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Effect of Multi-Sensory Intervention Programmes on Fluid Reading Abilities of Dyslexic Children in Primary Schools in Anambra State

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Abstract

This study investigated effects of multi-sensory intervention programme on fluid reading abilities of dyslexic children in primary schools in Anambra State. Specifically, it determined; the mean pretest and posttest achievement of dyslexic children taught reading using LAPH Reading Intervention programme and those taught using the conventional reading method, the mean pretest and posttest achievement of male and female dyslexic children, and the interaction effect of gender and LAPH Reading Intervention programme on their reading achievement**.** Three null hypothesis were tested at (P≤ 0.05) level of significance. Quasi-experimental Design was adopted. The population of the study was 58,187 pupils from 2,877 public primary schools in Anambra State. Four intact classes were used with one sixty seven children (87 for experimental and 80 for control group). Instruments for data collection were two standardized tests (WIAT-III and WISC-V) and LAPH Reading Intervention Programme. The intervention programme was validated by three experts and in pilot studies. Data was analysed using mean, standard and Analysis of Covariance (ANCOVA).The findings of the study revealed that the two groups had almost the same pretest achievement baseline mean before the reading intervention strategy (Experimental 17.24 ± 5.08 and Control 16.83 ± 3.10), children in Experimental Group had higher mean gain (37.09 ± 4.99) than the control Group (28.64 ± 5.01). Female and male children in the experimental group achieved almost the same with little mean difference 0.82.The Intervention programme and gender have positive interaction in the children's ability in Reading. In conclusion LAPH reading intervention programme improved dyslexic children's reading ability.

Keywords: Multi-Sensory, Intervention, Fluid, Reading, Ability, Dyslexia, Children.

Introduction

Reading is a process of communication from the writer to the reader involving the recognition of letters, words, phrases, clauses and a process of negotiating between the reader and the writer (Paris and Hamilton, 2009). Knowledge (including knowledge of language) experience and a particular purpose of reading influence the meaning a reader derives from a text (Rice, 2013). Reading enlightens the mind, makes the intellect sharper and makes an individual travel far without motion (Pearson, 2010). One of the most important factors in education is the ability to read, understand and critically comprehend the text. In the context of this study, reading is the ability of primary school pupils to read and understand a passage of instruction.

Reading is an essential skill towards literacy development, and should be provided so that children can master the skill at their early ages. Among the four basic skills in the context of English language, reading is the most vital skill because reading gives meaning and understanding of written texts (Berninger *et al*., 2013). Fakeye and Fakeye (2016) maintained that reading is one of the skills that should be mastered by learners of a foreign language and that without the ability to read, a child cannot fully access his or her democratic rights. Non-readers and poor readers cannot fully consider political or socio-economic, health and technological positions and issues; they cannot take complete advantage of available societal or governmental institutions for themselves or thoroughly access their rights and responsibilities as citizens. One aspect of reading skills is reading fluency, which is defined as "the ability to read text quickly, accurately, and with appropriate expression (Banfi *et al*., 2021).Children therefore, require reading skills for functionality in the society. Children who are encouraged to read and develop their reading skills will eventually pave a path towards effective understanding, grasping, thinking, and communication abilities. Studies have shown that children who are avid readers and who know the purpose of reading are more likely to have successful careers and a healthy lifestyle (Leverage Education, 2023).

At present in the Nigerian primary schools, reading, the core skill required for academic advancement is taught as part of language lesson. Pupils are made to read repeatedly from printed text in all their lessons. This does not allow adequate focus on the reading problems children face in schools coupled with the limited time allocated to it. As a result, progress in learning to read is severely limited; the average Nigerian primary school children are about three years behind their American or British counterparts in reading age (Abe, 1991). However, it seems that most children in primary schools including Anambra State find it difficult to read fluently because of reading difficulties. Nevertheless, the development of the skills to read and understand a text can be most difficult for dyslexic children.

