European Journal of Special Education Research
ISSN: 2501 - 2428
ISSN-L: 2501 - 2428
Available on-line at: www.oapub.org/edu

doi: 10.5281/zenodo.3766180 Volume 5 | Issue 4 | 2020

COMPARATIVE EFFECTS OF EXPLICIT INSTRUCTION AND CONCRETE REPRESENTATIONAL ABSTRACT STRATEGY ON MATHEMATICS ACHIEVEMENT OF PRIMARY THREE PUPILS WITH DYSCALCULIA IN FCT ABUJA, NIGERIA

Nwabueze Josephine Nneka[i]
Department of Educational Psychology,
F. C. T. College of Education,
Zuba, Abuja,
Nigeria

Abstract:
This study investigated the effects of Explicit Instruction (EI) and Concrete Representational Abstract (CRA) strategies on mathematics achievement of primary three pupils with dyscalculia in Federal Capital Territory (FCT) Abuja. The influence of gender on the pupils' mathematics achievement was also investigated. Two research questions were raised and two hypotheses were formulated to guide the study. The study employed a quasi-experimental research design. The population for the study was all the 97 primary three pupils with dyscalculia as identified by the special education unit in Abuja Municipal Area Council (AMAC) local education authority Federal Capital Territory Abuja. Purposive sampling technique was employed to select the three inclusive public schools with a large number of children with dyscalculia. In the schools selected, three intact classes comprising 31 primary three pupils made up of 16 males and 15 females were used for the study. The instrument for data collection was a 10-item Mathematics Achievement Test (MAT). The instrument was face and content validated. The reliability index of the instrument (MAT) was established as 0.88 using the Kendall coefficient of concordance. Research questions were answered using mean and standard deviation while the hypotheses were tested at 0.05 level of significance using Analysis of Covariance (ANCOVA).The result of the study revealed that there is no significant difference between the mean achievement scores of pupils with dyscalculia in mathematics when exposed to EI and when exposed to CRA. The results further showed that there was no significant influence of gender on the mathematics achievement scores of pupils with dyscalculia, Based on the findings it was recommended that the use of EI and CRA strategy should be emphasized and integrated into the mathematics curriculum of teacher training tertiary institutions, so as to popularize the use among the teachers and that the government and stakeholders in both mathematics education and special

[i] Correspondence: email joenwabu@yahoo.com

needs education should organize workshops and seminars on the use of modern teaching techniques such as EI and CRA strategy for the in-service teachers.

Keywords: dyscalculia, explicit instruction, concrete representational abstract, mathematics, gender

1. Introduction

Mathematics is the study of practices of counting, measuring, and describing the shapes of objects and relationships of quantities and sets, using numbers and symbols. According to Gallan as cited in Lerner and Johns (2009), mathematics is a symbolic language that enables human beings to think, record, and communicate ideas about the elements and relationships of quantity. It is also a process of inquiry whereby the learner observes, organizes information, generalizes and expresses ideas in mathematics and proves conjectures (Momoh, 2006).

There are basic mathematics skills people need to master that have daily importance and application to their lives. The skills include; addition, subtraction, multiplication, division and simple manipulation of numbers. The place of mathematics skills in an individual's life notwithstanding, some learners still fail in mastering such basic skills and concepts leading to failure in both internal and public examinations. According to Amazigo (2000), despite the relative importance of mathematics, it is very disappointing to note that students' achievement in the subject at both internal and public examinations has remained consistently poor. This is evidenced in Saad, Adamu and Sadiq, (2014) who reported WAEC results from 2009-2014, stating that in 2009 only 25.99% made five credits and above in mathematics and English but in 2010 there was a decline to 23.36%. In 2011 the percentage pass of students in WAEC rose to 30.9% and fortunately continued to rise to 38.81% in 2012. However, in 2013 the performance declined to 36.57%, and unfortunately continued to decline to 31.28% in 2014 (Saad, et al 2014).

