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I**nstructional Materials on Dyscalculia Students 'Academic Achievement in Junior Secondary School Mathematics in Imo State.**

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Abstract

This study investigated Instructional Materials on Dyscalculia Students' Academic Achievement in Junior Secondary School Mathematics in Imo State. The sample of the study consisted of 148 junior secondary school one (JSS1) dyscalculia students selected from a population of one thousand, four hundred and seventy-six (1476) dyscalculia students drawn from 22 Catholic mission owned schools in Orlu Education Zone of Imo State. The design for this study was quasi-experimental non-equivalent, non-randomized control group design. Mathematics Achievement Test on Geometry (MATOG) was the instrument used for the study. Two schools were assigned to experimental and control groups respectively for this study. Experimental group was taught using instructional materials while the control group was taught using conventional method. Two research questions and two null hypotheses guided this study. Descriptive statistics was used to answer the research questions while inferential statistics was applied using Analysis of Co-Variance (ANCOVA) for hypothesis testing at 0.05 level of significant. The results revealed that the use of instructional materials in teaching Mathematics increased dyscalculia students' academic achievement in geometry more than the conventional method of teaching. There was a significant difference between the mean achievement scores of experimental and control groups in favour of the experimental group. Both male and female dyscalculia students in the experimental group benefited highly as a result of instructional materials used in the teaching and learning process though gender was not significant. Based on the results of this study, it was recommended that Mathematics teachers should use instructional materials to teach Mathematics concepts to dyscalculia students.

Keywords; dyscalculia students, mathematics, geometry, achievements, instructional materials.

Introduction

Mathematics in its entirety is a subject that when mentioned every ear stands at attention. Mathematics is referred to as the specific body of knowledge, the deductive study of quantity, structure, pattern, space and change (Adetula, 2012). It is the science or branch of knowledge dealing with measurement, numbers, and quantities and can also be looked at as a language, as a particular kind of logical structure, as a body of knowledge about numbers and space, as a series of methods for deriving conclusions, as the essence of our knowledge of physical world or merely as an amazing intellectual activity (Ale and Adetula, 2010). Iji, Abakpa and Takor (2015) viewed knowledge of Mathematics as imperative, since every scientific finding is explained in mathematical terms. Mathematics is the life wire of technological advancement and an indispensable tool for development of science and technology. This simply implies that lack of basic mathematical knowledge and skills in any society may isolate such a society from the global scientific trend.

It is as a result of this importance attached to Mathematics that it is studied as a compulsory subject at both primary and secondary school levels so that every school child will acquire appropriate mathematical knowledge. Mathematics without doubt remains very important to all disciplines and fields of human study and work (Galadima and Okogbenin, 2012). This actually explains why Mathematics is one of the core subjects at the secondary school level as enshrined in the National Policy on Education (FRN, 2013).

Mathematics teaches patience, discipline and step-by-step problem solving skills. Among all the academic subjects studied at school, Mathematics has distinctively contributed to the objectives of general education of man than any other subject, the reason being its application to all spheres of human endeavors (Yusuf, 2011). Every individual needs Mathematics to function efficiently and effectively in our world today irrespective of the person's job or profession.

Despite the importance attached to Mathematics in national development, students' performance appears to be dwindling with little, slow or no improvement. Abakpa and Igwe (2013) added that students' achievement in Mathematics especially geometry component in external examinations is nothing to write home about. Chief examiners report from 2020 to 2023 indicated that geometry is the area where Mathematics learners demonstrate lowest

achievement compared to other topics in Mathematics as Mathematics at credit level and above has remained sorrowfully poor (West African Examination Council, Lagos).

Adaramola (2012) and Alio (2000) attributed under achievement of students in Mathematics to the low quality of Mathematics teachers produced by our tertiary institutions. Adaramola and Alamina (2007) gave their own reasons as students' negative attitude and lack of interest in Mathematics. Ekwueme, Popoola and Orim (2012) attributed the poor performance in Mathematics in secondary schools to lack of appropriate methods in teaching Mathematics. Ezeh and Uka (2021) attributed poor achievement to poor method of teaching mathematics and lack of basic concepts. Wonu and Ogunkunle (2015) in their own opinion said that students under achievement in Mathematics can also be attributed to students' low interest in Mathematics and presence of Students with Dyscalculia.

