Results from Table 2 revealed that is an impact of effect technology-based instruction in enhancing text analysis using auditory-kinesthetic learning strategy on teaching reading comprehension for reading speed of primary III pupils of Kaduna South LGA. The mean performance score for the experimental group was (M = 28.64, SD = 4.91) which is greater than that of the control group at (M = 26.13, SD = 2.55). The mean difference between the experimental and control groups was at 2.51. Therefore, this proved that technology-based instruction in teaching reading comprehension for reading speed has significantly enhanced primary III pupils' ability of text analysis by using auditory-kinesthetic learning strategy.

4.1.3 Research Question 3:

What is the effect of technology-based instruction in providing personalized reading practice using auditory-kinesthetic learning strategy on teaching reading comprehension for reading speed? To determine the effect of technology-based instruction in providing personalized reading practice using auditory-kinesthetic learning strategy on teaching reading comprehension for reading speed, the Read-Time-Reading-Speed Test was administered and the results were presented in Table 3.

Table 3: TBMI in Providing Personalized Reading Practice Using AKLS

Groups	N	Mean	Std.Dev	Mean Difference	Standard Error Mean
Experimental	56	28.41	8.09	2.74	1.77
Control	58	25.67	6.39		

Results from Table 3 showed that is an impact technology-based instruction in providing personalized reading practice using auditory-kinesthetic learning strategy on teaching reading comprehension for reading speed of primary III pupils of Kaduna South LGA. The mean performance score for the experimental group was (M = 28.41, SD = 8.09) which is greater than that of the control group at (M = 25.67, SD = 6.39). The mean difference between the experimental and control groups was at 2.74. Therefore, this proved that technology-based instruction in teaching reading comprehension for reading speed has significantly improved primary III pupils' personalized reading practice through application of auditory-kinesthetic learning strategy.

4.2 Testing Research Hypotheses

The hypotheses were formulated to determine the significant effect of the studied variables on the effects of Technology-Based Auditory-Kinesthetic Strategy on reading speed of Primary III pupils. Therefore, the hypotheses formulated consisted of three (3) Null Hypotheses that were tested using independent samples t-test. These are as follows:

4.2.1 Null Hypothesis 1:

H_{01}: There is no significant effect in technology-based instruction on improving critical thinking skills using auditory-kinesthetic learning strategy on teaching reading comprehension for reading speed. The independent samples t-test was used to test the null hypothesis at P≤0.005 as presented in Table 4.

Table 4: TBMI with AKLS to Improve Critical Thinking

Groups	N	Mean	Std.Dev	Df	t_{Cal}	P-Value	Remark
Experimental	56	27.06	14.96	112	3.65	0.001	
Control	58	16.63	8.43				

Table 4 revealed that there was a statistically significant effect in technology-based instruction on improving critical thinking skills using auditory-kinesthetic learning strategy on teaching reading comprehension for reading speed. The t-calculated was found at 3.65, and p-value at 0.001. Therefore, the hypothesis stated that, there is no significant effect in technology-based instruction on improving critical thinking skills using auditory-kinesthetic learning strategy on teaching reading comprehension for reading speed was rejected. The result has statistically indicated that the technology-based instruction in teaching reading comprehension for reading speed improved primary III pupils' critical thinking skills using auditory-kinesthetic learning strategy.

4.2.2 Null Hypothesis 2:

H_{02}: There is no significant effect in technology-based instruction on enhancing text analysis using auditory-kinesthetic learning strategy on teaching reading comprehension for reading speed. The independent samples t-test was used to test the null hypothesis at P≤0.005 as presented in Table 5.

Table 5: TBMI in Enhancing Text Analysis Using AKLS

Groups	N	Mean	Std.Dev	Df	t_{Cal}	P-Value	Remark
Experimental	56	28.64	4.91	112	1.95	0.000	
Control	58	26.13	2.55				

Table 5 revealed that there was a statistically significant effect in technology-based instruction on enhancing text analysis using auditory-kinesthetic learning strategy on teaching reading comprehension for reading speed. The t-calculated was found at 1.95 and p-value at 0.000. Therefore, the hypothesis stated that, there is no significant effect in technology-based instruction on enhancing text analysis using auditory-kinesthetic learning strategy on teaching reading comprehension for reading speed was rejected. The result has statistically indicated that the technology-based instruction in teaching reading comprehension for reading speed improved primary III pupils' ability in text analysis using auditory-kinesthetic learning strategy.