There are also repeatedly poor results in the junior secondary certificate examinations (JSCE) in mathematics. The evidence is the reports given by the director of Education Resource Center (ERC) a body in charge of the Junior Secondary School Certificate Examination in Federal Capital Territory, Abuja (2011 – 2014) which indicated that in 2011 session only 20.9% who took the examination had A – C (credit) grades, 25.62% got D – E (pass) grades while 53.48% got F (fail) level in mathematics. In 2012, 23.1% of the candidates were able to get A – C (credit) grades, 22.53% got D – E (pass) grades and 54.37% failed. There was however a slight improvement in 2013 as the candidates performed in the following grades; 23.7% with A – C (credit) grades, 26.45% with D – E (pass) grades and 49.85% with F (fail) level. However, in 2014, the performance reverted to be poor as only 20.63% of the candidates were able to score A – C (credit)

grades, 24.28 getting D – E (pass) grades and 55.05% came out with F (fail) level. (Delineated from Statistics Department of ERC, FCT in 2015)

The poor result might be suspected to be an offshoot from the primary school performance since in this dispensation of the Universal Basic Education (UBE) in Nigeria, there is no final certificate examination in primary schools until JSS 3 which is the end of the UBE phase. This failure further affects their interest and confidence to participate in a wide range of mathematical experiences and relationships both in school and in daily living.

According to National Key Result Area (NKRA) (2010), if the problems of mastering mathematics skills in primary schools were ignored constantly, cumulative academic failure will be difficult to be improved when the student enters a higher schooling stage. The consequences of it will be worse for persons with dyscalculia. Therefore, teaching that connects with early number competencies and that builds on these competencies is likely to be most effective for pupils with different categories of dyscalculia.

2. Literature Review

The word Dyscalculia according to Gaurav (2001) is a combination of two different words namely Latin word 'dys' meaning a form of special difficulty and the Greek word 'calculus' which means 'calculating' or counting. Thus, the word dyscalculia literally refers to the special difficulties with counting. The term dyscalculia as used in this study, can be defined as a significant discrepancy between specific mathematics performance and performance in other domains that cannot be explained by intellectual/sensory disabilities, inappropriate schooling or poor social environment.

Explicit instruction (EI) refers to teaching where the instructor clearly outlines what the learning goals are for the student, and offers clear, unambiguous explanations of the skills and information structures they are presenting (Jenkins, 2012). The strategy involves also actions in three main stages: the teacher demonstrates to pupils with dyscalculia what they must do (modeling the practice); then guides pupils through a group activity (guided practice) so that students have the necessary skills to complete the task, and then the students practice the task independently (independent practice). In this last stage before the evaluation, the pupils are involved in peer tutoring and cooperative learning while the teacher plays the role of scaffolding and monitoring the pupils. Researches such as those carried out by Bryant, Gersten, Scammacca, and Chavez, (2008) and Clarke, Doabler, Smolkowski, Baker, Fien, and Cary, (2014) have also shown explicit instruction to be effective for improving outcomes in mathematics for students experiencing math difficulties and at risk for learning disabilities.

Concrete Representational Abstract (CRA) strategy is a three phased method of instruction with each phase being an offshoot from the previous phase to promote students' learning and retention. Witzel (2005) defined CRA as a three-stage learning

process where students learn through physical manipulation of concrete objects, followed by learning through pictorial representations of the concrete manipulations and ending with solving problems using abstract notation.

The first of the three stages in CRA strategy is the concrete stage in which children with dyscalculia are provided with manipulatives and other materials or physical learning tools that will provide them the opportunity to explore a mathematical concept or process by actually doing it with tools.

The second phase is the representational phase. This involves completion of problems using drawings to represent numbers instead of manipulating objects. In the abstract phase, the third level, students could manipulate concepts or processes in the absence of the tools that were important in the early phase of learning. The CRA teaching sequence has been found to facilitate mathematics learning in a variety of basic skills including addition (Alireza, Prakash and Gowramma, 2010). What Works Clearinghouse (WWC; 2009) equally, has identified CRA as an effective practice for teaching mathematics for elementary and middle school students. Concrete representational abstract is therefore evident in improving the achievement of students with and without disabilities in mathematics content areas.

Another area that has been of interest to researchers is the issue of gender on mathematics achievement of learners. Literature on gender and academic performance in mathematics exist with different views and findings. Females outperform males in mathematics (Epstein et al 1998 as cited in Owolabi, and Adejoke, 2014). However, Abiam and Odok (2006) found no significant relationship between gender and achievement in number and numeration. Following these inconsistencies, this research is deemed necessary to help resolve this controversy on the issue of gender as it affects mathematics achievement.