Dyslexia is a language-based learning disability that is neurobiological in origin. It is characterized by difficulties with accurate or fluent word recognition and poor spelling and decoding abilities. Individual with dyslexia faces challenges in reading, spelling, writing, and pronouncing words. They often struggle with processing and understanding written text as the brain's neural pathways for language processing function differently for them. According to British Dyslexia Association (BDA) (2020), dyslexia is the inability of school aged children to read fluently and understand the reading text. One of the common difficulties experienced by all the dyslexic children is the inability to have a grasp on the letter shapes and then linking those shapes to the sounds symbolized by the letters (Elshazly, 2019). According to Mahmoud and Samir (2021), neurologically-based learning disability manifests as severe difficulties in reading, spelling, and writing words and sometimes in arithmetic. Dyslexia has several forms; according to Cicerchia (2016), more than 70% of students with Dyslexia have a phonological awareness disability that affects the ability to break down words into their component sounds. The acquisition of these skills is impaired in children with developmental dyslexia (Mahmoud and Samir (2021). It may affect any aspect of the reading process, difficulty in recognition of words fluently and accurately, decoding words, and difficulties in reading comprehension (Sedaghati, 2010). In children with reading difficulties and dyslexia, the difficulty of accurately and fluently interpreting the words during reading is not due to any cognitive impairment but mainly due to the deficiency in the language's phonological processing (National Institutes of Health, 2020). The development of reading skills in children with dyslexia is delayed, and they read at levels lower than the expected reading level for their age (Berninger et al., 2013). Children with dyslexia process and interpret the information differently from normal children who do not have reading difficulties (Palfiova *et al.,* 2016).

The difficulty in reading fluency for them has been known for decades and acknowledged by relevant organizations such as International Dyslexia Association [IDA] (Mascheretti *et al*., 2017). According to BDA (2020), dyslexia among school-going children is prevalent globally and was identified more than a hundred years ago. Dyslexia and Literacy International reported that "dyslexia is the most common form of learning difficulty with a prevalence of 7% or more of any given population". It affects about 15% to 20% of the world population (IDA, 2019). The prevalence of dyslexia varies in each country, and the number of cases ranges from 5–20% of the school-age child population (Lopes et al., 2020; Banfi et al., 2021; Gran Ekstrand et al., 2021). In China the prevalence was about 8%, Malaysia 7% of the entire population. A Study conducted by the National

Institute of Neurological Disorders and Stroke indicated that approximately 17% of children in the United States and 16% in Australia were affected by dyslexia (Lee and Tong, 2020; Peter et al., 2021b). Idoko (2018) estimated that one out of six primary school pupils in Nigeria show signs and symptoms of dyslexia which usually manifests from the age of five and above within the primary school age. Dyslexia affects the reading, spelling and writing abilities of an individual which are core skills required for academic achievement. Dyslexic children often struggle with these core skills and are labeled 'lazy, dull or dumb' by peers, parents and teachers as a result of lack of early diagnosis and intervention(Idoko, 2018). This may lead to loss of self-esteem, depression and sometimes, school dropout. Ogundare (2018) noted that although dyslexia is a lifelong disability, it can be managed with adequate facilities, carefully planned programs and specially trained teachers.

Support has been given in many ways to dyslexic children to teach them reading through using various multi-sensory methods and using computer-based applications that include animated characters and text-to-speech (TTS) technology. In such applications, although stimulating, it requires the children to call for help by clicking on the custom-made buttons on the computer screen, often, such an application requires the dyslexic children to be aware of their mistakes and be able to judge when help is needed. They are just reluctant to ask the computer for help. Hence, such technology does not provide immediate intervention to correct any reading failure.

Multi-sensory approaches that are explicit and systematic, however, have been recognized by educational researchers, as well as National Reading Organizations such as IDA, as an effective intervention to develop and strengthen the reading skills of children with learning impediments (Mostafa and Ghani, 2016). Multisensory reading instruction is an educational approach that engages more than one sense at a time, such as sight, hearing, movement, and touch. This method helps students, particularly those with dyslexia, connect and understand concepts more effectively. Multisensory techniques aim at providing a variety of ways for learners to access, engage, and retain knowledge. Teachers might integrate visual, auditory, kinesthetic, and tactile activities in a multisensory classroom to enhance learning and memory.

