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EFFECT OF ASSISTIVE TECHNOLOGY FOR DYSLEXIA ON STUDENTS' PERFORMANCE AND RETENTION IN READING IN PORT HARCOURT METROPOLIS, RIVERS STATE

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ABSTRACT
This study aimed to investigate the effect of assistive technology for dyslexia on secondary school students' performance and retention in Reading in Port Harcourt Metropolis, Rivers State by comparing it with collaborative and discussion instructional strategies. The study was guided by three research questions with corresponding hypotheses formulated in line with the objectives of the study. The design of the study was quasi-experimental and the population comprised two hundred and five (205) senior secondary school students one (S.S.1) in selected public secondary schools in Port Harcourt Metropolis. The sample size was two hundred and five (205) senior secondary school one (S.S.1) dyslexic students in Port Harcourt Metropolis, Rivers State. They were chosen through the census sampling technique. Experimental group 1 (N=60) was exposed to assistive technology, experimental group 2 (N=57) was exposed to collaborative instructional strategy and the control group (N=88) was taught through the discussion method. Data was collected through pre-test, post-tests and retention tests. Data were analyzed using Analysis of Covariance (ANCOVA). Findings showed that the performance of dyslexic students taught reading comprehension using assistive technology instructional strategy is higher than those of their counterparts taught using collaborative learning and discussion instructional strategies. Also, there was a significant difference in the effect of instructional strategy on the performance and retention of dyslexic students in reading and female dyslexic students taught Reading Comprehension performed slightly better than their male counterparts did. The study concluded that assistive technology instructional strategy requires students to participate in a collaborative setting, whereas collaborative learning and discussion require individuals to work together on self-directed tasks. Hence, it was recommended amongst others that government should provide assistive technology free of charge to dyslexic students to help them participate fully in the teaching and learning process, as well as influence their performance in Reading Comprehension.

KEYWORDS: *Technology, Assistive Technology, Learning Disability, Dyslexia, Academic Performance, Retention, English Language*

INTRODUCTION

Language is the principal method of human communication, consisting of words used in a structured and conventional way and conveyed by speech, writing, or gesture. It plays a central role in the human brain, from how we process colours to how we make moral judgments. It directs how we allocate visual attention, construe and remember events, categorize objects, encode smells and musical tones and stay oriented. Put simply, one cannot understand the human brain without understanding the contributions of language, both in the moment of thinking and as a formative force during earlier learning and experience. Exposure to written language restructures the brain, even when acquired late in life. There are different aspects of language but this study explored an aspect of language called Psycholinguistics.

Psycholinguistics is the study of the mental aspects of language and speech. It is primarily concerned with the ways in which language is represented and processed in the brain. Psycholinguistics is part of the field of cognitive science. According to David Carrol in "Psychology of Language," At its heart, psycholinguistic work consists of two questions. What knowledge of language is needed for us to use language? In a sense, we must know a language to use it. What cognitive processes are involved in the ordinary use of language? By 'ordinary use of language,' the researcher means such things as understanding a lecture, reading a book, writing a letter, and holding a conversation. By cognitive processes,' the researcher means processes such as perception, performance, memory,

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retention and thinking. Although students do few things as often or as easily as speaking and listening, we noticed that considerable cognitive processing is going on during those activities. The researcher, therefore, investigated the language and brain of dyslexic students in Reading as one of the language skills, utilizing assistive technology as seen in the National Policy on Education.

The National Policy on Education stipulated under special educational needs that schools shall be required to arrange regular sensory, medical and psychological screening assessments to identify any incidence of disability such as dyslexia, autism, dyscalculia, aphasia, dysgraphia, dyspraxia, attention deficit hyperactivity disorder (ADHD), etc. This is to enable students with learning disabilities to fully contribute their quota to national development.

The English language plays an essential role in communication and it becomes an indispensable tool for communication in various aspects of society, economy, and culture. The English language is widely used in our daily lives and it is necessary to use effective pedagogies in its delivery as a subject in schools. Under the New National English Curriculum Standards, students living with dyslexia should be encouraged to interact with a lot of English Reading software and also to use emerging technologies. Technology can help students of all ages work around their reading challenges.

Assistive technology is defined as any tool, device, or item designed to help people with learning disabilities perform better and encourage them to become more independent and self-reliant such as Reading, taking notes, Mathematics, organizing ideas, managing time, Writing, Spelling, etc. Many assistive technological tools work on digital devices but some of the most useful tools are not digital. Assistive technology can play an important role in special education because many students with disabilities need special instructional treatment. Assistive technology for dyslexia like Read Out Loud, dyslexiaquest, optical readers, smart pens, text-to-speech, speech-to-text, amplification systems, audiobooks, grammar check software, magnification and tracking supports. Text-to-speech and audiobooks are two examples of assistive technology for reading. For students who struggle to read text, technology can be a lifeline for them. An audiobook, for instance, allows them to read a story they might not be able to read with a traditional book. A highlighter can make a text passage understandable.