4.2.3 Null Hypothesis 3:

H_{03}: There is no significant effect in technology-based instruction on providing personalized reading practice using auditory-kinesthetic learning strategy on teaching reading comprehension for reading speed. The independent samples t-test was used to test the null hypothesis at P≤0.005 as presented in Table 6.

Table 6: TBMI in Providing Personalized Reading Practice Using AKLS

Groups	N	Mean	Std.Dev	Df	t_{Cal}	P-Value	Remark
Experimental	56	28.41	8.09	112	2.00	0.004	
Control	58	25.67	6.39				

Table 6 revealed that there was a statistically significant effect in technology-based instruction on providing personalized reading practice using auditory-kinesthetic learning strategy on teaching reading comprehension for reading speed. The t-calculated was found at 2.00 and p-value at 0.004. Therefore, the hypothesis stated that, there is no significant effect in technology-based instruction on providing personalized reading practice using auditory-kinesthetic learning strategy on teaching reading comprehension for reading speed was rejected. The result has statistically indicated that the technology-based instruction in teaching reading comprehension for reading speed provide primary III pupils with the opportunity to personalize reading practice using auditory-kinesthetic learning strategy.

5. Discussion

Technology-based instruction in teaching reading comprehension for reading speed through auditory-kinesthetic learning strategy is very important language and literacy instruction, especially at the early stage. This makes this study to find out the effect of technology-based instruction in order to help Primary III pupils improve their critical thinking skills, enhance their ability in text analysis, and provide them with the ability to personalize their reading practice through the application of auditory-kinesthetic learning strategy in teaching reading comprehension for reading speed. The findings of the study indicated that technology-based instruction in teaching reading comprehension for reading speed improved primary III pupils' critical thinking skills using an auditory-kinesthetic learning strategy. This showed that digital teaching of reading speed through application of digital language resources through the visual-kinesthetic learning strategy had significantly improved Primary III critical thinking skills. The above idea concurred with a recent study that suggested that digital language resources in the teaching of reading speed improve pupils' ability to pronounce words accurately, maintain appropriate pacing, and express ideas in the target language effectively (Li & Lan, 2022). In this regard, digital language resources have provided second language learners with an opportunity to engage with visual-kinesthetic learning experiences through animated storybooks and guided read-aloud in order to support visual and kinesthetic learners (Gagić, Gajić, Gavranović, & Maenza, 2023). The study had significantly improved their critical thinking skills while reading speed exercises compared to that of the control group. This confirmed that digital language teaching facilitates reading speed skills and development in order to understand effectively. The finding supports the argument that visual and kinesthetic reinforcement strengthens cognitive retention and reading proficiency (Fujita, 2024). Therefore, this strategy improved the pupils' critical thinking and reading

performance, particularly in reading tests, and improved their levels of reading a required text fast by attaining a proper level of comprehension.

In addition, the study further revealed that technology-based instruction in teaching reading comprehension for reading speed significantly improved primary III pupils' ability in text analysis using an auditory-kinesthetic learning strategy. In this regard, the interactive reading activities through digital language tools had significantly enhanced pupils' ability to analyze a given text for effective reading comprehension and speed exercises. Thus, digital language tools such as interactive e-books and text-to-speech applications have promoted pupils' learning engagement and exposure to text analysis, which are critical for reading speed development (Judijanto & Rusiadi, 2024). For the sake of the present study, the experimental group had performed better than that of the control group in text analysis activities. This recent study suggested that learning feedback and text interaction have significantly supported greater text comprehension and reading speed gains among the second language learners (Yang, Chiu & Yan, 2021). This concurred with recent findings that indicated that using an auditory-kinesthetic learning strategy had significantly supported second language learners in tracing difficult words and using motion-based learning resources to enhance memory retention and word recognition (Vas & Sharma, 2025). Therefore, integrating digital language interactive resources within reading instruction improves pupils' ability to analyze a given text, infer meaning of a text, understand connotative and denotative meanings, familiarize themselves with word meanings, and comprehend text.