There seems to be limited research on the efficacy of multi-sensory, explicit, and systematic language instruction on the fluid reading ability of primary school children with disabilities particularly in Anambra State. It is therefore worth to look at effect of an indigenous multi-sensory LAPH Reading Intervention Programme on fluid reading. LAPH programme is a multisensory programme targeted at enhancing visual processing, phonological awareness, working memory and fine motor skills which are important for

acquisition and enhancement of reading and writing abilities.

Purpose of the Study

The main purpose of the study was to investigate effect of Multi-Sensory LAPH Intervention programmes on fluid reading abilities of dyslexic children in primary schools in Anambra State. Specifically, the study determined:

1. mean pretest and posttest achievement of dyslexic children taught reading using LAPH Reading Intervention programme and those taught using the conventional reading method;
2. mean pretest and post test achievement of male and female dyslexic children taught reading using LAPH Reading Intervention programme and those taught using conventional reading method;
3. interaction effect of gender and LAPH Reading Intervention programme on primary schools' dyslexic children's achievement in reading.

Hypotheses

The following null hypotheses were tested by the study at 0.05 level of significance:

H_{O1}: There is no significant difference in the mean pretest and posttest achievement of dyslexic children taught reading using LAPH Reading Intervention programme and those taught using the conventional reading strategy;

H_{O2}: There is no significant difference in the mean pretest and post test achievement of male and female dyslexic children taught reading using LAPH Reading Intervention programme and those taught using the conventional reading strategy;

H_{O3}: There is no interaction effect of gender and LAPH Reading Intervention programme on primary schools dyslexic children's achievement in reading.

Methodology

***Design of the Study*:** The study adopted a quasi-experimental research design. The specific design for the study was Pretest Posttest Non-Equivalent Control Group Design. This design according to Shona (2019) is a special type of design that allows for the comparison of groups that are similar to each other in terms of baseline.

Area of the Study: The Area o**f** the study was Anambra State, south eastern Nigeria. It has 21 local government areas (LGAs).

***Population for the Study*:** The population of the study was 58,187 primary school pupils from 2,877 public primary schools in Anambra State. The pupils were males and females of 6 to 12 years.

***Sample for the Study*:** This was made up of 167 primary II pupils. These include 87 children (41 males and 46 females) for the experimental group, and 80 children (37 males and 43 females) for the control group. Multi-stage sampling technique was

adopted. Purposive sample method was used to select two education zones, two LGAs, and two primary schools. Primary schools were selected because the pupils and their teachers could communicate in English language. This decision was to rule out lack of familiarity with English language used in the instruments. Primary two pupils were also purposively selected from the schools. Primary two pupils were selected because they were at the early stage of primary education, and were expected to benefit more from early intervention.

***Instruments for Data Collection*:** The instruments for data collection were Weschler's Individual Achievement Test third edition (WIAT III), Weschler's Intelligence Scale for Children 5th edition (WISC V) and the LAPH Reading Intervention Programme. The two standardized instruments (WIAT III) and (WISC V) were adopted and used for the pretest and posttest determination of the reading abilities of the subjects, while the researchers developed LAPH Reading Intervention Programme was used for intervention in the experimental classes.

The LAPH intervention programme was validated by three experts each from Dyslexia foundation Lagos, Nigeria, and university experts in child development. The reliability of the test instruments (WIAT III), (WISC V) and the LAPH intervention programme was conducted in pilot studies three public primary schools in Nsukka local government area, Enugu State.

***Method of Data Collection*:** Before commencement of the study a pre-test was administered to all the children on their reading abilities using WIAT III and WISC V. They were divided into experimental and control groups. The LAPH intervention programme was administered to the experimental group in each school every school day for a period of eight weeks with help of two trained research assistants and class teachers during the 70 minutes allotted for English language every day for the experimental groups, while the control group did their English language using the conventional method. Routine effective monitoring of the study was also carried out. At the end of the eight weeks posttest was administered on all the children in both experimental and control groups with the same WIAT III and WISCV.

***Data Analysis Techniques*:** Mean and standard deviation were used to answer the research questions. Analysis of covariance (ANCOVA) was used to test the null hypotheses stated at 0.05 level of significance.

