A SURVEY FOR EXISTENCE OF DYSCALCULIA AMONG UPPER BASIC ONEMATHEMATICALLY AT-RISKSTUDENTS OF FEDERAL GOVERNMENT COLLEGE ENUGU, ENUGU STATE, NIGERIA

By

Iji, Clement.O. and Takor, David. I.

Departmentof Mathematics Education,Federal University of Agriculture, Makurdi, Benue State & Department of Mathematics, Federal Government College, Enugu, Enugu State.

ijiclements07@yahoo.com

Abstract

The study investigated the existence of dyscalculia and it associated learning difficulties among upper basic one mathematically at-risk students of Federal Government College Enugu. The survey research design was found appropriate and a sample consisting of 98 upper basic one mathematically at-risk students (51 males, 47 females) were disproportionately drawn forthe study. A 4-point Likert scale-type questionnaire was used for data collection. Mean scores andstandard deviations were used for analyzing data which provided answers for the three researchquestions. The three hypotheses were tested at 0.05 level of significance using chi-square (χ^2) test statistics.It was found in the analysis in the tables as well the test of hypotheses that neither of cognitive Mathematics understanding, confidence in reasoning to solve mathematics nor computation of mathematics problems have any significant effect onupper basic one students' mathematics underachievement. It was recommended that there is need to search among the exogenous factors, use repertoire of pedagogical approaches and remedy the situation at it foundational stage.

Key words: Dyscalculia, cognitive Mathematics understanding, Mathematics computation mathematically at-risk.

Introduction

In every human endeavour, numbers and arithmetic are so much part of our daily life, suchthat it is essential for children to acquire basic mathematicalcompetencies. Everywhere we turn,there are symbols carrying important pieces of information. Right on our palms, we may be able to consult either ourwatch or smart phone for time to estimate whether we have to run to catch up with the scheduled occasion. Also, there are the various PIN numbers and pass codes that we need to remember fornumerous activities and services that are now part and parcel of daily life. These few may remind us that one of humanity's greatest innovationaltools is Mathematics. This may be what informed Aghadiuno in Iji (2019) who posits that,for ideas and theories to be meaningful and understandable by the mind, they must be presented in a mathematically understandable form. This means Mathematicsis useful in developing mental processes that enhance critical thinking, accuracy and problem-solving skills. Thus, Lerner and Johns (2009) opined that Mathematics is a symbolic language that enables human beings to think, record, and communicate ideas about the elements and relationships of quantity. This universal language which encompasses numbers, form, chance, algorithm and change is meaningful to all people as quantitative information and events which are present in all natural environments(Van De Walle, 2004).Mathematics basic principles of addition, subtraction, division and multiplicationwhich are ubiquitous in all aspects of our lives do allowed us to reason with numbers, to calculate, and to enumerate quantities. Therefore being fluent, proficient and skillful with numbers is imperative in order to function successfully inour contemporary technological driven society.

Being mathematically proficient involves the ability to express oneself effectively in quantitative terms (Simmons, Willis & Adams 2011). It requires an understanding of numerical concepts and operations, and includes the ability to use this understanding in flexible ways to make mathematical judgments and develop useful strategies for handling numbers and operations. Good mathematical skills involve competence in and an understanding of the numerical system. When analyzed, these mathematical skills can be broken down into specific interdependent lower-order and higher-order skills. A child must first master lower-order skills, such as judging relative quantity and one-to-one correspondence, before more complex skills can follow as a certain level of developmental maturity is required for successful knowledge construction to take place (Bobis in Eksteen, 2014).This is to say that Mathematics is one particular structure of abstract ways of thinking which is applicable to a wide variety of situations (Skemp, 1962). As a higher subject of study Mathematics present itself in hierarchical stages where earlier stages like arithmetic and mensuration among others lead to and make possible the understanding of later stages like algebra.

A review of literature however, shows that in Nigerian secondary schools, students perform poorly in Mathematics compared to other subjects. This ugly trendKurumeh andImoko in Iji, Abakpa and Takor(2015) attributed to a very weak Mathematics foundation which begins at the primary school level and is carried over to the junior secondary and is culminated in senior secondary school.Agashi (2003) had earlier on posits that no matter the level of teaching, with deficit foundation every effort made cannot produce desired results. Many reasons have been attributed for students' underachievement in Mathematicsand that the picture is a complex one ranging from exogenous to endogenous factors with no single root cause.Either because these problems were not taken seriously at the foundation level, they escalated to Mathematics learning difficulties (MLD).However, the consequences are that, our failure to acquire adequate mathematical abilities and skills may severely hamper our prospects of career success as well as our physical and mental well-being (Butterworth, 2010; Kucian& von Aster, 2015).