Dyscalculia is generally seen as a specific learning disorder (Oak Foundation,2017). The Foundation further stated that the kids with dyscalculia may have difficulty in understanding number related concepts or using symbols or fractions needed for success in Mathematics. Learners who are dyscalculic have trouble with many aspects of Mathematics. Most often they do not understand quantities or concepts like biggest versus smallest. They find it difficult to understand that figures are associated with words e.g. "6" is the same thing as "six" in words. Dyscalculia students have trouble with the mechanics of doing Mathematics like being able to recall mathematical facts. Dyscalculia is also known by some other names like Mathematics learning disability, Mathematics learning disorder or Mathematics dyslexia (Oak Foundation, 2017). Oak went ahead to explain that no matter the type of name dyscalculia is associated with the clear fact is that it is the inability to comprehend easily the right mathematical concepts. The concept of dyscalculia is not well known worldwide. It is a new area of study especially in Imo State.

Dyscalculia can be acquired dyscalculia or developmental dyscalculia (DD). Acquired dyscalculia is low performance due to cerebral trauma. Mathematics learning difficulty with similar features but with no evidence of cerebral trauma is referred to as Developmental Dyscalculia (Munro,2003). This study will focus mainly on Developmental Dyscalculia (DD) which includes the 'purely' dyscalculics, the 'dyslexic dyscalculics, graphical dyscalculics, practognostic dyscalculics, ideognostic dyscalculics and others'. Developmental dyscalculia (DD) is a childhood primary cognitive disorder affecting the ability of an intelligent and healthy child to learn arithmetic (Wonu and Ogunkunle, 2015). Students who are purely developmental

dyscalculics (DD) have been reported in several studies to comprise of 3% to 6.5% of general school population (Wonu and Ogunkunle, 2015). Ansari, Price and Holloway (2010) also said that those who are pure dyscalculics are around 5% of the school population. British Dyslexia Association (2018) estimated the percentage of the pure dyscalculic students to range from 6% to 7% of the total school population. The percentage of dyslexic and other types of dyscalculics ranges from 50% to 60% of the total school population (British Dyslexia Association, 2018). Pure dyscalculics have only Mathematics difficulties but have fine performance in other areas of study while dyslexic and the other types of dyscalculics are those who have problems in language processing in Mathematics. British Dyslexia Association went further to say that many people's Mathematics disabilities stem from their problem with language and because they have problem with language it makes it hard for them to process the language in mathematical questions. Although all students who display low Mathematics achievement cannot be tagged as developmental dyscalculia students.

The development of a nation is not one man's business. For a nation to be termed developed every hand must be on deck starting from the very rich to the least peasant farmer. And for all hands to be on deck, every individual has to be equipped. The best equipment to be given to every individual of a nation is education of which Mathematics education plays a vital role (Wonu and Ogunkunle, 2015). Nigeria as a nation is fully aware of this and that is why she tries to ensure that all her citizens have equal access to education as engraved in the National Policy on Education FRN (2013), which states that "access to education is a right to all Nigerian children regardless of gender, religion and disability". Dyscalculia is a type of disability in Mathematics. Since every Nigerian child including the dyscalculics are entitled to education to ensure a better nation building, instructional materials of different kinds have to be employed to help dyscalculia students make achievement in Mathematics especially at the Junior Secondary School level. This will enable them aim higher in academics and thus make relevant contributions to nation building.

Instructional materials or material resources are educational materials or resources used in the teaching and learning process. Different writers have different definitions and different views about instructional materials across disciplines. Umuhoza and Uworwabayeho (2021) defined instructional materials as the various forms of communication that a teacher may employ in his teaching to make it simpler, more interesting, more enjoyable and closer to real life situation.

Murtala (2016) in his own view said that instructional materials are sight tools for teachers at all levels of education process for effective delivery and promotion of learners' academic achievement and the achievement of the stated objectives of the lesson. Murtala (2016) said that instructional materials have the characteristics of holding the attention of almost all the students because they reinforce verbal message by providing a multi-media approach. Murtala further stated that no matter how good a curriculum may be absence of the use of instructional materials can jeopardize its effective implementation.

Adebule and Ayoola (2016) carried out an investigation on "Impact of Instructional Materials on Students' Academic Performance in Mathematics in Secondary Schools" in Ekiti State, Nigeria. The study was a quasi-experimental research design of pre-test, post-test non-randomized control group design. The results obtained showed that significant difference existed between the experimental and control group. Oguchi and Usman (2019) studied the "Effect of Improvised Instructional Materials on Students Achievement and Interest in Longitude and Latitude". The study was carried out in Olamaboro Local Government Area of Kogi State. The research results showed that the mean achievement and mean interest scores of experimental group were higher than that of the control group. There was significant difference between the mean achievement score of experimental group and mean achievement score of control group. There was also a significant difference between the mean interest score of experimental group and that of the control group. Enohuean (2015) in no small measure studied the "Effects of Instructional Materials on Achievement and Retention of Biology concepts among Secondary School Students". The research findings of the study revealed that students taught with instructional materials did better than those taught using traditional method. It also showed no significant difference in the mean achievement of male and female students.