RESULTS

Table 1: Mean and Standard Deviation of the Pretest and Posttest achievement of Dyslexic Children taught Reading using LAPH Reading Intervention Programme and Those Taught Using Conventional Reading Strategy

Groups	$\bar{X}_1$	SD_1	$\bar{X}_2$	SD_2	$\bar{X}_d$
Experimental Group (N=87)	17.24	5.08	37.09	4.99	19.86
Control Group (N=80)	16.83	3.10	28.64	5.01	11.81

$\bar{X}_1$ = Pretest Mean; SD_1 = Pretest Standard Deviation; $\bar{X}_2$ = Posttest Mean; SD_2 = Posttest Standard Deviation; $\bar{X}_d$ = Mean Difference.

Table 1 shows the pretest mean and standard deviation achievement of the Experimental Group (17.24 ± 5.08), and that of the Control Group (16.83 ± 3.10). This means that the two groups have almost the same achievement baseline before the reading intervention strategy. The posttest mean and standard deviation achievement of the Experimental Group was (37.09 ± 4.99), and Control Group was (28.63 ± 5.01). It also showed the mean difference of children in pretest and posttest for the Experimental and control Group are 19.86 and 11.81 respectively. It indicates that children in Experimental Group had higher mean gain than those in control Group. Therefore, children with dyslexia taught reading with LAPH Reading Intervention programme in primary schools in Anambra State had higher mean achievement than those taught with conventional reading strategy.

Table 2: Mean and Standard Deviation Pretest and Posttest Achievements of Male and Female Dyslexic Children taught Reading using LAPH Reading Intervention Programme and those taught using Conventional Reading Strategy

Method	Gender	N	$\bar{X}_1$	SD_1	$\bar{X}_2$	SD_2	$\bar{X}_d$
Experimental Group	Males	41	16.43	3.27	36.69	5.47	20.27
	Females	46	18.03	3.36	37.47	4.48	19.45
Control Group	Males	37	16.30	3.31	28.47	5.91	12.17
	Female	43	17.33	2.80	28.80	4.00	11.46

N = Number of respondents; $\bar{X}_1$ = Pretest Mean; SD_1 = Pretest Standard Deviation; $\bar{X}_2$ = Posttest Mean; SD_2 = Posttest Standard Deviation; $\bar{X}_d$ = Mean Difference.

Table 2 shows that the pretest achievement means and standard deviation of male children in Experimental Group was (16.43 ± 3.27), and that of females in the same group were (18.03 ± 3.36). It also showed the pretest mean achievement and standard deviation of males in the Control Group (16.30 ± 3.31), and that of females (17.33± 2.80). It could be seen that female children in the entire group achieved a little higher in the

same achievement baseline before intervention treatment. It equally showed the posttest mean and standard deviation scores of male children in Experimental Group (36.70 ± 5.47), and that of female children (37.48 ± 4.48). The table finally showed the mean and standard deviation achievement of male children in the Control Group (28.47 ± 5.91), and that of female children (28.80 ± 4.00). It shows from the result that after the intervention treatment, female children in experimental group achieved almost the same with that of male children with just little mean difference 0.82 an insignificant number, showing that the differences that exist between male and female children in reading passages were not much. This shows that male and female children taught reading with LAPH Reading Intervention programme performed better than those taught using conventional reading strategy in primary schools in Anambra State.

Table 3: Mean ($\bar{X}$) and Standard Deviation (SD) Scores on the Interaction Effect of Gender and LAPH Reading Intervention Programme on Primary Schools' Dyslexic Children's Achievement in Reading Ability.

Method	Gender	N	$\bar{X}_1$	SD_1	$\bar{X}_2$	SD_2
Experimental Group	Males	41	16.43	3.27	36.70	5.47
	Females	46	18.03	3.36	37.48	4.48
Control Group	Males	37	16.30	3.31	28.47	5.91
	Female	43	17.34	2.80	28.80	4.00

N = Number of respondents; $\bar{X}_1$ = Pretest Mean; SD_1 = Pretest Standard Deviation; $\bar{X}_2$ = Posttest Mean; SD_2 = Posttest Standard Deviation;