Mathematicslearning difficulties (MLD) is a general term that refersto a group of disorders which are due toidentifiable or inferred central nervous systemdysfunction. This may be manifested by delaysin early development and/or difficulties in any of attention, memory,reasoning, co-ordination, communicating,spelling, calculation, social competence, andemotional maturation.Mathematics learning difficulty (MLD) also entailsinability to make connections in Mathematics, incomplete understanding of the language ofMathematics, and difficulty transferring mathematical knowledge, after exposure to normalmathematical instruction. Different terms and conditions for MLD are considered in the literature. In fact a repertoire of terms has been attributed to Mathematics learning difficulties. These terms Zerafa (2011) presented as shownin Table 1.

Table 1: List of Terms use in referring to Mathematics Difficulties

Developmental Dyscalculia (DD)	Shalev& Gross-Tsur (1993); Temple (1991); Sharma (2003); Butterworth (2003); and Rubinsten&Henik (2009)
Dyscalculia	Chinn (2004); Ernest (2011)

Mathematical Learning Difficulty (MLD)	Hopkins &Egeberg (2009)
Mathematical Disability (MD)	Geary (1993)
Mathematic Disorder	American Psychiatric Association (2000)
Arithmetic Learning Disability (AD, ARITHD or ALD)	Siegel & Ryan (1989); Geary & Hoard (2001); and Koontz &Berch (1996)
Number Fact Disorder (NF)	Temple and Sherwood (2002)
Psychological Difficulties in Mathematics	Allardice& Ginsburg (1983)

Source: Zerafa (2011). List of terms used to refer to difficulties in Mathematics

Geary and Hoard (2001) emphasize that in most of the literature and research, all these terms are referring to the same condition - a difficulty to understand number concepts and to acquire the numeracy skills necessary to understand and apply Mathematics.Of these disabilities, dyscalculia and developmental dyscalculia are said to be most prevalent in the study of Mathematics.

Approximate Number System(ANS) and Numerosity Coding Hypothesis(NCH)areamong the multiple theories that explained numerical development describing children’s innate ability to understand and compare numerical magnitudes. Numerical magnitude refers to the cardinal aspect of numbers: that is the understanding that the last number counted in a set denotes the quantity of that set, or its numerical magnitude. The child’s understanding of the relationships between different magnitudes and sets forms the foundation for his or her understanding of the number concept and further arithmetic development. Deficits in these numerical magnitude systems may cause a series of mathematical difficulties thought to underlie dyscalculia.

According to Butterworth (2005),dyscalculic children have a fundamental deficit in their capacity to understand, represent and manipulate numbers, something he referred to as “numerosity”, otherresearchers referred to it as “number sense”. Research indicates that very young infants, and even animals, have an innate capacity for detecting and comparing small quantities, thus researchers hypothesize that circuitry for the basic processing of numerical information is coded in our DNA (Brannon, 2005). Butterworth (2005) reasoned that this numerical capacity serves as a “starter kit” for the understanding of numbers and Mathematics. When this starter kit is defective, the child’s ability to understand and compare numbers is compromised, and the child fails to develop normally in areas pertaining to Mathematics.

Specifically, this study looks at Dyscalculia which is an impairment of the ability to solve mathematical problems, usually resulting from brain dysfunction. Definitions of dyscalculia abound in the literature. Some of these include; Kosc (1974) defined dyscalculia as a structural disorder of mathematical abilities which has its origin in genetic or congenital disorder in those parts of the brain that are the anatomical – physiological subtract of the maturation of the mathematical abilities adequate to age, without a simultaneous disorder of general mental function. Sharma (1997) defines dyscalculia as an inability to conceptualize numbers, number relationships (arithmetical facts) and the outcome of numerical operations estimating the answer to numerical problems before actually calculating. Dyscalculia according to the National Numeracy Strategy DfES (2001) is a condition that affects the ability to acquire arithmetical skills. For Stephanie (2014) dyscalculia is a brain-based mathematics learning disorder that affects arithmetic skills. According to Learning Disabilities Association of America (2014), dyscalculia is a particular learning disability that influences a person's capacity to comprehend numbers and learn mathematics facts. Dyscalculia according to Nekang (2016) is an impairment of the ability to solve mathematical problems, usually resulting from brain dysfunction. He therefore explains that dyscalculia is a brain-based condition that makes it hard to make sense of numbers and Mathematics concepts. Thus, due to brain dysfunction, Nekang (2016) posits that it is very common for kids to have more than one learning issue.Some kids with dyscalculia cannot grasp basic number concepts. They work hard to learn and memorize basic number facts (Nagavalli, 2015). They may know whatto do in a mathematics class but do not understand whythey are doing it. In other words, they miss the logic behind it. Other kids understand the logic behind the Mathematics but are not sure how and when to apply their knowledge in solving problems.

These definitions shows that Dyscalculia is a specific learning disability that related to identification and operation with numbers, hence the term is created for the disability of performing mathematics operations (Ferraz&Neves ,2015). According to Butterworth (2001),most dyscalculic learners will have cognitive and language abilities in the normal range, and may excel in non-mathematical subjects. Dyscalculia learners may have difficulty understanding simple number concepts, lack an intuitive grasp of numbers, and have problems in learning of number facts and procedures (Amiripour,;Bijanzadeh,; Rostamy-Malkhalifeh&Najafi, 2012). Dyscalculia whether brain-based or genetic origin is a Mathematics learning disorder that affects arithmetic skills of growing children.