3. Statement of the Problem

Mathematics is of prime importance in everyday life because today's world requires processing unprecedented levels of numerical information. Computers, smart phones, financial and healthcare information processing are just a few of the many contemporary demands requiring numerical fluency. Despite this landscape, some economically active individuals in countries such as Nigeria remain functionally innumerate. According to Orim, and Igwe, (2017), this can cause students to become frustrated and develop behavioral and social problems. This is the plight of individuals with dyscalculia. This notwithstanding, research on understanding more completely what a dyscalculia means and what can be done about it in schools have lagged behind in the country. Consequently, there is a felt need to improve on the teaching of mathematics for this category of learners by exploring the use of some innovative learner centered teaching–learning methods such as explicit instruction (EI) and concrete representational abstract (CRA). EI and CRA strategies were chosen because researches in the western world such

as the ones by Witzel (2005) and Burney (2015) have proved these are effective strategies which improve achievement in different subjects for learners in both primary and secondary schools. However, the researcher is not sure if such studies have been conducted in Nigeria. It is also unclear which of the two strategies would be more effective in enhancing the mathematics achievement of pupils with dyscalculia in primary schools.

The problem of this study is therefore, to find out the comparative effects of EI and CRA strategies on mathematics achievement of primary three pupils with dyscalculia.

4. Material Methods

The study adopted a non-randomized pre-test, post-test quasi-experimental control group design. The design was considered appropriate for the study because intact classes were used to avoid disruption of normal class lessons and to control extraneous variables. This design was used to compare the effects of explicit instruction and concrete representational abstract strategies on the mathematics achievement of primary three pupils with dyscalculia. The pupils in the experimental group one were exposed to mathematics learning tasks using Explicit Instruction (EI) method, pupils in the experimental group two were exposed to the same tasks using Concrete-Representational-Abstract (CRA) strategy while pupils in the control group were exposed to conventional method (CM) of teaching.

The study was carried out in the Abuja Municipal Area Council (AMAC), in the Federal Capital Territory (FCT), Abuja. The rationale for the choice of this area was the presence of schools that were inclusive in operation whereby pupils with special needs were admitted together with the regular pupils in the general school. There were already identified cases of dyscalculia by the special educators in the model inclusive primary schools. This was done by selecting those pupils that have had consistent failures in mathematics tests and examinations over a period of three to four years.

The population of this study consists of all the 97 pupils with dyscalculia in three public schools in AMAC. The sample of this study therefore consists of 31 pupils with dyscalculia from the three schools. The case schools and the primary three classes were purposively sampled and the 31 pupils obtained from the intact classes in the schools were used for the study. The intact classes were randomly assigned to experimental and control groups.

Data were collected through the use of a 10-item essay Mathematics Achievement Test (MAT) measuring mathematics achievement level of primary three pupils with dyscalculia in the concepts of addition (**+**), subtraction (**–**), multiplication (**x**) and division (**÷**). The initial drafts of the instrument for the study, the scoring guide (marking scheme) and the lesson plans were face validated by three experts; one from Special Education, one from Mathematics Education and one from Measurement and Evaluation all in University of Nigeria Nsukka. Using Kendall's Coefficient of Concordance (W) the

reliability co-efficient of .88 was obtained for the MAT based on the result of a trial testing. Means and standard deviation were used to answer the research questions and Analysis of covariance (ANCOVA) was used to test the hypotheses formulated for the study at .05 level of significance.

6. Research Questions

1) What is the difference in mean achievement score of primary three pupils with dyscalculia taught with EI and CRA methods?
2) What are the pre-test and pos-test mean achievement scores of primary three pupils with dyscalculia taught using EI, CRA and conventional methods?
3) What are the mean achievement scores of male and female pupils with dyscalculia taught with EI and CRA methods?

6.1 Hypotheses

1) There is no significant difference between the post-test mean achievement scores of primary three pupils with dyscalculia exposed to explicit instruction and CRA strategies in mathematics.
2) There is no significant difference between the post-test mean achievement scores of pupils with dyscalculia in experimental (EI and CRA) and control groups in Mathematics
3) There is no significant influence of gender on the mathematics achievement of pupils with dyscalculia in the experimental groups.