STATEMENT OF THE PROBLEM

Personal observation has shown that school administrators and teachers rarely identify students living with dyslexia on time. According to available research, dyslexic students frequently experience taunts, bullying, and other forms of abuse from both peers and teachers, which can make the learning environment for them intolerable. Students who are unable to read or write correctly are often times subjected to derogatory labels such as stupid, lazy, fool, and slow learner, from both teachers and other students. These students who bring dysfunctional language skills into the classroom setting go unnoticed, ignored, or wished away by the unequipped and de-motivated teachers. Dyslexics perhaps show an inability to hold information in a retrievable form for the task at hand, a high proportion of errors in oral reading, difficulty in extracting the sense from written material without substantial re-reading, omission of words, a high degree of distractibility when reading and weak phonological awareness. Due to the stigma attached to dyslexia, lack of awareness, absence of early assessment, and very few qualified remedial teachers, many children are left at risk of dropping out of school, and subsequently facing social exclusion. Despite the possible contribution of dyslexia to the poor performance of the English language in the country, there is limited research on the extent to which dyslexia affects learning in Nigerian schools. It is against this backdrop that this study explored the effect of assistive technology on dyslexic students' performance and retention. It also explored classroom practices in this regard via assistive technology. Dyslexics are being deprived of a proper learning environment where appropriate digital learning tools are utilized. This study addressed this gap.

AIM AND OBJECTIVES OF THE STUDY

This study aimed at investigating the effect of assistive technology for dyslexia on secondary school students' performance and retention in Reading in Port Harcourt Metropolis, Rivers State. The specific objectives of the study were to;

1. Investigate the effect of assistive technology, collaborative learning and discussion method on the performance of dyslexic students in Reading.
2. Determine the effect of assistive technology, collaborative learning and discussion method on the retention of dyslexic students in Reading.
3. Examine the influence of gender on the performance of dyslexic students in Reading.

RESEARCH QUESTIONS

The understated research questions guided this study:

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1. What is the effect of assistive technology, collaborative learning and discussion method on the performance of dyslexic students in Reading?
2. What is the effect of assistive technology, collaborative learning and discussion method on the retention of dyslexic students in Reading?
3. What is the gender effect on the performance of dyslexic students in Reading?

HYPOTHESES

For this study to establish and determine the stated objectives, research hypotheses that are testable and analyzable based on data collected therefore need to be formulated. The following research hypotheses were formulated to guide the study.

$H0_1$: There is no significant difference among dyslexic students taught using assistive technology, collaborative learning and discussion method in their performance in Reading.

$H0_2$: There is no significant difference among dyslexic students taught using assistive technology, collaborative learning and discussion method in their retention of Reading.

$H0_3$: There is no significant difference between the performance of male and female dyslexic students in Reading.

SIGNIFICANCE OF THE STUDY

This study will be beneficial to special educational needs teachers in secondary schools if they adhere to the hybrid learning approach of the 21st century which is the integration of assistive technology into teaching and learning. Teachers will understand that their duty has changed from "one who knows all" to a facilitator who is also a student in the learning process. The Special Educational Needs (SEN) teachers also knew that one size does not fit all and differentiated the learning of the dyslexics based on their abilities. This study created awareness of the need for SEN teachers to upgrade themselves and also integrate emerging technologies into their lessons. Based on the International Society for Technology in Education (ISTE) there are responsibilities stipulated for teachers such as teachers should engage in professional development and leadership, demonstrating computer-age work and learning, facilitate and show computer citizenship and responsibility. The teachers mentioned here include; English language teachers, English lecturers, primary school teachers, secondary school teachers and speech pathologists/therapists. More so, the utilization of assistive technology for Reading Comprehension can serve as a catalyst for English language teachers to emulate. It can also guide them on a better approach to introducing dyslexics to Reading via assistive technology.

The findings of this study can as well improve dyslexics' knowledge of Reading and the importance of interactive learning which is trending globally. This study encouraged the students living with dyslexia to always be ready for Reading Comprehension lessons as it is full activity based which can arouse students' interest and led to better performance in speaking and reading skills. ISTE standards for students showed that students are encouraged to become knowledge constructors (find it), innovative designers (make it), computational thinkers (solve it), creative communicators (share it), global collaborators (connect it), empowered learners (use it), and a digital citizen (protect it). 2016 ISTE standards and 2018 students' readiness standards showed recent shifts in the field and are meant to equip learners for tomorrow. Interest and engagement which are two levels of interactivity via assistive technology were revealed to students living with dyslexia; it helped them judge their recent level so that they will re-adjust if actually they want to enjoy Reading via assistive technology.