Signs of Dyscalculia in Upper Basic School (JSS 1- 3)

- Struggles with Mathematics concepts like commutability ($3 + 4$ is the same as $4 + 3$) and inversion (not being ableto solve $3 + 22 - 22$ without calculating).
- Has a tough time understanding Mathematics language and coming up with a plan to solve a Mathematicsproblem.
- Has trouble keeping score in sports games and gymnastic activities.
- Has difficulty figuring out the total cost of items and often runs out of money on his lunch account.
- May avoid situations that require understanding numbers, such as playing games that involve Mathematics.

Types of Dyscalculia

Literature shows that many authors explained dyscalculia by giving out the types. Some of which Kosc (1974)and Nagavalli and Fidelis (2015) explained that there are six types of dyscalculia, these are:

Verbal (interpretation of verbal mathematics terms); This is the problem in naming amount of things; difficulties with talking aboutmathematical concepts or relationships e.g. verbal dyscalculics may be able to read and writenumbers, but unable to talk about them, remember their names, or recognize them when they arespoken by others.

Operational (performing basic arithmetic operations); Operational dyscalculia is a difficulty with performing, mathematical operations or calculations. A person with operational dyscalculia can understand numbers and their relationship to one another, but finds it hard to do any kind of calculation that requires manipulating numbers and mathematical symbols.

Lexical (reading written mathematics terms, symbols); This is the problem of reading mathematical symbols including operationalsigns +, -, ÷ and numerals. When mathematical signs occur in number sentences or equations,lexical dyscalculic may be able to read individual digits, but unable to recall their place in largernumbers.

Graphical (symbol manipulation); This is the Problem in writing Mathematics symbols and numeral. Theycannot shape the mathematical signs or symbols as they appear.

Ideognostic (mental calculations); This is the problem in understanding mathematical concepts and relationship. Dyscalculic have difficulties in identifying which sequence of numbers is larger or smaller. This type of dyscalculia is a generalized difficulty with understanding Mathematics and numbers as a whole. At times, it is described as inability to recall mathematical ideas or concepts after learning them.

Practognostic (pictorial representation); This is the problems in manipulating things mathematically, forexample comparing objects to see which one is bigger or larger. Dyscalculic have difficultiestranslating their abstract knowledge to real world actions or proceeding. They have difficultiesworking with actual quantities, volumes or equations in a practically way.

Sharma (2015) explains that there are three types of Dyscalculia:

Qualitative dyscalculia; this is the result of difficulties in understanding of instructions or the failure to master the skills required for an operation. When a child has not mastered numerical facts, he cannot benefit from the stored information about the number that is used to solve problems involving addition, subtraction, multiplication, division and square roots.

Quantitative dyscalculia; this is when there is a deficit in the skills of counting and calculating. Dyscalculic pupils have a serious problem when using figures since counting is a problem. At times they have to meet another person for estimation when they need to use a huge amount of money.

Intermediate dyscalculia;this involves the inability to operate with symbols or numbers. Once mathematics operationalsigns like <, >, t, -, x, ÷, √, appear on a paper, the individual dyscalculic is no longer comfortable.When the numbers are as large as a Billion(100,000,000), he or she will certainly need an assistance tomanipulate or read it. When dyscalculia is as a result of destruction in the neurons, there will be anoverlap of neuro-diversity of difficulties.

Khing (2016) explains that there are two subtypes of mathematical disorder:

1. Mathematical computation disorder
2. Mathematical reasoning disorder

1. Mathematical computation disorderKhing said affects an individual to solve mathematics calculations. A person with dyscalculia may have difficulty in solving simple addition, subtraction, multiplication and division problems with mathematics problems usually given at elementary school and continue through secondary school and into adulthood. Signs that may be indicative of mathematics disorders include:

- Writing or printing numbers.
- Counting

- Adding and subtracting.
- Working with mathematical signs.
- Learning names that include disorder affects an individual's ability to utilize mathematical reasoning to solve problems.

2. Mathematical reasoning disorders affect an individual's ability to utilize mathematical reasoning to solve problems. People with dyscalculia have difficulty with abstract concepts of time and direction. Those who suffer from Mathematics disorder usually suffer from other learning disorder as well, Mathematics of visual processing difficulty associated with it. An individual suffering from a visual processing difficulty is unable to see the difference between two similar letters, shapes or objects. A person with dyscalculia may need special education services to treat this neurological disorder.

