



RELATIONSHIP BETWEEN DYSCALCULIA AND LEARNING OUTCOME IN MATHEMATICS AMONG JS 111 STUDENTS IN NYANYA EDUCATION ZONE, FCT, ABUJA, NIGERIA

DR. SULE SAMUEL SARDAUNA & BABAGANA MOHAMMED BUTU

Department of Education, Faculty of Arts and Education, Yobe State University, Damaturu, Nigeria

ABSTRACT

This study was carried out to investigate the relationship between dyscalculia (sequential, verbal, practognostic, operational) and students' learning outcome in Mathematics in Nyanya Education zone, Federal Capital Territory (FCT), Abuja, Nigeria. The study applied correlational survey research design. The population of the study comprised of all the junior secondary three (JS111) students in Nyanya Education Zone, Federal Capital Territory, Abuja, Nigeria. Through Simple random sampling procedures, the sample size of

INTRODUCTION

Mathematics as a core subject in schools has become very essential due to the specific role it plays in the academic and professional preparation of students for future career. To Evans (2000), science is the base that provides the foundation for the growth of technology and mathematics is the gate and key to sciences. Ekwueme and Meremikwu (2009) observed that mathematics is the language of science and technology which helps children to be sensible in building a solid foundation for a living. In the society today, without knowledge in mathematics, science and technology, living a fulfilling and productive life is increasingly challenging for individual. Fakuade (1973) exclaimed that the growing nature of knowledge and complexity of our societal organization has made it necessary for an incredible expansion of application of logical and qualitative methods of teaching. It is germane to know that mathematics is hierarchical and as such students, who do not understand a step, will also find it difficult to move on which may lead to mathematical phobia (Mayer, 2004). No matter the level of teaching with deficit foundation, every effort made cannot produce desired results (Agashi, 2003). Mathematics presents various challenges for man as it is frequently regarded as difficult and tedious subject to learn (Sedig, 2008). A review of students' performance in public examinations such as West African Examination Councils (WAEC) and National Examination Councils (NECO) reveals that over a decade now, students' mathematics



two hundred (200) students were randomly drawn from five different schools within the study area. This study used an instrument called a Questionnaire (SQ) constructed by the researcher and validated by experts in the field of Mathematics Education and Measurement and evaluation... One research question was stated to guide the study. Data collected were analyzed using Pearson product-moment correlation analysis and tested at $\alpha = 0.05$ level of significance. The results of the study revealed among others that; there is significant relationship between dyscalculia (sequential, verbal, practognostic, operational) and students' learning outcome in Mathematics. Based on this findings therein, the study recommended that students should engage in practice, extra-time, graphicalzed their work and evaluate their work or problems.

Keywords: Dyslexia; Dyscalculia; Mathematics; Teaching and learning; Students

achievement has not been encouraging due to difficulties they (students) usually encounter. According to Agashi (2003), the inability of students to achieve their potentials is due to what educationists, researchers as well as psychologists' term mathematics learning difficulty and technically refers to as dyscalculia. The term dyscalculia is derived from Greek prefix "dys" which means "badly" and Latin "calculare" which means to count. Thus, dyscalculia simply means counting badly (Orim, 2016).

The learning of mathematics is carried out differently. Therefore, dyscalculic students may have difficulty with numbers and remembering mathematical operations leading to poor performance in and out of needs. Students with dyscalculia may have difficulty understanding simple number concepts, lack an intuitive grasp of numbers and have problems learning number facts and procedures. Even though they produce correct procedure or answer, it may mechanically be done without confidence (British Dyslexia Association, 2009). It is against this background, the researcher deems it necessary to investigate the relationship between dyscalculia and learning outcome in mathematics among JSIII students in Nyanya Education zone, FCT, Abuja, Nigeria.