7. Results and Discussion

The results of the study were presented in line with the research questions and hypotheses as follows:

Research Question 1: What is the difference in mean achievement score of primary three pupils with dyscalculia taught with EI and CRA methods?

Table 1: Pre-test and post-test mean achievement scores of primary three pupils with dyscalculia taught using explicit instruction (EI) and concrete-representational-abstract (CRA)

Variable		**Pre-test**		**Post-test**		**Mean gain**
Instructional Strategies	**N**	$\bar{x}$	**SD**	$\bar{x}$	**SD**	
EI	10	7.00	4.83	51.00	6.58	44.00
CRA	11	8.18	5.60	49.09	10.91	40.91

The result as presented in Table 1 shows that the pre-test mean achievement scores obtained by pupils with dyscalculia exposed to EI was 7.00 with a standard deviation of 4.83 and a post-test mean of 51.00 with a standard deviation of 6.58. The difference

between the pre-test and post-test means was 44.00. The result in Table 1 also indicates that the pre-test mean achievement scores obtained by pupils with dyscalculia exposed to CRA was 8.18 with a standard deviation of 5.60 and a post-test mean of 49.09 with a standard deviation of 10.91. The difference between the pre-test and post-test means was 40.91. For both groups exposed to EI and CRA, the post-test means were greater than the pre-test means. However, pupils with dyscalculia who were exposed to EI had a mean gain of 44.00 which is slightly higher than 40.91 for their counterparts who were exposed to CRA. This implies that the use of EI appears to slightly improve the mean achievement scores of pupils with dyscalculia in mathematics than the use of CRA strategy.

Research Question 2: What are the pre-test and pos-test mean achievement scores of primary three pupils with dyscalculia taught using EI, CRA and conventional methods?

Table 2: Pre-test and post-test scores of the effect of EI, CRA and conventional (CM) on the mean achievement scores of pupils with dyscalculia in mathematics

Variable		**Pre-test**		**Post-test**		**Mean gain**
Instructional Strategies	**N**	$\bar{x}$	**SD**	$\bar{x}$	**SD**	
EI	10	7.00	4.83	51.00	6.58	44.00
CM	10	8.00	5.37	15.50	7.25	7.50
CRA	11	8.18	5.60	49.09	10.91	40.91
CM	10	8.00	5.37	15.50	7.25	7.50

Data in Table 2 show that pupils in all the experimental groups obtained higher mean achievement scores than their counterparts in control group. This means that the treatment procedures had positive effect on Mathematics achievement of pupils in the experimental groups than those in the control group. This is indicative that the use of explicit instruction (EI) and concrete representational abstract (CRA) strategies seemed to improve the mean achievement scores of pupils with dyscalculia in mathematics more than the conventional method (CM).

Research Question 3: What are the mean achievement scores of male and female pupils with dyscalculia taught with EI and CRA methods?

Table 3: Mean and Standard deviation of pretest and posttest mean mathematics achievement scores of male and female pupils with dyscalculia

Variable		**Pre-test**		**Post-test**		**Mean gain**
Gender	**N**	$\bar{x}$	**SD**	$\bar{x}$	**SD**	
Male	16	7.50	5.16	38.44	17.96	30.94
Female	15	8.00	5.28	39.33	19.44	31.33

Result in Table 3 indicates that male pupils had a pre-test mean of 7.50 with a standard deviation of 5.16 and a post-test mean of 38.44 with a standard deviation of 17.96. The difference between the pre-test and post-test mean was 30.94. The table shows also that

female pupils had a pre-test mean of 8.00 with a standard deviation of 5.28 and a post-test mean of 39.33 with a standard deviation of 19.44. The difference between the pre-test and post-test mean for the female group was 31.33. For both male and female groups, the post-test means were greater than the pretest means with female pupils with dyscalculia having a mean gain of 31.33 which is slightly higher than 30.94 for their male counterparts.

Hypothesis 1: There is no significant difference between the post-test mean achievement scores of primary three pupils with dyscalculia exposed to explicit instruction (EI) and concrete representational abstract (CRA) strategies in mathematics.