Learning difficulties involving Mathematics can be so different, that means the effects they have on an individual's development can be just as different. Hence, a person who has trouble processing language will face different challenges inMathematics from a person who has difficulty with visual- spatial relationships. Another person with troubleremembering facts and keeping a sequence of steps in order will have yet a different set of Mathematics-relatedchallenges to overcome. With such understanding, the present study investigates the existence of dyscalculia among mathematically at-risk Upper Basic one (9-10 years) students of Federal Government College Enugu. The college looked at these students as being mathematically at-risk because of their consistent failure in Mathematics in both first and second terms Mathematics assessment tests. This observed underachievement in Mathematics is in compliance with Ministry of Education's directives that no child repeats a class twice. Generally, mathematically at-risk students are those experiencing academic deficits affecting their ability to learn Mathematics thus having:

- One or more years behind their age or grade level in Mathematics or number identification skills
- Low scores on tests of academic achievement and scholastic aptitude in Mathematics
- Have a history of failure and are being held back to repeat a class in school when their classmate are promoted to the next higher class
  (Mahmood, 2004; Osciak&Milheim, 2001).

Statement of the Problem

One's ability to express him-self effectively in quantitative terms isvery crucial and much needed for survival in today's scientific and technological advancement, which has become so demanding for people in problem-solving on daily basis.This is because for ideas and theories to be meaningful and understandable by the mind, they must be presented in a mathematically understandable form.Yet there are children who consistently have been underachieving in Mathematics right at the primary to secondary school levels.

Researchers have attributed this failure to exogenous or endogenous factors. However, the majority of researchers agree that dyscalculia, a specificmathematical learning disability, is not causedby these domain-general, languages, emotional or social factors (Bugden& Ansari, 2015; Butterworth & Yeo, 2004; Kaufmann et al., 2013; Reeve & Gray, 2015; Regiosa-Crespo& Castro, 2015). Instead, dyscalculia is understood to be a neuro-developmental disorder rooted in specific numerical deficits that involve the understanding, accessibility and use of numerical information. That means several areas of the brain are needed to recognize patterns, estimate solutions, and process images (Stephanie, 2014). These processes require good permanent and working memory, good language, reasoning and visual processing skills, paying attention and the ability to conceptualize both verbally and non-verbally. Any deficit in these areas will lead to issues when learning Mathematics.

In order to know which direction is the cause of underachievement amongthe upper basic one mathematically at-risk students of Federal Government College Enugu,this study investigates the existence or non-existence of DyscalculiaamongUpper Basic one mathematically at-risk students of the College so as to provide at the right time appropriate intervention.

Purpose of the Study

The main purpose of this study was to assert if the underachievement in Mathematics by Upper Basic one mathematically at-risk students is cause by endogenous factors. Specifically the study was to:

I. Identify if there are students with deficits in cognitiveunderstanding of mathematical sentences
II. Identify if there are students with deficits in confidence inreasoning to solve mathematical problems
III. Identify if there are students with deficits in Mathematical computations

Research Questions

The following research questions were asked to guide the study:

1. Howdoes cognitive understandingof mathematical sentences affectupper basic one students' Mathematics achievement?
2. Howdoes confidence in reasoning to solve mathematical problems affect upper basic one students' Mathematics achievement?
3. How does computation of Mathematics problems affect upper basic one students' Mathematics achievement?

Hypotheses

The following hypotheses were formulated for the study and tested at 0.05 level of significance,

H$_{01}$:Upper basic one students' Mathematics underachievement dependsupon their inability to cognitively understand mathematical sentences.

H$_{02}$:Upper basic one students' Mathematics underachievement dependsupon their in-confidence in reasoning to solve mathematical problems.

H$_{03}$:Upper basic one students' Mathematics underachievementdependsupon their in ability to compute mathematical problems.

Methods

The design of this study was a simple survey research design. This is because the study sought the subject's opinion on the issues under discussion. The target population for this study was Upper Basic one (JSS1) mathematically at-risk students of Federal Government College Enugu. There are ten streams in Upper Basic one; each stream has student population of 50 per stream. A total of 98 (51 male, 47 female) Upper Basic one mathematically at-risk students participated. This sample size was arrived at through end of first and second terms mathematics assessment tests scores. Simple random sampling technique was used to arrive at the sample size.

The instruments used for the study were:Cognitive understanding of mathematical sentences (CUMS),Confidence in reasoning to solve mathematical problems (CRSM) anddeficits in Mathematics computations (DMC). Both were four points scale calibrated in the form of strongly disagree (SD), disagree (D), agree (A) and strongly agree (SA) weighted 1, 2, 3 and 4 accordingly.These instruments consist of five (5) items for CUMS, five (5) items for CRSM, and ten (10) items for DMC, a total of twenty (20) items developed by the researcher.The instruments were validated by three experts in mathematics education and two experts in measurement and evaluation. A reliability index of .83 wasestablished for the instruments using Cronbach Alpha (α).

The instruments were administered consecutively by the researcher who happens to be a mathematics teacher with the institution. Each instrument was completed and returned within ten minutes. The data collected and collated was analyzed using the descriptive statistic of mean and standard deviation. Chi-square statistics was used to test the hypotheses at 5% level of significance. To arrive at a decision, items that were positively skewed which had a mean score of 2.5 and above were accepted, while any item with a mean score less than 2.5 were rejected. For negatively skewed items, the revise was the case.

