SEX DIFFERENCE IN THE PREVALENCE OF DYSCALCULIA AMONG PUBLIC SECONDARY SCHOOL STUDENTS IN NIGERIA

Martins Noyosase IGBINEWEKA Ph.D.[1]*,
Osenweugwor Ngozi AIHIE Ph.D.[2],
Patience Ndidi AGBOMA[3]

University of Benin, Faculty of Education, Department of Educational Evaluation and Counselling Psychology, Benin City, Nigeria
martins.igbineweka@uniben.edu

Abstract

This study examined sex difference in the prevalence of dyscalculia among public secondary school students in Ika South Local Government Area of Delta, Nigeria. Two research questions were raised with their corresponding hypothesis formulated and tested at 0.05 alpha level of significance. This research adopted the descriptive survey research design. The population comprised of ten thousand, three hundred and ninety-two (10,392) students as at 2021/2022 academic session and the multistage sampling technique was employed to select one thousand, three hundred and forty-four (1,344) respondents were used for the study. The research instrument was a questionnaire titled "Dyscalculia Screening Questionnaire Among Secondary School Students" (DSQ) which was adapted from the Dyscalculia Screening Tool (DST) as developed by Adaikala and Pio (1982). The data was analysed using the descriptive statistics (mean and standard deviation) and inferential statistics (t-test and one-way ANOVA). The finding of the study revealed that dyscalculia disorder was moderately prevalent among public secondary school students in Ika South Local Government Area of Delta State. It was also found that there is no significant sex difference among secondary students with dyscalculia in Ika South Local Government of Delta State. It is therefore recommended that intervention should be provided to secondary school students to manage the prevalence of dyscalculia among secondary school students.

Keywords: *Sex; Prevalence; Dyscalculia Disorder; Students.*

Introduction

Learning disorder otherwise known as learning disabilities is an umbrella term for a wide variety of learning problems. According to Kemp et al, (2017) learning disability is not a problem with intelligence or motivation but their brains are simply wired differently from others and these differences affect how they receive and process information (Osisanya et al, 2018). Repeated evidence literature has proven that basic number skills form the foundations for learning more complex mathematical skills (Li et al., 2018); and later achievement in mathematics is dependent on early numerical skills (Zhang et al., 2017; Blume et al., 2021). While human experience h is as an active process and multifaceted has been observed to be the outcome of learning (Abu-Hamour & Al-hmouz, 2017). Specific Learning Disability (SLD) is a broad term referring to a diverse group of neurobehavioral disorders characterized by significant unexpected and persistent difficulties in the acquisition and application of efficient reading (dyslexia), writing (dysgraphia), and mathematical (dyscalculia) abilities Eteng-Uket (2023).

The term dyscalculia is derived from the combination of Greek and Latin words: “Dys” comes from Greek word which means “difficulty”; “calculia” from Latin word which means calculation (Khing, 2016). Literally, dyscalculia means calculation difficulty. Dyscalculia according to Nwabueze, (2020) is a combination of two different words in Latin and Greek; namely Latin - '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; there may be reason to believe dyscalculia may just be one aspect of dyslexia (Andersson et al., 2021). According to Forbes (2017) dyscalculia is an inherited neurological condition that affects the acquisition of skills in mathematics. It is a learning disability affecting children with normal intelligence and age-appropriate school education in which they have problems with the acquisition of numerical-arithmetical skills (WHO, 2010; McCaskey et al, 2018). Persons with dyscalculia show varieties of symptoms like problem comprehending numbers, inaccurate calculations, difficulties recognizing and remembering numerical symbols, inability to follow the sequence of steps involved in various mathematical task and lack of concentration on mentally intensive tasks and a host of other problems (Zygouris et al. 2017; Ogbogo & Opara 2021; Ogbogo & Orluwene 2021).

Dyscalculia is also perceived as a difficulty in mathematical performance resulting from impairment in those parts of the brain that are involved in mathematical processing, without a concurrent impairment in general mental function (Wilson, 2015). This implies that dyscalculia is a learning disability in a learner with normal intelligence but weak in

mathematical skills and its operations. The fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-V), stated that Dyscalculia is an alternative term used to refer to a pattern of difficulties characterised by problems processing numerical information, learning arithmetic facts, and performing accurate calculations; and noted that the "prevalence of specific learning disorders across the academic domains of reading, writing and mathematics is 5%-15% among school age children" (APA, 2013). Different terms have been used to identify dyscalculia by different researchers. Some of the terms include developmental dyscalculia (Anobile et al, 2016; Attout & Majerus, 2015; Attout et al, 2015; Bugden & Ansari, 2016; McCaskey et al, 2017; Rosenberg-Lee et al, 2015; Sousa et al, 2016). Mathematics disability (Abu-Hamour, 2018; Radhika & Kiran, 2017). Mathematical learning disability (Kroesbergen & van Dijk, 2015; Lewis & Fisher, 2016; Schwartz et al, 2018). Mathematics difficulties (Abu-Hamour & Al-hmouz, 2017; Karakonstantaki et al, 2017; Monei & Pedro, 2017). Disorder in mathematics (Zygouris et al, 2017). Numeracy deficit (Ribeiro et al, 2017) and Mathematics anxiety (Kucian et al, 2018; Mammarella et al, 2017; Rubinsten, 2015), among others.