The above literatures revealed that there is a relationship with the present study as they all focused on some aspects of instructional materials, be it improvised or already made instructional materials. However, they differed in content, geographical location and scope hence creating a gap in knowledge in terms of the academic achievement among the dyscalculics.

Research Questions:

The following research questions guided this study.

1. What is the difference between the mean achievement scores of dyscalculia students taught mathematics with instructional materials and those taught using conventional method?
2. What is the difference between the mean achievement scores of male and female dyscalculia students taught Mathematics using instructional material?

Hypotheses

The following null hypotheses guided the study:

Ho_1: There is no significant difference between the mean achievement scores of dyscalculia students taught mathematics with instructional materials and those taught using conventional method.

Ho_2: There is no significant difference between the mean achievement scores of male and female dyscalculia students taught mathematics using instructional materials

Methodology

This study employed a quasi-experimental, non-equivalent, non-randomized control group design. Quasi- experimental design was considered appropriate for this study because intact classes were used for the study. Intact classes were used to avoid disrupting normal school periods. The intact classes were randomly assigned to experimental and control groups respectively. The sample of the study consisted of 148 Junior Secondary School one (JSS1) dyscalculia students selected from a population of one thousand, four hundred and seventy-six (1476) dyscalculia students drawn from 22 Catholic mission owned schools in Orlu Education Zone of Imo State through purposive sampling technique.

The instrument used for data collection was the Mathematics Achievement test on geometry (MATOG). MATOG was used as achievement test to measure the academic achievement of students in geometry. This instrument (MATOG) comprised of twenty-five (25) multiple choice items with five (5) options. These items were from the four main contents selected from geometry for this study; properties of plain shapes, properties of solid shapes, perimeter of plane shapes and area of plane shapes. The items in the instrument were constructed using Junior Secondary One (JSS1) Mathematics Curriculum as stipulated by FME (2013) through a table of specification. The stated objectives of the topic geometry in JSS One (JSS 1) Mathematics Curriculum was a guide in developing the questions. Ten (10) questions were set from the first content while five (5) questions each were set from the remaining three (3) contents making a total of twenty-five (25) questions. All the questions carried equal weight of 4 marks each. MATOG comprised of higher and lower order questions.

MATOG was administered before carrying out the experiment. Pre-MATOG papers were collected and marked by the researcher and the records were also kept by the researcher. Four (4) weeks after the real classroom teaching using the two methods, the students were tested again with the same instrument which was restructured numerically by the researcher. The researcher collected the scripts and marked them and the results were tabulated for analysis.

DATA ANALYSIS: Research questions were answered using mean and standard deviations while the null hypotheses were tested using the Analysis of Covariance (ANCOVA) at 0.05 level of significance.

Results

Research Question 1.

What is the difference between the mean achievement scores of dyscalculia students taught mathematics with instructional material and those taught without instructional material?

Table 1: Mean achievement scores and standard deviation scores of Experimental and Control groups in the pre-test and post-test on Mathematics Achievement Test on Geometry (MATOG).

Group	Type of test	N	Mean	Std. Dev.	Mean Diff.
Experi.	Pretest	74	27.08	7.09	
	Posttest	74	40.05	11.99	12.97
Control	Pretest	74	26.92	7.26	
	Posttest	74	29.76	9.47	2.84

The analyzed result presented in table 1 above showed that the mean score for pre-test (MATOG) for the experimental group is 27.08 with standard deviation of 7.09 while the control group has the mean score of 26.92 with standard deviation of 7.26. This showed that at the commencement of this study, experimental and control groups were at the same level in the knowledge of geometry. In the post-test (MATOG) as presented in table 1 above, the mean and standard deviation scores for the experimental group are 40.05 and 11.99 respectively, giving the experimental group the mean difference of 12.97, while the mean and standard deviation scores for the control group are 29.76 and 9.47 respectively with a mean difference of 2.84 for the control group. The mean score difference between the experimental and control groups were

10.14 in favor of the experimental group. This showed that the use of instructional materials have more impact positively on dyscalculia students' mean achievement score in Mathematics than the conventional method.

Research Question 2:

What is the difference between the mean achievement scores of male and female dyscalculia students taught with instructional materials?

Table 2: Mean Achievement Scores and Standard Deviation Scores of Male and Female Dyscalculia Students taught mathematics with Instructional Material.