METHODOLOGY

This study adopted a quasi-experimental nonequivalent pretest-posttest control group design to identify the effectiveness of assistive technology on dyslexic students learning performance and retention in Reading. This plan was viewed as most fitting since it was without randomization utilizing intact class. Dyslexic students that participated in this study got treatment in their various classes without reshuffling the class arrangement. (Nwankwo, 2016). The design is schematically represented as follows;

The design is schematically structured as:

E_1 0_1 X_1 $0_2 - 0_3$
E_2 0_1 X_2 $0_2 - 0_3$
……..
C 0_1 - 0_2 $- 0_3$

Where:

E_1 stands for experimental group 1.
E_2 stands for experimental group 2.
C shows the Control group that will not receive treatment but a conventional plan.

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0_1 denotes the pretest for each experimental group.
0_2 stands for posttest for all groups.
0_3 stands for post posttest for all groups.
X_1 stands for treatment for the experimental group1 (Assistive Technology Reading).
X_2 stands for treatment for experimental group 2 (Collaborative Learning Strategy).
….. denotes no treatment for the control group

The population of this study comprised two hundred and five (205) senior secondary school students one (S.S.1) in selected public secondary schools in Port Harcourt Metropolis. The sample size was two hundred and five (205) senior secondary school one (S.S.1) dyslexic students in Port Harcourt Metropolis, Rivers State. They were chosen through the census method or technique. This was done after the preliminary study to determine students that are dyslexic. The researcher used all the senior secondary students one (S.S.1) identified as dyslexic. Utilization of explicit qualities like web offices through computers, interactive whiteboards (IWB) smart boards, Ipads, (tablets) iPhones and smartphones. These gadgets served as a prerequisite to take the Reading Comprehension course utilizing assistive technology (Read-Out-Loud Speechify App) and the dyslexics must have access to the internet. Therefore, the experimental groups were made up of dyslexics who have smartphones; computers and can access the internet while the control group did not have access to the Read-Out-Loud Speechify App and the internet.

The criteria that were utilized for the proper representation of male and female dyslexic students were; public schools with ICT offices for Assistive Technology or strategy, consent of dyslexic students and trained and qualified Special Education Needs (SEN) facilitators. The instruments that were utilized to gather data for the study are: (1) Dyslexia Screening Questionnaire (DSQ). (2) Reading Performance Test (RPT) and Reading Retention Test (RRT). The research instruments were designed by the researcher and were validated by the researcher's supervisors, experts in Measurement and Evaluation and Language Education.

Dyslexia Screening Questionnaire (DSQ) was used as a preliminary study for identification of students with Dyslexia. Dyslexia Screening Questionnaire (DSQ) had four segments labeled alphabetically A, B, C, and D with 20 items (see Appendix). The dyslexics were permitted to demonstrate their level of acceptance or rejection on the number of positive and negative statements on Phonological awareness and Reading. Its questions probed dyslexics' skills, qualities, motivation, behaviour, and feelings. The researcher applied critical thinking skills to formulate the items which were relevant to ascertain the skills of the dyslexics. Section A was for demographic data which the dyslexic students wrote their names and gender. Secondly, Section B, C and D was on phonemic sounds, feelings, level of acceptance and rejection of the lessons taught and the method utilized for the lessons. Likert scale of Strongly Agree (SA), Agree (A), Disagree (D), and Strongly Disagree (SD) was utilized to score the response of the dyslexic students. The following values were allotted to the responses: SA = 4, A = 3, D = 2, SD = 1. The criterion that was utilized to access the dyslexic students' skills in Reading was the average of the response figures: (4+3+2+1)/4 = 10/4 = 2.5. In this way, dyslexic students that scored below 2.5 had poor Reading skills while dyslexic students that scored above 2.5 exhibited high Reading skills, meaning the absence of dyslexia. The instruments were given to two secondary school English Language teachers and an expert in measurement and evaluation for validation. The test-retest method was used to generate two sets of scores from students outside the sample of this study and the scores were correlated using the PPMC to determine their internal consistency. The reliability coefficients of the instruments were 0.89 for Dyslexia Screening Questionnaire (DSQ) and 0.77 for Reading Performance Test (RPT). The researcher carried out the data collection procedure in stages for three weeks. The researcher visited the selected schools for permission in using their students and some of the school facilities. Afterward, the dyslexic students were identified utilizing Dr Warren's Dyslexia Screening Questionnaire (DSQ). The control and experimental groups were exposed to Reading Performance Test (RPT) before the experimental treatment (pre-test). This is to empower the researcher to set up the standard information of the dyslexic students in the control and experimental groups before the learning environment changed from face-to-face to web-based learning for experimental group 1. The items from the instruments were reshuffled utilizing a yellow paper to print the questions but the content remained the same for the post-test and retention test. The data of the post-test and post-posttest were utilized for the study. The post-test was scored and used to generate quantitative data which was analyzed using Analysis of Covariance (ANCOVA). The significance level of 0.05 was used to test the null hypotheses.