Table 4: Analysis of Covariance (ANCOVA) of the significant difference in the mean achievement scores of pupils with dyscalculia in mathematics when exposed to explicit instruction (EI) and those exposed to concrete-representational-abstract (CRA)

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	182.719[a]	4	45.680	.516	.725
Intercept	13555.536	1	13555.536	153.031	.000
Pretest	137.719	1	137.719	1.555	.230
Groups	42.690	1	42.690	.482	.498
Gender	31.493	1	31.493	.356	.559
Groups * Gender	2.195	1	2.195	.025	.877
Error	1417.281	16	88.580		
Total	54100.000	21			
Corrected Total	1600.000	20			

The result in Table 4 shows that an F-ratio of 0.482 with associated probability value of 0.498 was obtained with respect to the difference between the mean achievement scores of pupils with dyscalculia in mathematics exposed to EI and those exposed to CRA strategy. Since the associated probability (0.498) was greater than 0.05 level of significance set as the criterion for taking a decision, the null hypothesis (H_{01}) was not rejected. It was therefore concluded that there was no significant difference between the mean achievement scores of pupils with dyscalculia when exposed to EI and CRA strategies.

Hypothesis 2: There is no significant difference between the post-test mean achievement scores of pupils with dyscalculia in experimental (EI and CRA) and control groups in Mathematics.

Table 5: Analysis of Covariance (ANCOVA) of the significant difference between the mean achievement scores of pupils with dyscalculia in mathematics when exposed to EI and CRA, and those exposed to conventional method (CM)

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	154.136[a]	6	25.689	5.403	0.097
Intercept	26.020	1	26.020	5.473	0.101
Post_Scores	0.486	1	0.486	0.102	0.770
(Main Effect) Treatment	152.290	5	30.458	6.406	0.029
Error	14.264	3	4.755		
Total	26794.000	10			
Corrected Total	168.400	9			

Table 5 indicates that the computed F-ratio for the main effect of the experimental (EI and CRA) and control (CM) groups on the mean achievement scores in Mathematics of pupils with dyscalculia was 6.406 which was significant at P-value of 0.029 (p-value 0.029 < 0.05). Since the computed p-value of 0.029 was lesser than the tested p-value of 0.05, the null hypothesis of no significant difference between mean achievement scores of pupils with dyscalculia in experimental (EI and CRA) and control (CM) groups as measured by their post-test scores in mathematics achievement test was rejected. Finally, there was a significant difference between mean achievement scores of pupils with dyscalculia in experimental (EI and CRA) and control (CM) groups as measured by their post test scores in mathematics achievement test.

Hypothesis 3: There is no significant influence of gender on the mathematics achievement of pupils with dyscalculia in the experimental groups.

Table 6: Analysis of Covariance (ANCOVA) of the significant difference between the mean achievement scores of Male and Female pupils with dyscalculia in mathematics when exposed to EI, CRA and CM

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	8465.229[a]	6	1410.872	20.273	.000
Intercept	10166.503	1	10166.503	146.083	.000
Pretest	354.746	1	354.746	5.097	.033
Groups	8195.066	2	4097.533	58.878	.000
Gender	19.159	1	19.159	.275	.605
Groups * Gender	16.718	2	8.359	.120	.887
Error	1670.254	24	69.594		
Total	56975.000	31			
Corrected Total	10135.484	30			

The result in Table 6 also shows that an F-ratio of 0.275 with associated probability value of 0.605 was obtained with respect to the influence of gender on the mathematics achievement scores of pupils with dyscalculia. Since the associated probability (0.605)

was greater than 0.05 set as the level of significance and criterion for taking a decision, the null hypothesis (H_{02}) was not rejected. It was therefore concluded that there is no significant influence of gender on the mathematics achievement scores of pupils with dyscalculia.

The data on Table 1 has shown that there is a slight difference between the mean achievement scores of the pupils with dyscalculia taught with explicit instruction (EI) and those taught using concrete representational abstract strategies. As shown on table 4, the associated probability (0.498) was greater than 0.05 level of significance set as the criterion for taking a decision. This finding that the post-test mean scores of the pupils with dyscalculia in the EI and CRA did not differ significantly is contrary to the a priori expectation. It is expected that students in the CRA who used manipulatives and the pictorial representations of objects before attempting the abstract numbers which involved various senses in the experiment would have performed better than their counterparts in the EI experimental group. This could be as a result of the fact that EI involves using highly structured and sequenced steps to teach specific skills; the learners are meant to be informed of the learning objectives which they will restate in their own words in advance; that they will pursue, driving the learning activities and determining the anticipated results. The result corroborates with Witzel (2005) who in his study, maintained that CRA and EI have been proven to be effective in inclusive and resource settings, with elementary and secondary students, private and public schools, small and large populations, and with students with disabilities and nondisabled students.