Group	Type of test	N	Mean	Std. Deviation	Mean Diff.
Male	Pretest	37	26.81	6.79	
	Posttest	37	41.73	12.20	14.92
Female	Pretest	37	26.81	7.82	
	Posttest	37	38.38	11.72	11.57

Table 2 above showed the mean achievement and standard deviation scores of male and female dyscalculia students taught Mathematics using instructional materials. From the above results, male dyscalculia students' mean and standard deviation scores for the pre-test are 26.81 and 6.79 respectively with post-test scores of 41.73 for mean and 12.20 for standard deviation. Their mean difference is 14.92. The female dyscalculics had mean and standard deviation scores of 26.81 and 7.82 respectively for the pre-test and mean and standard deviation scores of 38.38 and 11.72 respectively in the post-test with a mean difference of 11.57. The difference in the mean of male and female dyscalculia students on MATOG is 3.35 in favor of male dyscalculia students. Both male and female dyscalculics taught with instructional materials performed well though the male students performed slightly higher than their female counterpart.

Hypothesis 1:

Ho_1: There is no significant difference between the mean achievement scores of dyscalculia students taught mathematics with instructional materials and those taught using conventional method.

Table 3: ANCOVA Result of Experimental and Control Groups on Mathematics Achievement Test on Geometry (MATOG).

Source of Variation	Type III sum of squares	df	Mean square	F	Sig	Decision at P< 0.05
Corrected model	6436.737[a]	2	3218.368	36.995	.000	S
Intercept	5012.05	1	5012.05	57.056	.000	S
Pretest	1416.169	1	1416.169	16.279	.000	S
Teaching Method	4898.362	1	4898.362	56.306	.000	S
Error	12614.371	145	86.996			
Total	193556.000	148				
Corrected total	19051.108	147				

R Squared = .338 (Adjusted R Squared = .329

Table 3 above showed that the observed difference between the mean achievement scores of dyscalculia students taught with instructional materials and those taught using conventional method produced F value of **56.306** which is significant at **.000.** The value of F=**56.306** is also significant at **P<0.05.** This simply showed that the experimental group taught geometry using instructional materials performed better than the control group who were taught the same contents using conventional method. The hypothesis which states that there is no significant difference in the mean achievement scores of students taught geometry using instructional materials and those taught the same contents using conventional method was therefore rejected.

Hypothesis 2:

Ho_2: There is no significant difference between the mean achievement scores of male and female dyscalculia students taught geometry using instructional materials.

Table 4: ANCOVA Results on mean achievement scores of Male and Female dyscalculia students on MATOG

Source of Variation	Type III sum of squares	df	Mean square	F	Sig	Decision at P< 0.05
Corrected model	760.105[a]	2	380.052	2.767	.070	NS
Intercept	4484.589	1	4484.589	32.651	.000	S
Pretest Achieve.	552.321	1	552.321	4.021	.049	S
Gender	207.784	1	207.784	**1.513**	**.223**	N**S**
Error	9751.679	71	137.348			
Total	129232.000	74				
Corrected total	19051.108	73				

a. R Squared = .072 (Adjusted R Squared = .046)

Table 4 above shows that the effect of instructional materials on male and female dyscalculia students taught geometry using instructional materials produced F value of **1.513** probability levels. This is not significant at **.223** probability level. F= 1.513 is also not significant at P $< 0.05.$ So there is no significant difference between the mean achievement scores of male and female dyscalculia students treated with instructional materials on geometry. The null hypothesis which stated that there is no significant difference in mean achievement scores of male and female dyscalculia students taught geometry with instructional materials was therefore not rejected. This simply implies that instructional materials are gender friendly when applied in teaching mathematics especially geometry to dyscalculia students in junior secondary schools in Imo State.

Conclusion

Based on the findings of this research work concluded that the use of instructional materials in teaching Mathematics concepts increased dyscalculia students' academic achievement in Mathematics. There was no significant difference between the mean achievement scores of male and female dyscalculia students who were taught geometry using Mathematics instructional materials. So, gender has no effect on the academic achievement of dyscalculia students.

Recommendations

The following recommendations were made based on the findings of this research work.

1. Mathematics teachers should use instructional materials in teaching Mathematics concepts like geometry to dyscalculia students since the use has been found to enhance the achievement of dyscalculia students in Mathematics.
2. Instructional materials should be provided by the Ministry of Education for effective teaching and learning of Mathematics in junior secondary schools in Imo State because it goes a long way in increasing the mean achievement scores of dyscalculia students in Mathematics.
3. The professional bodies like Science Teachers Association of Nigeria (STAN), Mathematical Association of Nigeria (MAN), National Mathematical Center (NMC) and Nigeria Education Research and Development Council (NERDC) should try to incorporate the production of instructional materials in Mathematics in their seminars and workshops and how to use those materials to teach various topics in Mathematics

to benefit Mathematics students especially the dyscalculia students and ease the work of the teachers.

4. Mathematical Association of Nigeria (MAN) and Computer Association of Nigeria (CAN) should come together to produce software and hardware packages like Computer Assisted Instructional (CAI) packages, three dimensional shapes, audio and audio-visual aids that can be fully and strongly beneficial to students during lessons in Mathematics.

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