RESULTS

Research Question One: What is the effect of assistive technology, collaborative learning and discussion method on the performance of dyslexic students in Reading?

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Table 1: Mean score and standard deviation of the effect of assistive technology, collaborative learning and discussion method on the performance of dyslexic students in Reading.

Instructional Strategies	n	Pretest		Posttest		Mean Gain
		$\bar{x}$	SD	$\bar{x}$	SD	
Discussion	88	5.73	2.80	13.99	1.93	8.26
Assistive Technology	60	5.13	2.25	20.33	1.53	15.20
Collaborative Learning	57	6.91	1.83	17.12	2.77	10.21

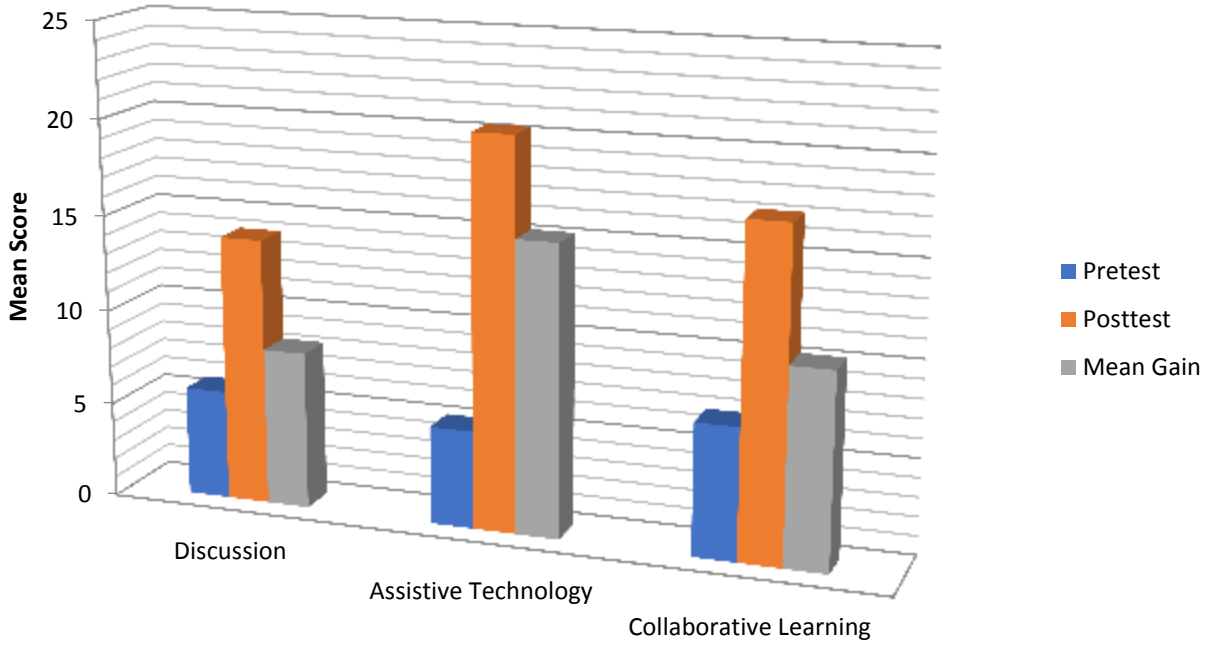

Figure 1: Chart on the effect of assistive technology, collaborative learning and discussion method on the performance of dyslexic students in Reading

Table and Figure 1 show the effect of assistive technology, collaborative learning and discussion method on the performance of dyslexic students in Reading. The results indicated that dyslexic students taught Reading Comprehension using assistive technology instructional strategy (Pretest; $\bar{x}$ = 5.13, SD = 2.25, Post-test; $\bar{x}$ = 20.33, SD = 1.53, Mean Gain = 15.20) performed better than dyslexic students taught reading comprehension using collaborative learning instructional strategy (Pretest; $\bar{x}$ = 6.91, SD = 1.83, Post-test; $\bar{x}$ = 17.12, SD = 17.12, Mean Gain = 10.21), followed by dyslexic students taught Reading Comprehension using the discussion instructional strategy (Pretest; $\bar{x}$ = 5.73, SD = 2.80, Post-test; $\bar{x}$ = 13.99, SD = 1.93, Mean Gain = 8.26).The implication of these results is that the performance of dyslexic students taught Reading Comprehension using assistive technology instructional strategy is higher than those of their counterparts taught using collaborative learning and discussion instructional strategies.

Research Question Two: What is the effect of assistive technology, collaborative learning and discussion method on the retention of dyslexic students in Reading?