Result of data analysis on Table 2 and 5 have shown that pupils taught with concrete- representational- abstract (CRA) and explicit instruction (EI) performed significantly better in the mathematics achievement test than their counterparts who were taught using the conventional lecture method (CM). This is in consonance with Agrawal, (2013) who observed from her research that explicit instruction with students who had mathematical difficulties showed consistently positive effects on performance with word problems and computation. This result is equally in agreement with the results of Strozier (2012) whose studies showed that CRA significantly improved mathematics achievement of pupils with mathematics learning disabilities. The reason for the higher performance by the experimental groups could be attributed to the fact that, as a teaching method the EI is learner – centered and ensures active participation and interaction of learners with learners and the teacher in the teaching learning process more than the lecture method. It is also related to the visual nature of instruction and the fact that the pupils were more actively involved in the CRA processes which involved using manipulatives in computations, drawing pictures and diagrams to represent objects and also progressing to working with symbols and numbers which were absent with the control group throughout their lesson periods. In fact, lecture method often subjects the learner to the position of the passive recipient of facts as handed down to him by the teacher.

From the results presented on Table 3 the mean scores of pupils with dyscalculia are such that the female pupils' score is slightly higher than that of the male pupils. This was concluded on table 6 as no statistical significant influence of gender on the mathematics achievement scores of pupils with dyscalculia when tested at 0.05 level of significance. This finding is in line with Adimora, et al (2014) whose findings revealed that gender as a factor did not have a significant influence on the mathematics achievement of students with learning disabilities. But this is at variance with Ajai and Imoko (2015), in which part of their findings established significant difference in favour of males and another part in favor of the females. It therefore means that male and female learners with dyscalculia are capable of competing and collaborating in mathematics. There is need therefore to give boys and girls exactly the same opportunities and challenges using modern strategies such as the EI and CRA strategies.

8. Recommendations

1) The use of explicit instruction and concrete representational abstract should be emphasized and integrated into the mathematics curriculum of teacher training tertiary institutions, so as to popularize the use among the prospective teachers.
2) The government and stakeholders in both mathematics education and special needs education should organize workshops and seminars on the use of modern teaching techniques such as explicit instruction and concrete representational abstract amongst others for the in-service teachers.
3) The government, through the state and Federal ministries of education should encourage the authors of mathematics textbook to write and publish mathematics textbooks based on the explicit instruction and concrete representational abstract strategies.

9. Conclusion

From the foregoing findings, it was observed that comparatively, the mathematics achievement of pupils with dyscalculia exposed to EI and CRA did not differ significantly contrary to priori expectation. The study also showed that pupils with dyscalculia exposed to EI and CRA strategy performed significantly better in their mathematics achievement than their counterparts exposed to conventional method of teaching. It was equally concluded that there was no statistically significant influence of gender on the mathematics achievement of pupils with dyscalculia taught using explicit instruction and concrete representational abstract strategy. Therefore, EI and CRA strategies are effective strategies for teaching pupils with dyscalculia concepts and skills in mathematics to enhance their achievements.

Acknowledgement

I quite acknowledge the enormous contributions made by Dr. Mrs. L. N. Onuigbo, who stood firm for me even when it was not convenient for her just to read through, correct the work and counsel with persuasion on how to go about the research work. I will forever be grateful. A heartfelt thanks goes to Prof. U. N. Eze who believed in my potential and continued helping me develop my skills to research.

About the Author

Nwabueze Josephine Nneka is a PhD holder in special education majoring in learning disabilities from University of Nigeria Nsukka. She is a principal lecturer at the Federal Capital Territory (FCT) College of Education Zuba Abuja Nigeria. She is a lucid writer who has published many articles both in local and international journals and coauthored many text books. She is a member of National Association of Exceptional Children (NAEC), National Association of Special Education Teachers (NASET), International Association of Special Education (IASE) and West and Central African Association of Special and Inclusive Education (WACAASIE).