Results

Question 1: How does cognitive understanding of mathematical sentences affect upper basic one students' Mathematics achievement?

H_{01}:Upper basic one students' Mathematics underachievement depends upon their inability to cognitively understand mathematical sentences.

Table 1: Cognitive understanding mathematical sentences

	Items	SD	D	A	SA	$\bar{x}$	S.dev	Dec.	x^2	Df
1	I have no difficulties understanding numerical figures.	0	0	35	63	2.70	0.46	A	3.02	3
2	I cannot count numbers from 1-100 without some objects.	0	0	26	72	2.53	0.50	A	8.83	3
3	I have good understanding of numerical figures and their correct place value.	0	0	41	57	2.64	0.48	A	3.12	3
4	I do remember what each mathematical operators and symbols stand for.	1	2	47	48	2.85	0.36	A	5.02	3
5	I do understand both figures and word presentations in mathematics.	0	10	35	53	2.58	0.50	A	24.90	3
Total/Average		**01**	**12**	**184**	**293**	**2.66**	**0.46**		**44.89**	**15**

From Table 1, the respondents opined that they have no problem of writing numerical figures, not even in placing figures correctly in their place value (magnitude). Conclusively, cognitive understanding mathematical sentences seem not to be the cause ofupper basic one students' Mathematics underachievement as evidence in their means and standard deviation($\bar{x} = 2.66 \pm 0.46$**).** Since the calculated value (**x^2= 44.89**) is greater than the table value (**x^2= 25.00**) with df = 15 at p $\leq$ 0.05 level of significance, wereject **Ho_1** and state that Upper basic one students' Mathematics underachievement is independent of their inability to cognitively understand mathematical sentences.

Question 2: How does confidence in reasoning to solve mathematical problems affect upper basic one students' Mathematics achievement?

H_{02}: Upper basic one students' Mathematics underachievement depends upon their in-confidence in reasoning to solve mathematical problems.

Table 2: Confidence in reasoning to solve Mathematics Problems

	Items:	SD	D	A	SA	$\bar{x}$	S.dev	Dec.	x^2	Df
1	I can read mathematical statements very fluently.	39	40	11	8	2.61	0.49	A	102.79	
2	I have no difficulties comprehendingmathematical phrases like one-tenth.	5	10	35	48	2.59	0.49	A	16.75	
3	Reading mathematical signs such as **+, -, ÷, x** is not a problem.	7	21	30	40	2.95	0.22	A	3.17	
4	Reading mathematical symbols like < and > is not confusing to me.	10	20	30	38	2.80	0.41	A	1.02	
5	I normally read and interpret what I have written in my maths class.	2	18	30	48	2.70	0.46	A	13.51	
Total/Average		**63**	**109**	**136**	**182**	**2.73**	**0.41**		**137.24**	**12**

From Table 2, the respondents opined that they have no problem of reading and spelling in mathematics, not even in interpreting mathematical signs and symbols correctly. Conclusively, confidence in reasoning to solve mathematics problems seems not to be the cause of upper basic one students' mathematics underachievement. This is evidence in their means and standard deviation ($\bar{x} = 2.73 \pm 0.41$**).** Also, the calculated chi-square value (***x^2*= 137.24**) is greater than the table value (***x^2*= 25.00**) with df = 15 at p ≤ 0.05 level of significance.Thus, wereject **Ho_2** and state that upper basic one students' mathematics underachievement is not dependent on their in-confidence in reasoning to solve mathematical problems.

Question 3: How does computation of mathematical problems affect upper basic one students' mathematics achievement?

H_{03}: Upper basic one students' Mathematics underachievement depends upon their in ability to compute mathematical problems.

Table 3: Mathematical computation ability

	Items	SD	D	A	SA	$\bar{x}$	S.dev	Dec.	x^2	df
1	I have no difficulties adding and subtracting numbers in their correct place value order.	2	3	25	68	**2.82**	**0.39**	A	**20.92**	
2	I have no problem multiplying decimals and fractions**.**	5	5	35	53	**2.87**	**0.34**	A	**4.71**	
3	I have no difficulties dividing numbers byzero.	5	15	43	35	**2.70**	**0.46**	A	**4.87**	
4	I have no difficulties in subtracting and adding negative numerals.	6	18	45	29	**2.53**	**0.50**	A	**12.64**	
5	Thelength and breadth of my classroom are not the same.	9	9	45	35	**2.64**	**0.48**	A	**5.40**	

6	I have no difficulties grasping or remembering math formulas	5	18	45	30	**2.51**	**0.52**	A	**9.92**	
7	I have no difficulties interpreting math signs and symbols	7	9	45	37	**2.62**	**0.49**	A	**3.05**	
8	I have no difficulty with abstract concepts of time and direction	5	10	30	53	**2.84**	**0.36**	A	**3.91**	
9	I have no difficulty in recalling schedules and sequences of events	5	8	25	60	**2.67**	**0.43**	A	**11.61**	
10	I have no fear of handling money and cash transactions	5	15	43	35	**2.72**	**0.42**	A	**3.77**	
Total/Average		**54**	**110**	**381**	**435**	**2.71**	**0.44**		**80.8**	**30**

From Table 3, the respondents opined that they have no problem of arithmetic disorder. They can multiply, divide and use mathematical signs and symbols correctly. This is an indication that, computation of mathematics problems seems not to be the cause of upper basic one students' mathematics underachievement as evidence in their means and standard deviation ($\bar{x} = 2.71 \pm 0.44$**).** Also,since the calculated chi-square value (x^2**= 80.8**) is greater than the table value (x^2**= 43.77**) with df = 30 at p ≤ 0.05 level of significance, wereject **Ho_3** and state thatupper basic one students' mathematics underachievement is not dependent ontheir in-ability to compute mathematical problems.