Table 2: Mean score and standard deviation of the effect of assistive technology, collaborative learning and discussion method on the retention of dyslexic students in Reading

Instructional Strategy	n	Posttest		Post-Post test		Mean Gain
		$\bar{x}$	SD	$\bar{x}$	SD	
Discussion	88	13.99	1.93	13.89	1.67	-0.10
Assistive Technology	60	20.33	1.53	20.89	1.86	0.56
Collaborative Learning	57	17.12	2.77	17.30	4.01	0.18

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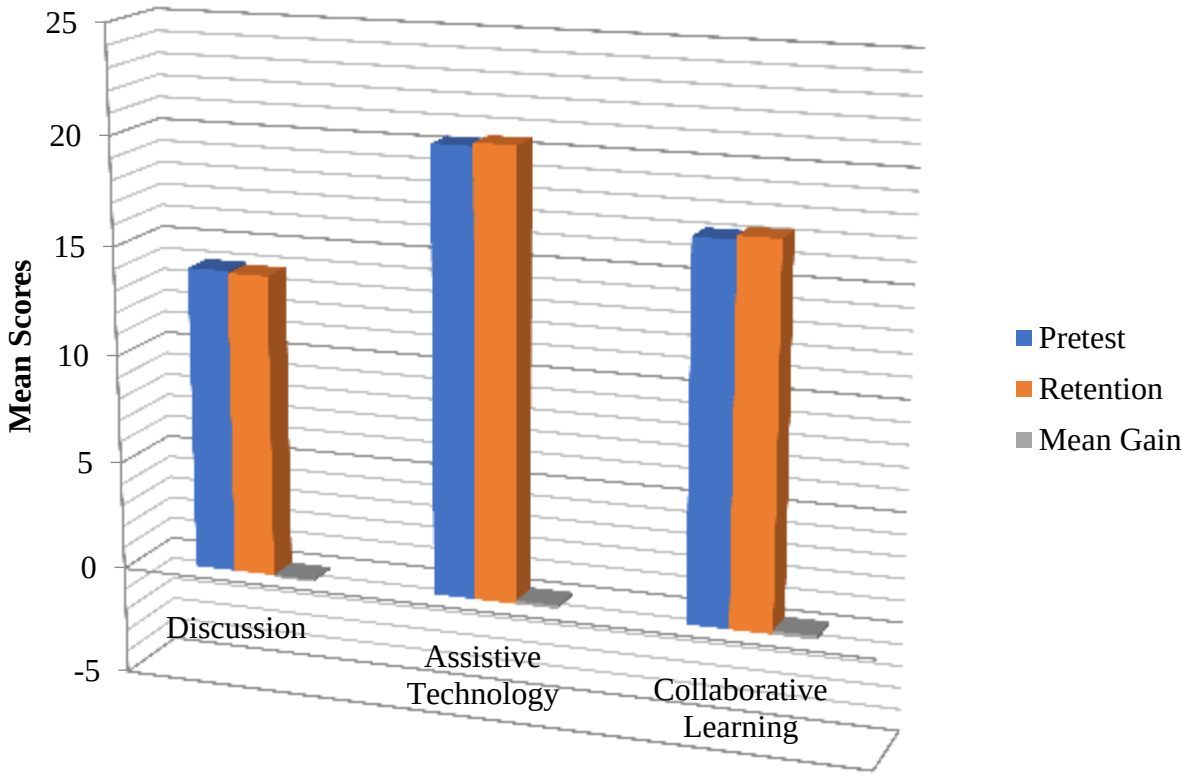

Figure 2: Chart on the effect of assistive technology, collaborative learning and discussion method on the retention of dyslexic students in Reading

Table and Figure 2 show the effect of instructional strategy on the retention of dyslexic students in Reading Comprehension. The results indicated that dyslexic students taught Reading Comprehension using assistive technology instructional strategy (Posttest; $\bar{x}$ = 20.33, SD = 1.53, Retention; $\bar{x}$ = 20.89, SD = 1.86, Mean Gain = 0.56) had higher retention than dyslexic students taught reading comprehension using collaborative learning instructional strategy (Posttest; $\bar{x}$ = 17.12, SD = 2.77, Retention; $\bar{x}$ = 17.30, SD = 4.01, Mean Gain = 0.18), followed by dyslexic students taught Reading Comprehension using the discussion instructional strategy (Posttest; $\bar{x}$ = 13.99, SD = 1.93, Retention; $\bar{x}$ = 13.89, SD = 1.67, Mean Gain = -0.10). The implication of these results is that the retention of dyslexic students taught Reading Comprehension using assistive technology instructional strategy was higher than those of their counterparts taught using collaborative learning instructional strategies. Conversely, dyslexic students taught reading comprehension using discussion instructional strategy showed negative retention. In other words, dyslexic students have forgotten what they learned after two weeks.

Research Question Three: What is the gender effect on the performance of dyslexic students in Reading?