Dyscalculia causes have been attributed to biological and environmental factors. Students with dyscalculia show significant reduced activity in the brain regions that belongs to networks of quantity and number processing (Aquil & Ariffin, 2020). The symptoms include mathematics anxiety, difficulty in calculation processes, inability to understand mathematical facts, have little or no confidence in their ability to study mathematics, low level of concentration, among others, which may lead to poor performance in numeracy related subjects. This calculation difficulty may also be caused by a poor Specific Processor (SP1) being manifested psychometrically by a correlation between calculation problems and a discrepancy between low Verbal IQ (VIQ) and high-Performance IQ (PIQ) (May & Ahmad, 2020). It has been observed that the prevalence of dyscalculia is about 5-8% among secondary school aged students; with an estimated case of up to 25% of economically active individuals in countries such as the United Kingdom lack basic numerical knowledge, skills and understanding that would have been essential for them to act confidently and independently in everyday life, educational settings and work (Snyder et al, 2016); leading to lower academic attainment as a result of low self-esteem and frustration faced from the problem of anxiety.

Dyscalculia is quite common among adolescents with age bracket 11-19 years secondary school age (APA, 2013). In Nigeria, Orim and Uko, (2017) estimate the dyscalculia prevalence to be 15-30%, while Osuroji, (2013) put the prevalence among children within the school age to be 45%, dyslexia alone have 25%, attention deficit has about 15% and

others has 5%. The Federal Ministry of Women Affairs and Social Development (2011) in a baseline survey on PWDs report that SLD has the highest prevalence of about 58%, reading disability takes about 31% leaving 11% to other sub-types. Department of Special Education University of Calabar (2015) screened 100 pupils in Calabar metropolis and the result indicated that 25% has dyscalculia, 35% with dyslexia, 15% are dysgrahic, 10% has dyspraxia, attention deficit and others have 8% and 7%. It is difficult to distinguish individuals with dyscalculia from those who are 'slow learners' (delayed acquisition), or suffering from impaired acquisition due to low cognitive ability (Butterworth, 2018). These challenges in identifying dyscalculia further contribute to the lack of its recognition.

Dyscalculia does not affect students' only academic work in school; it also affects their daily lives (out-of-school activities). In general, people with dyscalculia have trouble relating to the numbers, weakness in the observation process as they do not observe the numbers in Mathematics as a whole as well as recognizing patterns (Peters, et al, 2018; Bizzaro, et al, 2018). Students with dyscalculia show significant reduced activity in the brain regions that belongs to networks of quantity and number processing (Aquil & Ariffin, 2020). This may likely be the result of genetic deficiency of congenital core competencies which leads to certain cognitive functions not developing according to developmental tasks. Environmentally, it can be acquired by brain damage as a result of brain injury or stroke. Individuals with dyscalculia show the following symptoms or characteristics which include difficulties in understanding number values, patterns and have challenges in computing basic mathematical operations. Nkomo (2020) found that students have problems in the area of calculation and solving simple arithmetical problems which may be attributed to the intensity of school activities, duration of school, impact of school workload, social functioning, and students' poor coping skills which could set significant stress on the students.

The fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-V) noted that the “prevalence of specific learning disorders across the academic domains of reading, writing and mathematics is 5%-15% among school age children” (APA, 2013; p.70). Studies by the United States of America Centre for Learning Disability, on representative samples of both school-based and general populations have been carried out in various countries across the world. The resulting estimates suggest that as many as 3-6% of individuals may suffer from dyscalculia, while adolescents from 12 to 17 years who suffer from dyscalculia are 2.6% (Onukwufor, 2016). The researchers are of the opinion that some secondary school students who do not perform well in numeracy related subjects as evident in West African Senior Secondary Schools Certificate Examination

(WASSCE) and National Examination Council (NECO) might also be linked to dyscalculia. From the records of the different National Examinations, learning difficulties can be said to be present as revealed from the poor academic performances in mathematics.