Discussion

In research question 1, the respondents opined from the given five items that,they have no difficulties in cognitive understanding of their mathematical sentences.That is to say that, the respondents has no difficulties identifying figures, words, signs, symbols and their arrangement in any given Mathematics sentence. This is confirmed by the chi-square test of hypothesis result.This result is in support of Nekang (2016) who posits that, it is very common for kids to have more than one learning issue. Thus, among other learning issues we may think of is the exogenous factors of learning that may be affecting this Upper basic one mathematically at-risk students.

The result of Table 2 is an attestationof respondents' opinion that, they are confidence in reasoning to solve Mathematics problems. That means the respondents have attested that they can interpret every given Mathematics problem logically.Thus, they have no Mathematical reasoning disorder. Their response attest strongly that, their Mathematics underachievement is not as a result of a neuro-developmental disorder rooted in specific numerical deficits that involve the understanding, accessibility and use of numerical information as claim by Bugden& Ansari, (2015) Kaufmann et al., (2013) Reeve & Gray, (2015)Regiosa-Crespo& Castro, (2015).

Table 3 shows respondents opinion in respect to research question 3 and the chi-square statistical results. The respondents opined that computation of Mathematics problems is not the cause of upper basic one students' Mathematics underachievement. That means the respondents are confident of solving simple addition, subtraction, division and multiplication problems required for daily living. This is confirmed by the tested chi-square result which show that $x^2_{cal} > x^2_{tab}$. This result exonerates the upper basic one students from the sub-types of Mathematical disorder identify by Khing (20116).

Conclusion

The results of hypotheses one, two and three contradict all the signs and characteristics of dyscalculia. The results show no evidence of correlation between respondents'expressions on endogenous factors and Upper basic one students' underachievement in Mathematics.Therefore, there is need to search among the exogenous factors and remedy the situation at it foundational stage.

Recommendations

Teachers need to use their pedagogical repertoire and appropriate intervention to remedy this situation appropriately at it foundational stage. Employers and school administrators need to employ to reduce teacher's work load and teacher- student ratio appropriately.

References

Agashi, P. P. (2003). Attainment of Van Hiale levels of mental development in geometry in Junior Secondary School students. *Journal of National Association Science, Humanities,Educational Research, 1(1), 25-31.*

Allardice, B. S., and Ginsburg, H. P. (1983).Pupils‟ psychological difficulties in mathematics.In H. P. Ginsburg (Ed.).*The development of mathematical thinking.*New York: Academic Press.

American Psychiatric Association. (2000). *DSM IV-TR: Diagnostic and statistical manual of mental disorder.* Washington, D.C.: American Psychiatric Association.

American Psychiatric Association. (2013). ***Diagnostic and statistical manual of mental disorders*** (5th ed.). Washington, DC:

Amiripour, P.;Bijanzadeh, M. H.;Rostamy-Malkhalifeh, M. &Najafi,M. (2012).The Effects of Assistive Technology on Increasing Capacity ofMathematical Problem Solving in Dyscalculia Students.*Journal of Applied Mathematics, Islamic Azad University of Lahijan,* Vol.8, 4(31), 47-55.

Ansari, D. and Karmiloff-Smith, A. (2002). Atypical trajectories of number development: a neuroconstructivist perspective. *Trends Cognitive Science* 6, 511-516.

Brannon, E. (2005). What Animals Know about Numbers.In J. I. D. Campbell (Ed.), *Handbook of mathematical cognition* (pp. 85-107). New York: Psychology Press.

Bryant, B.R. and Bryant, D.P. (2008). Introduction to the special series: Mathematics and learning disabilities. *Learning Disability Quarterly* 31: 3-8.

Bryant, D. P. (2005).Commentary on early identification and intervention for students with mathematics difficulties.*Journal of Learning Difficulties 38* (4) 340-345.

Bugden, S., and Ansari, D. (2015).How can cognitive neuroscience constrain our understanding if developmental dyscalculia. In S. J. Chinn (Ed.), *The Routledge international handbook of dyscalculia and mathematical learning difficulties* (pp. 18-43). London: Routledge.

Butterworth, B. (2003). *Dyscalculia screener: Highlighting children with specific learning difficulties in mathematics.* London: NFER-Nelson.