Table 3: Mean and standard deviation of the effect of gender on the performance of dyslexic students in Reading

Gender	n	Pretest		Posttest		Mean Gain
		$\bar{x}$	SD	$\bar{x}$	SD	
Male	85	6.02	2.29	16.72	3.32	10.70
Female	120	5.78	2.63	16.72	3.45	10.94

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Figure 3: Chart on the effect of gender on the performance of dyslexic students in Reading

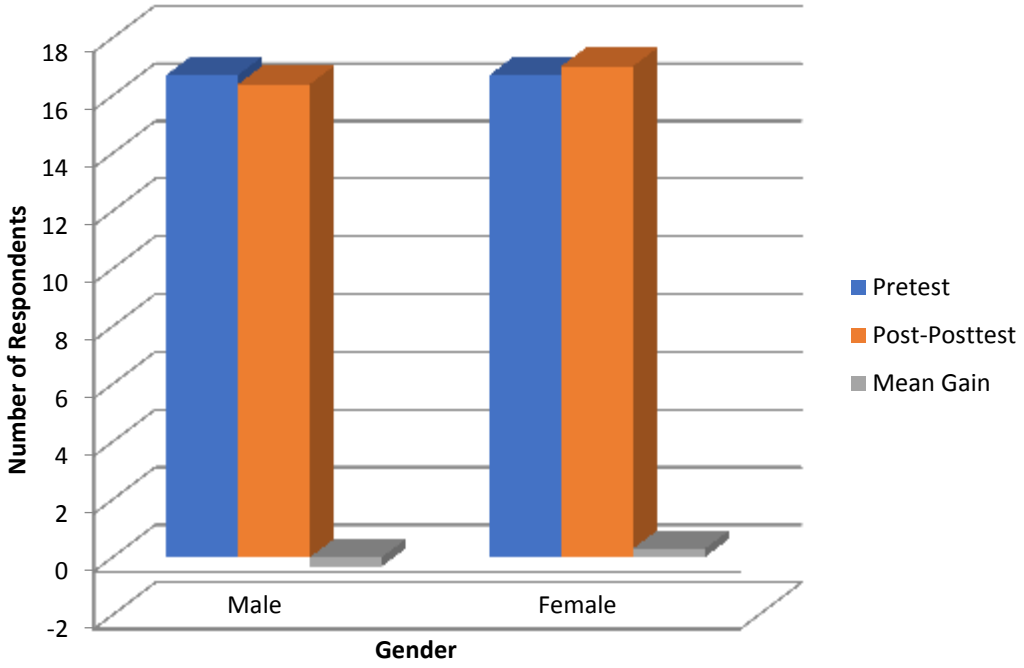

Table and Figure 3 showed how gender influences the performance of dyslexic students in Reading. The results indicated that male dyslexic students taught reading comprehension (Pretest; $\bar{x}$ = 5.78, SD = 2.63, Post-test; $\bar{x}$ = 16.72, SD = 3.45, Mean Gain = 10.94) performed better than their male counterparts (Pretest; $\bar{x}$ = 6.02, SD = 2.29, Post-test; $\bar{x}$ = 16.72, SD = 3.45, Mean Gain = 10.94). The implication of these results is that the female dyslexic students taught reading comprehension performed slightly better than their male counterparts did.

Hypothesis One: There is no significant difference among dyslexic students taught using assistive technology, collaborative learning and discussion method in their performance in Reading

Table 4a: Summary of Analysis of Covariance (ANCOVA) of the effect of assistive technology, collaborative learning and discussion on the performance of dyslexic students in Reading

Dependent Variable: Post-Test

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	1449.13[a]	3	483.04	109.04	0.00
Intercept	8372.33	1	8372.33	1889.85	0.00
Strategies	1441.26	2	720.63	162.67	0.00
Pretest	0.00	1	0.00	0.00	0.98
Error	890.46	201	4.43		
Total	59629.00	205			
Corrected Total	2339.59	204			

a. R Squared = 0.619 (Adjusted R Squared = 0.614)

Table 4a shows that there is significant difference in the effect of instructional strategy on the performance of dyslexic students in reading ($F_{2, 201}$, = 164.37, P = 0.00< 0.05). Thus, null hypothesis one is rejected at 0.05 alpha level. The implication of this result is

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that the performance of the dyslexic students taught Reading Comprehension using assistive technology, collaborative learning and discussion instructional strategies differed significantly.

Table 4b: Scheffe Post Hoc analysis on the difference in the effect of assistive technology, collaborative learning and discussion instructional strategies on the performance of dyslexic students in Reading

Multiple Comparisons

Scheffe

Dependent Variable	(I) Strategy	(J) Strategy	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Pre-test	Discussion	ATS	0.59	0.40	0.34	-0.40	1.59
		CLS	-1.19*	0.41	0.02	-2.19	-0.18
	Assistive Technology	DS	-0.59	0.40	0.34	-1.59	0.40
		CLS	-1.78*	0.45	0.00	-2.88	-0.68
	Collaborative Learning	DS	1.19*	0.41	0.02	0.18	2.19
		ATS	1.78*	0.45	0.00	0.68	2.88
Posttest	Discussion	ATS	-6.35*	0.35	0.00	-7.21	-5.48
		CLS	-3.13*	0.36	0.00	-4.01	-2.25
	Assistive Technology	DS	6.35*	0.35	0.00	5.48	7.21
		CLS	3.21*	0.39	0.00	2.25	4.17
	Collaborative Learning	DS	3.13*	0.36	0.00	2.25	4.01
		ATS	-3.21*	0.39	0.00	-4.17	-2.25

*. The mean difference is significant at the 0.05 level.