The results of Senior Secondary School Certificate Examination (SSCE) in the National Examination Council (NECO) and West African Examinations Council (WAEC) in the recent times have attested to the fact that the prevalence of learning disabilities might be high in Nigeria. It is generally believed that more than 40% of registered candidates who sat for the Senior School Examinations failed either English Language or Mathematics, with less than four credits pass out of eight or nine registered subjects. Presumption of this might be learning disabilities: dyslexia and dyscalculia, since these disorders affect reading and mathematical skills (Westwood, 2016).

Table 1.1: Statistics of students Performance in Mathematics in WAEC in Nigeria

Year	Number of Students who sat	No of students with A1 -C6	% of students with A1 -C6	No of students with D7 -F9	% of students with D7 -F9
2016	1,544,234	597,310	38.68	946,924	61.32
2017	1,559,162	796,041	59.22	54,8169	40.78
2018	1,572,396	786,016	49.98	786,380	50.02
2019	1,590,173	447,809	28.16	1,142,364	71.84
2020	1,538,445	425,022	27.53	1,113,423	72.37
2021	1,560,261	688,858	44.15	871,403	55.85

Source: West African Examination Council (WAEC) Website (2016-2021) and National Bureau of Statistics, (2022).

Table 1.2: Statistics of students Performance in Mathematics in NECO in Nigeria

Year	Number of Students who sat	No of students with A1 -C6	% of students with A1 -C6	No of students with D7 -F9	% of students with D7 -F9
2016	1,022,474	812,846	80.16	209,628	19.84
2017	1,051,472	745,053	70.85	306,419	29.15
2018	1,032,729	738,195	71.48	294,534	28.52
2019	1,151,016	829,787	71.59	321,229	28.41
2020	1,209,992	984,101	73.89	225,891	26.11
2021	1,225,631	945,853	77.17	279,778	22.83

Source: National Examination Council (NECO) Website (2016 -2021)

Osisanya et al, (2018), observed that sex is not a factor in dyscalculia prevalence as they found no significant difference between male participants with dyscalculia and female participants with dyscalculia. In the same vein, while symptoms of dyscalculia occur in both sexes, females are more prone in the manifestation of dyscalculia than their male counterpart (Nkomo, 2020). In a study by Cheng., Miao and Zhou, (2021), to access Prevalence of Learning Disabilities among Chinese Children, Adolescents, and Young Adults: Comorbidity, Age Trend, and Gender Differences, a significant gender difference in the prevalence rate of dyscalculia existed among all participants: males had a higher prevalence (6.4%) than females (5.3%). Some studies have reported that dyscalculia is more prevalent in girls (Lambert & Spinath, 2014; Landerl & Moll, 2010).

Research questions

- Is dyscalculia disorder prevalent among public secondary school students in Ika South Local Government Area of Delta State?
- Is there any difference in dyscalculia disorder among public secondary school students in Ika South Local Government Area of Delta State by sex?

Hypotheses

- There is no significant influence in dyscalculia disorder among public secondary school students in Ika South Local Government Area of Delta State by sex.

Ethical considerations

Ethical clearance for this particular research was obtained as follows: the principals of the selected schools were informed, then teachers of the randomly selected students were instructed by the principals to assist the researchers in explaining the reasons for the consent forms to the students – this was to improve the student's confidence with regard to confidentiality, after which consent letters were signed by the recipients and returned to the researcher, while those who refused were excluded, before the questionnaires were administered.

Methodology

The descriptive survey research design was used for the study.

Participants

The population of this study consists of all students in the public secondary schools in Ika South Local Government Area of Delta State. The Local Government Area has a total of twenty-one (21) public secondary schools with a total population of ten thousand, three hundred and ninety-two (10,392) students as at 2021/2022 academic session. This is made up of five thousand and fourteen (5,014) male students and five thousand, three hundred

and seventy-eight (5,378) female students from JSS 1 to SSS 3 (Ministry of Education, Ika South Local Government Area, 2022) (See Appendix A).

Sample and Sampling Technique

The local government area is delineated into two constituencies (namely: Agbor and Abavo constituencies). Agbor constituency has sixteen (16) secondary schools, while Abavo constituency has five (5) secondary schools. Secondly, random sampling technique was used to select seven (7) secondary schools from the twenty-one (21) secondary schools. This was used so that a section of the two constituencies will not be under-populated. Five (5) secondary schools were selected from Agbor constituency while two (2) secondary schools were selected from Abavo constituency. The selected schools have a total population of three thousand, one hundred and sixty-eight (3,168) (1,562 females and 1,606 males). Finally, the simple random sampling technique was used to select two hundred and twenty-four (224) students (98 males and 126 females) from each class in the seven (7) selected secondary schools making a total of 1,344 respondents which is 12.93% of the total population for the study. One hundred and ninety-two (192) students (84 males and 108 females) were selected from each school using purposive sampling

The methodology section is incomplete without description of instrument, data collection procedure and analysis

Results

Research Question One:

Is dyscalculia disorder prevalent among public secondary school students in Ika South Local Government Area of Delta State?