Butterworth, B., and Yeo, D. (2004).*Dyscalculia guidance : helping pupils with specific learning difficulties in maths*. London: nferNelson.

Butterworth, B. (2005). The development of arithmetical abilities.*Journal of Child Psychology and Psychiatry, 46* (1) 3-18.

Butterworth, B. (2010). Foundational numerical capacities and the origins of dyscalculia.*Trends in Cognitive Sciences*, *14*(12), 534–41. doi:10.1016/j.tics.2010.09.007

Chinn, S. J. (2004). *The trouble with maths: a practical guide to helping learners with numeracy difficulties.* London: RoutledgeFalmer.

Desoete, A., Stock, P., Schepens, A., Boeyens, D. and H. Roeyers. 2009. Classification, seriation and counting in Grades 1, 2 and 3 as two-year longitudinal predictors of low achieving in numerical facility and arithmetical achievement. *Journal of Psychoeducational Assessment* 27 (3): 252-264.

Doabler, C.T. andFien, H. 2013. Explicit mathematics instruction: What teachers can do for teaching students with mathematics difficulties.*Intervention in School and Clinic* 48: 276-258.

Dowker, A. (2004). *What works for children with mathematics difficulties?* (RR554) London:DfES. On http://www.catchup.org/LinkClick.aspx?fileticket=59GXj0uNY1A%3d&tabid=105,

Dowker, A. 2005.Early identification and intervention for students with mathematics difficulties.*Journal of Learning Disabilities* 38: 324-332.

Eksteen, L. J. (2014). Mathematical learning difficulties in Grade 1: The role and interrelatedness of cognitive processing, perceptual skills and numerical abilities.

Ernest, P. (2011). *Mathematics and special educational needs.*Berlin: LAP LAMBERT Academic Publishing.

Evans, A. (2007). *Evaluation of the Catch Up Numeracy project – Interim report on the research and development stage of the project.* School of Social Sciences, Cardiff University. On http://www.catchup.org/LinkClick.aspx?fileticket=ZUN_oNlUs4%3d&tabid=105,

Ferraz, F., andNeves, J. (2015).*A Brief Look into Dyscalculia and Supportive Tools*.15-18.

Fuchs, L. S., Compton, D. L., Fuchs, D., Paulsen, K., Bryant, J. D., andHamlett, C. L. (2005).The prevention, identification and cognitive determinants of math difficulty.*Journal of Educational Psychology, 97*, 493-513.

Fuchs, L.S. and Fuchs, D. (2007).A model for implementing responsiveness to intervention.*Teaching Exceptional Children* 39 (5): 14-20.

Geary, D. C. (1993). Mathematical disabilities: cognition, neuropsychological and genetic components. *Psychological Bulletin, 114*, 345-362.

Geary, D. C., and Hoard, M. K. (2001). Numerical and arithmetical cognition: a longitudinal study of process and concept deficits in pupils with learning disability. *Journal of Experimental Pupil Psychology, 54*, 372-391.

Geary, D.C. (2011).Consequences, characteristics and causes of mathematical learning disabilities and persistent low achievement in mathematics.*Journal of Developmental and Behavioral Pediatrics* 32: 250-263.

Hopkins, S., andEgeberg, H. (2009). Retrieval of simple addition facts: complexities involved in addressing a commonly identified mathematical learning difficulty. *Journal of Learning Disabilities 42*, (3), 215-229.

Iji, C.O., Abakpa, B.O. and Takor.D.I (2015).Utilizing Mathematical Manipulatives to Improve Upper Basicducation One Students' Achievement in Algebra in Kwande Local Government Area, Benue State.*The Journal of the Mathematical Association of Nigeria.*40(1) 300- 309.

Iji, C. O. (2019). Quest for Scientific Development in Nigeria: Insight and Issues. A Lead Paper Presented at the 7th Annual National Conference of the School of Sciences, College of Education Oju, Benue State, Nigeria held from 11th – 15th March, 2019.

Kaufmann, L., Mazzocco, M. M., Dowker, A., von Aster, M., Gobel, S. M., Grabner, R. H., andNuerk, H. C. (2013).Dyscalculia from a developmental and differential perspective.*Frontiers in Psychology, 4*, 5. doi:10.3389/fpsyg.2013.00516

Khing, B. (2016). Dyscalculia: Its Types, Symptoms, Causal Factors, and Remedial Programmes.*Learning Community*: 7(3): 217-229.

Kucian, K., and von Aster, M. (2015).Developmental dyscalculia.*European Journal ofPediatrics*, *174*(1), 1–13. doi:10.1007/s00431-014-2455-7

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

Mahmood, M. K. (2004). *A comparion of traditional method and computer assisted instruction on student achievement in general science*. (Doctoral dissertation, University of the Punjab, Lahore). Retrieved from Pakistan Research Repository at http://eprints.hec.gov.pk/view/year/2004.html

Moors, A., Weisenburgh-Snyder, A. and Robbins, J. (2010).Integrating frequency-based mathematics instruction with a multi-level assessment system to enhance response to intervention frameworks.*The Behavior Analyst Today* 11 (4): 226-244.