Table 4b shows that extent to which the difference in the effect of instructional strategy on the performance of dyslexic students in Reading differed. For the pre-test performance, the interaction between the discussion strategy (DS) and assistive technology strategy (ATS) was not significant (MD = 0.59, Sig = 0.34 >0.05), while the interaction between DS and collaborative learning strategy (CLS) was significant (MD = -1.19, Sig. = 0.02< 0.05). Also, the interaction between the ATS and DS was not significant (MD = -0.59, Sig = 0.34 >0.05), while the interaction between ATS and CLS was significant (MD = -1.78, Sig. = 0.00< 0.05). Furthermore, the interaction between the CLS and DS was significant (MD = 1.19, Sig = 0.02 <0.05), and the interaction between CLS and ATS was significant (MD = 1.78, Sig. = 0.00< 0.05).

For the post-test performance, the interaction between the DS and ATS was significant (MD = -6.35, Sig = 0.00<0.05), and the interaction between DS and CLS was significant (MD = -3.13, Sig. = 0.00< 0.05). Also, the interaction between the ATS and DS was significant (MD = 6.35, Sig = 0.00 < 0.05), while the interaction between ATS and CLS was significant (MD = 3.21, Sig. = 0.00< 0.05). Furthermore, the interaction between the CLS and DS was significant (MD = 3.13, Sig = 0.00 <0.05), and the interaction between CLS and ATS was significant (MD = 3.21, Sig. = 0.00< 0.05).

Hypothesis Two: There is no significant difference among dyslexic students taught using assistive technology, collaborative and discussion method in their retention in Reading.

Table 5a: Summary of ANCOVA on the effect of assistive technology, collaborative and discussion method on the retention of dyslexic students in Reading.

Dependent Variable: Retention

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	1606.353[a]	3	535.45	81.88	0.00
Intercept	584.891	1	584.89	89.44	0.00
Strategies	403.691	2	201.85	30.87	0.00
Posttest	31.369	1	31.37	4.80	0.03
Error	1314.408	201	6.54		
Total	60545.000	205			
Corrected Total	2920.761	204			

a. R Squared = 0.550 (Adjusted R Squared = 0.543)

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Table 5a shows that there is a significant difference in the effect of instructional strategy on the retention of dyslexic students in Reading ($F_{2, 201}$, = 118.20, P = 0.00< 0.05). Thus, null hypothesis two is rejected at 0.05 alpha level. The implication of this result is that the retention of the dyslexic students taught Reading Comprehension using assistive technology, collaborative learning and discussion instructional strategies differed significantly.

Table 5b: Scheffe Post Hoc analysis on the difference in the effect of instructional strategy on the retention of dyslexic students in Reading.

Multiple Comparisons

Scheffe

Dependent Variable	(I) Strategy	(J) Strategy	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Post Posttest	Discussion Strategy	ATS	-6.60*	0.43	0.00	-7.66	-5.53
		CLS	-3.41*	0.44	0.00	-4.49	-2.33
	Assistive Technology	DS	6.60*	0.43	0.00	5.53	7.66
		CLS	3.19*	0.48	0.00	2.01	4.36
	Collaborative Learning	DS	3.41*	0.44	0.00	2.33	4.49
		ATS	-3.19*	0.48	0.00	-4.36	-2.01

*. The mean difference is significant at the 0.05 level.

Table 5b shows the extent to which the difference in the effect of instructional strategy on the retention of dyslexic students in Reading differed. For the post-post-test, the interaction between the DS and ATS was significant (MD = -6.60, Sig = 0.00<0.05), and the interaction between DS and CLS was significant (MD = -3.41, Sig. = 0.00< 0.05). Also, the interaction between the ATS and DS was significant (MD = 6.60, Sig = 0.00 < 0.05), while the interaction between ATS and CLS was significant (MD = 3.19, Sig. = 0.00< 0.05). Furthermore, the interaction between the CLS and DS was significant (MD = 3.41, Sig = 0.00 <0.05), and the interaction between CLS and ATS was significant (MD = -3.19, Sig. = 0.00< 0.05).

Hypothesis Three: There is no significant difference between the performance of male and female dyslexic students in Reading.

Table 6: Summary of ANCOVA on the difference between the performance of male and female dyslexic students in Reading.