Table 1

Mean and Standard Deviation of Dyscalculia Disorder Prevalence Among Public Secondary School Students

SN	Items	N	Mean	Std. Dev.	Decision
1	Numerical Difficulties	1344	2.67	0.54	Moderate
2	Identification Difficulties	1344	2.77	0.56	Moderate
3	Cognitive Difficulties	1344	2.70	0.55	Moderate
4	Problem Solving Difficulties	1344	2.79	0.52	Moderate
5	Logical/Reasoning Difficulties	1344	2.85	0.59	Moderate
6	Understanding Difficulties	1344	2.87	0.60	Moderate
	Dyscalculia Prevalence	1344	2.78	0.33	Moderate

Key: 1.00 – 2.33 = Low level; 2.34 – 3.67 = Moderate level; 3.68 – 5.00 = High level

Table 1 showed that the mean value for numerical difficulties of respondents is 2.67 and standard deviation is 0.54; for identification difficulties, mean of respondents is 2.77 and standard deviation is 0.56; for cognitive difficulties, mean of respondents is 2.70 and standard deviation is 0.55; for problem solving difficulties, mean of respondents is 2.79 and standard deviation is 0.52; for logical/reasoning difficulties, mean of respondents is 2.85 and standard deviation is 0.59; for understanding difficulties mean of respondents is 2.87 and standard deviation is 0.60. Since all the difficulties fall within 2.34 – 3.67, therefore, the difficulties have moderate prevalence. The mean response is 2.78 and standard deviation is 0.33, falling within 2.34 – 3.67, therefore dyscalculia disorder is said to be moderately prevalent among all public secondary school students in Ika South Local Government Area.

Hypothesis One

There is no significant difference in dyscalculia among public secondary school students in Ika South Local Government Area of Delta State using sex.

Table 2

T-test showing difference in Dyscalculia Disorder Among Public Secondary School Students in Ika South Local Government Area of Delta State by Sex

Sex	N	Mean	Std. Deviation	T	Sig. (2 tailed)
Male	756	111.19	13.66	.315	.753
Female	588	110.96	13.00		

α = 0.05 level of significance

Table 2 shows a t-test value of 0.315 and a *p-value* of 0.753 testing at an alpha level 0.05; the *p-value* is greater than the alpha level. So, the null hypothesis which states that there is no significant influence in dyscalculia disorder among public secondary school students in Ika South Local Government Area of Delta State by sex is retained. This means that sex has no moderating effect on the prevalence of dyscalculia disorder among public secondary school students in the local government area.

Discussion

The findings revealed that dyscalculia disorder is said to be moderately prevalent among all public secondary school students in Ika South Local Government Area. Why? Give reasons for your finding before linking it to other studies. The a finding lends credence to studies which opined that dyscalculia quite common among adolescents with age bracket

11-19 years secondary school age for which the age bracket of the sample population falls with (APA, 2013). In line with the aforementioned findings, evidence in Nigeria estimated the prevalence rate to be 15-30% (Orim & Uko, 2017).

Finally, it was revealed that sex had no influence on the prevalence of dyscalculia disorder among public secondary school students in Ika South Local Government Area. This FINDING corroborates the findings of Osisanya et al, (2018) which observed that sex was not a contributing factor in dyscalculia prevalence as they found no significant difference between male a and female participants with dyscalculia, alluding to the fact that symptoms of dyscalculia occur in both sexes. Contrary to the aforementioned finding which stated that sex had no influence on the prevalence of dyscalculia disorder among public secondary school students, Nkomo, (2020); Lambert and Spinath, (2014) are of the opinion that females are more prone in the manifestation of dyscalculia than their male counterpart. While Miao and Zhou, (2021), opined from their study that males had a higher prevalence (6.4%) than females (5.3%).

Conclusion

It was concluded from this study that dyscalculia disorder was moderately prevalent among all public secondary school students in Ika South Local Government Area, while sex had no influence on the prevalence of dyscalculia disorder among public secondary school students in Ika South Local Government Area.

Recommendations

- Since dyscalculia disorder is said to be moderately prevalent appropriate counselling intervention be put in place by counsellors to manage it.
- Attention should be given to clients with dyscalculia irrespective of sex during interventions.

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