The findings of the study also proved that technology-based instruction in teaching reading comprehension for reading speed provided primary III pupils with the opportunity to personalize reading practice using an auditory-kinesthetic learning strategy. The results of the present study suggested that learning assessment and feedback had positively provided primary III pupils with the opportunity to personalize reading practice using an auditory-kinesthetic learning strategy. Here, the findings of the study have shown that language assessments through digital auditory-kinesthetic learning strategies provide second language learners with immediate feedback, which enables them to track and measure their reading speed performances in order to adjust their reading strategies accordingly (Bakkouche & Saito, 2025). Thus, the present study had significantly improved reading speed through reading comprehension in a way that digital auditory-kinesthetic learning strategy feedback provided primary III pupils with the opportunities to personalize their reading practice by identifying reading errors and receiving effective corrective feedback (Romig, & Jetton, 2023). In addition, the application of the auditory-kinesthetic learning strategy has provided second language learners with interactive mechanisms and movement-based reading exercises that support pupils to personalize reading practice, thereby enhancing their critical thinking skills through reading motivation and comprehension (Chidingozi & Eke, (2025). Therefore, the study had emphasized the significance of integrating auditory-kinesthetic learning strategies into adaptive learning technologies in order to support personalized pupils' language assessments and scaffold support to optimize reading comprehension for reading speed.

6. Conclusion

This study investigated the effect of technology-based instruction through auditory-kinesthetic learning strategy to enhance reading comprehension and speed among Primary

III pupils in Kaduna South. The study centered on only three main areas, which include improving critical thinking, developing the ability of text analysis skills, and personalized reading comprehension activities through technology-based auditory-kinesthetic instruction. The findings of the study showed a significant improvement in pupils' cognitive and interpretive abilities when exposed to technology-based instruction using a digital auditory-kinesthetic strategy. Here, pupils had demonstrated a strong ability to engage with texts and analyze their content effectively through interactive reading practices that required immediate feedback and auditory-kinesthetic learning engagement. Incorporating digital resources through an auditory-kinesthetic learning strategy has shown significant strength in the area of second language learning. The study validated the effect of technology-based instruction through an auditory-kinesthetic learning strategy that offered meaningful reading engagement, particularly in multilingual settings.

The practical implications of the study findings emphasized the need to utilize and incorporate digital auditory-kinesthetic teaching resources into primary school literacy classrooms. The curriculum developers and policymakers would use the results of this study to entrench technology-based instruction through auditory-kinesthetic learning strategy into the primary school reading curricula. Policy frameworks would ensure equitable provision of digital resources in primary schools to promote inclusive learning. Educational technologists and content developers are very important to design and develop digital language learning platforms that are linguistically appropriate and culturally relevant to Nigerian pupils. School administrators and management would strive to ensure that the necessary school infrastructure (tablets, interactive whiteboards, and laptops) would be provided to maximize the significant effect of technology-based auditory-kinesthetic instruction as recognized in this study. Additionally, parents and guardians in this direction would be involved where they should motivate their children to rigorously utilize technology-based resources at home. Therefore, the use of a technology-based auditory-kinesthetic strategy has proven to significantly improve reading speed, vocabulary development, and comprehension. The study had presented the need for stakeholders to implement technology-based instruction through auditory-kinesthetic learning strategies as an effort to change the system of literacy education, especially in resource-limited and diverse multilingual contexts like in Kaduna State.

Future research should attempt to investigate the effects of the long-term impact of digital learning resources on reading comprehension, fluency, and speed beyond Primary III pupils by considering their levels, language background, different age groups, learning styles, and abilities. Another study would be carried out to compare visual-kinesthetic strategies with other multimodal instructional approaches in order to enhance reading comprehension strategies. Further investigation into second language teachers' professional development in integrating digital language learning tools for vocabulary development, reading comprehension, fluency, and speed instruction is so much needed across the primary education levels in order to strengthen early language and literacy skills. Research should also be conducted to investigate parental involvement in second language teaching and learning using digital-based vocabulary development, reading comprehension, fluency, and speed instruction through flipped language learning at home. Finally, a study should be conducted on the disparities in access to digital learning resources between rural and urban language learners as a comparative study.

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