Table 3 shows pretest mean achievement and standard deviation scores of male children in Experimental Group (16.43 ± 3.27),and that of females in the same group are (18.03 ± 3.36). It also showed the pretest mean and standard deviation of males in the Control Group (16.30 ± 3.31), and females (17.34 ± 2.80). It could be seen that female children in the entire group achieved a little higher in the same achievement baseline before instructional treatment but the mean differences are insignificant. The table equally showed the mean achievement and standard deviation scores of male children in Experimental Group (36.70 ± 5.47), and that of female children (37.47 ± 0.48). The table further showed the mean achievement and standard deviation scores of male children in the Control Group was (28.46 ±5.91), and that of female children (28.80 ±4.00). This result indicates that both male and female children operate in the same achievement baseline after instructional treatment, indicating that both LAPH Reading Intervention programme and gender have positive interaction in the Primary Schools' Dyslexic Children's ability in Reading.

Table 4: Summary of Analysis of Covariance on the Significant Difference in Mean Achievement Scores of Dyslexic Children taught Reading Using

LAPH Reading Intervention Programme and those taught using Conventional Reading Strategy (HO_1)

Dependent Variable: Posttest					
Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	7358.872[a]	2	3679.436	152.072	.000
Intercept	10730.242	1	10730.242	243.483	.000
Pretest	261.798	1	261.798	14.953	.000
Method	6775.821	1	6775.821	140.046	.000
Error	9436.202	165	24.195		
Total	447681.000	167			
Corrected Total	16795.074	166			

a. R Squared = .338 (Adjusted R Squared = .335)

Table 4, shows that F (1,165)= 140.05, P<.000. This leads to the rejection of the null hypothesis (HO_1) and the acceptance of the alternative hypothesis. This means that there is a significant (P<0.05) difference between the Mean Achievement Scores of Dyslexic Children taught reading using LAPH Reading Intervention programme and those taught using conventional Reading Strategy.

Table 5: Summary of Analysis of Covariance on the Significant Difference in the Mean Achievement Scores of Male and Female Dyslexia Children Taught Reading Books Using LAPH Reading Intervention Programme and those taught using conventional Reading Strategy (HO_2)

Dependent Variable: Posttest					
Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	7363.926[a]	4	1840.982	75.738	.000
Intercept	10370.965	1	10370.965	326.664	.000
Pretest	230.313	1	230.313	13.589	.000
Method	6773.573	1	6773.573	178.667	.000
Gender	2.882	1	2.882	.119	.731
Method * Gender	1.931	1	1.931	.079	.778
Error	9431.148	155	24.307		
Total	447681.000	167			
Corrected Total	16795.074	166			

a. R Squared = .338 (Adjusted R Squared = .333)

Table 5 shows that F (1,155)= 0.08, P>0.78. Therefore the null hypothesis (HO_2) which stated that there is no significant difference in the mean achievement scores of male and female dyslexic children taught reading using LAPH Reading Intervention programme and those taught using conventional reading strategy was accepted.

Table 5, also shows that the F-calculated 0.08 under method and

gender is not significant at 0.78 which is greater than 0.05 level of significance (P>0). The null hypothesis (HO_3) which stated that there is no interaction effect of gender and LAPH Reading Intervention programme on primary schools' dyslexic children's achievement in reading was not rejected.

Discussion

The study investigated the effect of LAPH Reading Intervention multi-sensory programme on the fluid reading abilities of dyslexic children in primary schools in Anambra State. The finding shows that the children in the experimental and control groups have almost the same achievement baseline pretest mean achievement before the reading intervention strategy. Hence, the dyslexic children were of the same reading ability level. This supports the finding by Idoko (2018) that one out of six primary school pupils in Nigeria show signs and symptoms of dyslexia. After the intervention period result indicated that children in the Experimental Group had higher mean gain than those in control Group. This could be so since the intervention programme engaged multiple senses at a time, such as sight, hearing, movement, and touch, which helps students, particularly those with dyslexia, connect and understand concepts more effectively. This finding collaborates with the finding of Mostafa and Ghani (2016) that pupils with Dyslexia tend to have a better performance when teachers use multi-sensory activities to teach them. On a similar note children with reading disabilities and dyslexia are characterized by decreased phonological awareness and are likely to use the non-phonological approach to memorize words (Miller and Kupfermann, 2009). Another important factor that may have improved children's reading skills is that the tool allows children to play their recorded sound of the word pronunciation and can be repeated until the children match the pronunciation with the words and correctly spell them. This way, the children are able to identify their shortcomings in pronouncing the words and prompt them to correct the words by repeating them. Based on this, Katai and Toth (2010) suggested that the phoneme-grapheme association by making connections between the spoken and written words is an effective teaching strategy in children with reading disabilities and dyslexia. The finding also agrees with Mostafa and Ghani (2016) and Seidenberg (2013) who opined that Multi-sensory approaches that are explicit and systematic, however, have been recognized by educational researchers, as well as National Reading Organizations such as IDA, as an effective intervention to develop and strengthen the reading skills of children with learning impediments.