Dependent Variable: Post-Test

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	4.782E-01[a]	1	4.782E-01	0.00	1.00
Intercept	55620.02	1	55620.02	4826.00	0.00
Gender	4.782E-01	1	4.782E-01	0.00	1.00
Error	2339.59	203	11.53		
Total	59629.00	205			
Corrected Total	2339.59	204			

a. R Squared = 0.00 (Adjusted R Squared = -0.01)

Table 6 shows that there is no significant difference in the influence of gender on the performance of dyslexic students in Reading ($F_{1,201}$ = 0.00, P = 1.00> 0.05). Thus, null hypothesis three is retained at 0.05 alpha level. The implication of this result is that the performance of male and female dyslexic students taught reading comprehension did not differ significantly.

DISCUSSION OF FINDINGS

The study investigated the effect of assistive technology on dyslexic students' performance and retention in Reading in Port Harcourt Metropolis. From the data gathered, and analysis carried out, the findings of research question one showed that the performance of dyslexic students taught reading comprehension using assistive technology instructional strategy is higher than those of their counterparts taught using collaborative learning and discussion instructional strategies. Furthermore, the result of hypothesis one showed that there is a significant difference in the effect of instructional strategy on the performance of dyslexic students in reading. The finding is consistent with the findings of Marsh (2012), which revealed that the speech recognition group significantly performed better than the control group in word recognition, spelling and reading comprehension. Furthermore, the finding is supported by Smith

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(2017), whose study revealed that the use of assistive technology seems to have transfer effects on reading ability and to be supportive, especially for students with the most severe difficulties.

Also, the findings of research question two showed that the retention of dyslexic students taught Reading Comprehension using assistive technology instructional strategy was higher than those of their counterparts taught using collaborative learning instructional strategies. Conversely, dyslexic students taught Reading Comprehension using discussion instructional strategy showed negative retention, in other words, the students forgot what they have been taught. Furthermore, the result of hypothesis two showed that there is a significant difference in the effect of instructional strategy on the retention of dyslexic students in reading. These findings are consistent with the findings of Bogi, Mutter, McGregor and Gordon (2017), which revealed that assistive interventions proved overall beneficial, but the most commonly used interventions were unexpectedly not the most effective. Interventions based on word processing, multimedia and hypertext proved the most effective, while smart pens and text-to-speech systems presented mixed results. Speech-to-text systems had a small positive effect. The finding is supported by Ghazizah and Fatemipour (2021), whose study revealed that assistive technology influenced their reading proficiency at a statistically significant level.

The findings of research question three showed that the female dyslexic students taught Reading Comprehension performed slightly better than their male counterparts did. Furthermore, the result of hypothesis three showed that there is no significant difference in the influence of gender on the performance of dyslexic students in Reading. These findings are corroborated by Virginia, Doo and Michael (2020), which revealed that there was no significant difference in the mean scores of the two groups.

CONCLUSION

The study investigated the effect of assistive technology on dyslexic students' performance and retention in reading in Port Harcourt Metropolis, Rivers State. Consequently, the study revealed that the performance of dyslexic students taught Reading Comprehension using assistive technology instructional strategies is higher than that of their counterparts taught using collaborative learning and discussion instructional strategies, while the retention of dyslexic students taught Reading Comprehension using assistive technology instructional strategies is higher than that of dyslexic students taught using collaborative learning and discussion instructional strategies. Furthermore, the instructional strategy was higher than those of their counterparts taught using collaborative learning instructional strategies, among others.

The gender comparison revealed that there was no significant difference in the performance and retention of dyslexic students taught using assistive technology, collaborative learning, and discussion instructional strategies, which implied that male and female dyslexic students' performance and retention did not differ significantly. Therefore, it can be deduced that dyslexic students are weak in not only reading and writing but also in comprehension, memory, and other higher-order mental processes that are necessary for accurate reading and understanding.

Based on the findings of the study, it was concluded that the provision of appropriate assistive technology would reduce the challenges faced by dyslexic students; as such technology allows them to effectively navigate the environment, increasing their ability to read and understand the content. This is because; assistive technology instructional strategy requires students to participate in a collaborative setting, whereas collaborative learning and discussion require individuals to work together on self-directed tasks.

RECOMMENDATIONS

Considering the findings, discussion and conclusions of this study, the following recommendations were proffered:

1. Government should provide assistive technology free of charge to dyslexic students to help them participate fully in the teaching and learning process, as well as influence their performance in Reading Comprehension.
2. Parents of dyslexic students should know that early intervention with explicit and intense instruction in the sound structure of language (phonemic awareness) and how sounds relate to letters (phonics) is the key. They should provide Text-to-Speech assistive technology for their wards to enable them to gain the ability to retain what is learned extensively.
3. The Rivers State Ministry of Health should carry out intensive diagnosis and remediation programmes in public schools in Port Harcourt Metropolis, as many male and female dyslexic students are not aware of their predicament.

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