Nagavalli, T. (2015).A study of dyscalculic primary school Children in Salem district and evaluation of applicability of innovative strategies as remedial measures

Nagavalli, T., and Juliet, P. (2015). Technology ForDyscalculic Children. *SALEM, 16*, 1-10. Retrieved June 21st, 2018.

National Center for Learning Disabilities.Dyscalculia. (2014). Retrieved June 21st, 2018, from http://www.ncld.org/glossary/dyscalculia

Nekang, F. N. (2016). A survey of the mathematical problems (dyscalculia)Confronting primary school pupils in Buea municipality in theSouth west region of Cameroon. *International Journal of Education and Research* 4 (4), 437- 450.

Osciak, S. Y., andMilheim, W. D. (2001).Multiple intelligence and the design of web-based instruction. *International Journal of Instructional Media*, *28*, 355-361.

Ranpura, A., Isaacs, E., Edmonds, C., Rogers, M., Lanigan, J., Singhal, A., and Butterworth, B. (2013).Developmental trajectoriesof grey and white matter in dyscalculia.*Trends in Neuroscience and Education*, *2*(2), 56-64.http://doi.org/10.1016/j.tine.2013.06.007

Rapin, I. (2016). Dyscalculia and the calculating brain.*Pediatric Neurology*.http://doi.org/10.1016/j.pediatrneurol.2016.02.00

Reeve, R., and Gray, S. (2015). Number difficulties in young children.Deficits in core number? In S. J. Chinn (Ed.), *The Routledge international handbook of dyscalculia and mathematical learning difficulties* (44-59). London: Routledge.

Regiosa-Crespo, V., and Castro, D. (2015). Dots and digits: How do children process the numerical magnitude? Evidence from brain and behaviour. In S. J. Chinn (Ed.), *The Routledge international handbook of dyscalculia and mathematical learning difficulties* (pp. 60-77). London: Routledge.

Shalev, R. S., and Gross-Tsur, V. (1993).Developmental dyscalculia and medical assessment.*Journal of Learning Disabilities, 27,* (2), 123-134.

Sharma, M. (2003). *What is dyscalculia?* On www.bbc.co.uk/skillswise/tutors/expert/column/dyscalculia/index.shtml,

Sharma, M. (2015).Center for Teaching/Learning of Mathematics, Inc. http://www. dyscalculia.org/experts/sharma-s-ctlm/sharma-publications[29/07/17].

Siegel, L. S., and Ryan, E. B. (1989). The development of working memory in normally achieving and sub-types of learning disabled pupils. *Pupil Development, 60,* 973-980.

Simmons, F.R., Willis, C. and Adams A. 2011. Different components of working memory have different relationships with different mathematical skills. *Journal of Experimental Child Psychology* 111: 139-155.

Skemp, R. R. (1962). The Psychology of learning and teaching mathematics.United Nations Educational, Scientific and Cultural Organization.

Sousa, D. A. (2008).*How the brain learns mathematics.* California: Corwin Press.

Stephanie, G. M. (2014). Dyscalculia: An Essential Guide for Parents.

Temple, C. M. (1991). Procedural dyscalculia and number fact dyscalculia: double dissociation in developmental dyscalculia. *Cognitive Neuropsychology, 8,* 155-176.

Temple, C. M., and Sherwood, S. (2002). Representation and retrieval of arithmetical facts: developmental difficulties. *Quarterly Journal of Experimental Psychology, 55A,* (3), 733-752.

Tian, J. andSiegler, R. S. (2016).Fractions learning in children with mathematics difficulties.*Journal of Learning Disabilities*, , 1-7. DOI: 10.1177/0022219416662032

Van De Walle, J. A. (2004). *Elementary and middle school mathematics.*(5th Edition). Boston: Pearson Education.

Van Nes, F. and De Lange, J. 2007. Mathematics education and neurosciences: Relating spatial structures to the development of spatial sense and number sense. *The Montana Mathematics Enthusiast* 4(2): 210-229.

Von Aster, M. G., &Shalev, R. S. (2007).Number development and developmental dyscalculia.*Dev. Med. Child Neurol*, *49*(11),868-873.

Wang, E., Qin, S., Chang, M., and Zhu, X. (2015). Digital memory encoding in Chinese dyscalculia: An event-related potentialstudy. *Research in Developmental Disabilities*, *36*, 142-149. http://doi.org/10.1016/j.ridd.2014.09.020

WHO, (2005).ICD-10. International Statistical Classification of Diseases and Related Health www.bbc.co.uk/skillswise/tutors/expert/column/dyscalculia/index.shtml,

Yusuf, F. I. (2009). Strategy for effective Teaching and Learning of Calculus in Secondary Schools.*Abacus: The Journal of the Mathematical Association of Nigeria,* 34(1). Pp 19-24.

Zerafa, E. (2011). Helping children with Dyscalculia: The implementation of a Teaching Programme with Three primary school children.Master dissertation.