There is a significant (P<0.05) difference between the Mean Achievement Scores of Dyslexic Children taught reading using LAPH Reading Intervention programme and those taught using conventional Reading Strategy.

The findings showed that the female children in the entire group

achieved a little higher in the same achievement baseline before instructional treatment. It shows from the result that after the instructional treatment, female children in experimental group achieved almost the same with that of male children with just little mean difference an insignificant number, showing that the differences that exist between male and female children in reading passages were not much. This shows that male and female children taught reading with LAPH Reading Intervention programme performed better than those taught using conventional reading strategy in primary schools in Anambra State. The LAPH Reading Intervention programme used in this study is an educational approach that engages more than one sense at a time, such as sight, hearing, movement, and touch. This method helps students, particularly those with dyslexia, connect and understand concepts more effectively, bringing in playfulness as a tool, which increases learner-system interactions irrespective of their gender differences in line with the views of (Mostafa and Ghani, 2016). Lin et al. (2017) noted that playfulness in such social environment has been proved to enhance learner-system interactions based on gender in children with Dyslexia. The findings also agree with the findings by Ashbaugh (2016), who concluded that multisensory teaching methods and strategies inspire learners by involving and motivating them to use more of their senses. The null hypothesis which stated that is no significant difference in the mean achievement scores of male and female dyslexic children taught reading using LAPH Reading Intervention programme and those taught using conventional reading strategy was accepted.

The result equally indicated that both male and female children operate in the same achievement baseline after instructional treatment, indicating that both LAPH Reading Intervention programme and gender have positive interaction in the primary schools' dyslexic children's ability in reading. The null hypothesis which stated that there is no interaction effect of gender and LAPH Reading Intervention programme on primary schools' dyslexic children's achievement in reading books was not rejected

Conclusion

The findings of this study revealed that many primary school children had reading difficulties with dyslexia symptoms in the state. Using a multi-sensory LAPH reading intervention strategy to teach dyslexic children reading in primary schools improved their reading ability than conventional methods. That LAPH Multi-sensory reading intervention strategy had positive interaction in teaching male and female dyslexic children reading in public primary schools in Anambra State. It is evident that if multi-sensory strategy LAPH Reading Intervention programme is adapted in reading, there will be visible change and improvement in the reading, spelling and writing ability of dyslexics thereby changing the view that they are lazy and unintelligent and ensure brighter future literacy wellbeing.

Recommendations

The following recommendations were made based on these findings:

1. Stakeholders in primary education should ensure that enabling environments are created in primary schools to make multi-sensory reading intervention strategy attainable for developing reading skills in Anambra State.
2. The teachers' training curriculum for National Certificate in Education (NCE) and First Degree (B. Ed.) should include a basic program that should prepare teacher to identify and handle children with dyslexics to improve their performance.
3. The State and Federal ministries of Education should provide teachers of primary schools in-service training programmes to learn the application of multi-sensory programmes in teaching reading for male and female children with dyslexia in Nigeria.
4. Ministries of primary education should intensify efforts to adjust or alter completely, the method or strategy of teaching reading to multi-sensory approaches to primary school children at foundation levels to help their difficulties and set them on a higher academic level.

Ethical Clearance

Ethical clearance was obtained from the ethics committee at the University of Nigeria Teaching Hospital (UNTH), Ituku-Ozalla, Enugu (No. NHREC/05/01/2008B-FWA00002458-IRB00002323).

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