References

Adimora, D. E., Onyishi, C. N. & Nwokenna, E. N. (2014). Effect of strategic content learning on mathematics achievement of students with learning Disabiliy *European Academic Research.* 2, (3), 3151 – 3167.

Agrawal, J. (2013). *The effects of explicit instruction with manipulatives on the fraction skillsof students with autism.* An unpublished PhD dissertation submitted at George Mason University, USA.

Ajai, J. T. & Imoko, I. I. (2015). Gender differences in mathematics achievement and retention scores: A case of problem-based learning method. *International Journal of Research in Education and Science (IJRES),* 1 (1) 45 – 50.

Amazigo, J. C. (2000). *Mathematics phobia diagnosis and prescription:* 1st annual lecture held at National Mathematical Centre. Abuja, July.

Bryant, D. P., Bryant, B. R., Gersten, R., Scammacca, N., & Chavez, M. M. (2008). Mathematics intervention for first-and second-grade students with mathematics difficulties: The effects of Tier 2 intervention delivered as booster lessons. *Remedial and Special Education*. 29, 20 – 32.

Burney, S. L. (2015). *Interventions to improve student achievement in mathematics for middle school students with autism.* Thesis paper 10 presented at Georgia College and state University. Retrieved 12/01/2017 from https://pdfs.semanticscholar.org/fdaa/6cf8ee9a2456e347a052818ca92c3dee616c.pdf

Clarke, B., Doabler, C. T., Smolkowski, K., Baker, S. K., Fien, H., & Cary, M. S. (2014). Examining the efficacy of a Tier 2 kindergarten mathematics.

Education Resource Center (ERC) Statistics (2015). *Federal Capital Territory (FCT) Junior Secondary School Certificate Examination result from 2011 to 2014.* ERC Abuja.

Gaurav R. W. (2001) *E-Book, Summary "Dyscalculia from detection to diagnosis".* Retrieved on 12/05/2016 from http://ssrn.com/abstract=2125647

Jenkins, B. (2012). *Does traditional or exploratory learning work better?* Retrieved on 14/05/2016 from http://www.scilearn.com/blog/implicit- vs-explicitinstruction-word-learning

Lerner, J., & Johns, B. (2009). *Learning disabilities and related mild disabilities: characteristics, teaching strategies and new directions*. Boston: Houghton Mifflin Harcourt

Momoh, I. M. (2006). Effect of guided scoring strategy on students' achievement and interest on quadratic equation. Unpublished. M. Ed thesis. University of Nigeria, Nsukka

Orim, R. E. & Igwe, B. (2017). Correlates of dyscalculia and learning outcome in mathematics among SSII students in Obudu, Cross River state Nigeria. *British Journal of Education.* 5 (8) 18 – 22.

Owolabi, J. and Adejoke, E. O. (2014). Effect of Gender, Age and Mathematics Anxiety on College Students' Achievement in Algebra *American Journal of Educational Research* 2 (7) 474 – 476.

National Key Result Area NKRA (2010). *Leading the Y generation to greater heights.* Retrieved on 14/07/2015 from http://www.teo-education.com/teo/?cat=60

Saad, T. U., Adamu, A. & Sadiq, A. M. (2014). The causes of poor performance in mathematics among public senior secondary school students in Azare metropolis of Bauchi State, Nigeria**.** *Journal of Research & Method in Education.* 4 (6) 32 – 40.

Strozier, S. D. (2012). *The effects of concrete-representational-abstract sequence and a mnemonic strategy on algebra skills of students who struggle in mathematics.* A Ph. D. dissertation submitted to the Graduate Faculty of Auburn University Alabama.

What Works Clearinghouse (WWC; 2009). Assisting students struggling with mathematics: Response to intervention for elementary and middle schools. Retrieved from https://ies.ed.gov/ncee/wwc/Docs/PracticeGuide/rti_math_pg_042109.pdf

Witzel B. S. (2005). Using CRA to teach algebra to students with math difficulties in inclusive settings. *Learning Disabilities: A Contemporary Journal.* 3 (2) 49 – 60.