Aims and Objectives of the Study

The purpose of this study was to investigate the relationship between dyscalculia and learning outcome in mathematics among JS111 students in Nyanya Education zone Federal Capital Territory (FCT), Abuja, Nigeria. Specifically, the study sought to investigate:

1. If there is relationship between dyscalculia (sequential, verbal, practognostic, operational) and students' learning outcome in Mathematics.

Research Question

The following research question was stated in order to guide the study:

1. Is there relationship between dyscalculia (sequential, verbal, practognostic, operational) and students learning outcome in Mathematics?



Research Hypothesis

The following alternative hypothesis was formulated and tested at $\alpha = .05$ level of significance.

1. There is significant relationship between dyscalculia (sequential, verbal, practognostic, operational) and students learning outcome in Mathematics

Significance of the Study

Significantly, the findings of this study would benefit the following stakeholders: students, teachers (educators) parents/guidance as it enables them to determine inabilities, phobia, and anxiety and develop compensatory mechanism for under developed areas. This study would bring significances to Nyanya Education Zone, Federal Capital Territory (FCT), Abuja /Ministry of Education as a whole and future researchers. The findings would be useful to determine the allocations of funding and resources for the students with learning difficulties. It would help to create the awareness of dyscalculia among the people.

Literature Review

This section specifically deals with theoretical framework/conceptual presentation and previous studies on variables of the present study. These variables include; Concept of dyscalculia; Types of dyscalculia in students. These are discussed as follows:

Concept of Dyscalculia

In the context of this study, dyscalculia is a learning difficulty faced by an individual/ students (learners). Dyscalculia is a condition that affects the ability to acquire arithmetical skills (Department for Education and Skills, 2001). The concept of dyscalculia is linked with problems in reasoning, selecting, attention span, memory and focusing on relevant stimuli (Shimamura, 2002). It is a learning disability (difficulty) that may give rise to low self-esteem, school dropout, rigid understanding of counting, poor understanding of number magnitude, immature strategies during problem-solving and a bigger handicap on a learning process (Udgen, 2004). There is no single type of mathematics disability. Dyscalculia varies from one person to another and can hinder people differently at different levels of life leading to life-long difficulties in learning skills both in school and outside bringing about frustration and avoidance of learning the subject. Perhaps, the disposition of any individual could affect the level of mathematical difficulties (Pseudo- dyscalculia). Dyscalculia occurs at all ages.

Dyscalculia could also be referred to the manifestation of vague and unpleasant emotion experienced in a learner which interferes with the manipulation of numbers and solving of Mathematics problems and sciences. Several students who suffer from dyscalculia have little confidence in their ability to study Mathematics. Dyscalculia is quite rare and individuals diagnosed as possessing this disorder are often actually dyslexic. There are treatments and therapies available to dyscalculia individuals seeking to improve their mathematical skills. From the researcher's point of view, Mathematics language refers to the collection of signs or symbols, abbreviations, axioms, lemma, methods, formulae, and units that are necessary in sciences and Mathematics teaching and learning. Specific vocabulary that refers to quantities and spatial placement tend to create problems for dyslexic students. These include words and phrases such



as before, after, more than, less than, and between. It is difficult for dyslexic students to understand the meaning of such words in relation to Mathematics.

To identify a child with learning disabilities can be difficult as there are many areas of development to be considered. Some of these areas are: Child's gross and fine motor skills, reading, mathematics attention span (MAS), social and emotional development (Nieme, 2007). Moreover, as arithmetical thinking involves a wide variety of components, there are many forms and causes of arithmetical difficulty, with different degree of importance (Mazzocco & Myers, 2006; Desoete & Roeyers, 2003)

Types of Dyscalculia in Students

The observation of dyscalculia in children can be done differently having it in mind or bearing in mind that it is a learning disability or difficulty. Some of them are discussed below:

- Sequential dyscalculia:-counting according to sequence/using the sequence effectively. students with neurological impairments have difficulty generating and producing counting sequence (Lacert, 1997) and applying steps in arithmetic procedures in a correct sequence (Gordon 1992). The understanding and utilization of sequence is very necessary for effective mathematics learning outcome. This is so because the answer is not what is needed but the step taken in solving a mathematical problem to achieve at such answer is based on student's level of understanding.
- Verbal Dyscalculia: - refers to challenges in remembering and naming mathematical terms and symbols. Challenges associated with this types of dyscalculia is a problem of recalling numbers, calculation and geometric shapes.
- Practognostic Dyscalculia: - refers to challenges using manipulative/pictures when solving a mathematical problems. Any student with this type of disorder fails to understand and answers oral or written problems that are presented in words or picture.
- Operational Dyscalculia: - deals with issues of basic arithmetic operations. A student with this type of dyscalculia has difficulties arranging numbers by size and sequences. Finger counting becomes a solution to manage the situation. Bad memory of multiplicative tables.

Several studies have been conducted or carried out on dyscalculia by different researchers with empirical findings reported in reputable Journals, Dissertations and Theses. Rim and Igwe (2017) researched on correlates of dyscalculia and learning outcome in Mathematics among SSII students in Obudu, C.R.S- Nigeria. The survey research design was adopted for the study. A sample of 200 students was randomly drawn for the study. Data generated were subjected to statistical analysis using Pearson product moment correlation analysis at 0.05 level of significant. Results obtained show among others that dyscalculia significantly correlates with students learning in mathematics. Based on this, it was recommended among others that students should engage in practice, extra-time, graphicalized their work and evaluate their work.

Yoong, Gengatharan and Amat Yasin (2022) conducted a study on the survey of the problems of dyscalculia in primary schools. The researchers employed quantitative design to carry out the study. Survey method is used to collect the data. Descriptive and inferential statistics are



used to analyse the survey data. A study was conducted with 381 primary schools Mathematics teachers in Malaysia. Means and standard deviation were used to analyse the level of problems of dyscalculia, whereas independent t-test were used to compare the level of problems of dyscalculia between school locations. The results show that the level of problems of dyscalculia is medium high ($M=3.31, \sigma=0.97$). On the other hand, the problem of dyscalculia in rural area is slightly higher ($M=3.822, \sigma=0.697$) than the urban area ($M=3.717, \sigma=0.696$). In short, there is no significant difference for the level of problems of dyscalculia between different school locations ($p=0.147, p>0.05$). As a conclusion, interventions and diagnosis need to be carried out in order to improve the capabilities of these pupils to the maximum. Despite several researches carried out on dyscalculia, the fact still remains that there are still students in and out of schools with difficulties when it comes to learning mathematics. This can be well-known when a child is yawning for an English or History classes and will not want to attend a mathematics class. Other signs of dyscalculia among students are performing below expectations, discrepancy between developmental level and cognitive ability, laterality, rote counting, rules and formulae, sequencing, time management and so on.

Most studies reviewed above are related to the present study. However, none of the studies is exact to the topic of the current study, it is on this basis, the researcher deems it necessary to investigate the relationship between dyscalculia and learning outcome in mathematics among JS111 students in Nyanya Education zone, Federal Capital Territory (FCT), Abuja, Nigeria in particular. This is the gap the current study sought to close.

Method and Materials

This study applied a correlational survey research design. This type of survey design is appropriate for the study since it establishes the relationship that occurs between two or more variables. The population of the study comprised all the 27 junior secondary three (JS111) students in Nyanya Education Zone, Federal Capital Territory (FCT), Abuja, Nigeria. Using simple random sampling procedures, five schools were drawn out of the 27 schools in the area of the study. Five intact classes of 40 students each from the five schools drawn were used. Therefore, a sample size of 200 students was used for the study. This study used an instrument called a questionnaire. The instrument was subjected to content and face validity by specialists (Mathematics educators) and those in measurement and evaluation. The instrument was comprehensively assessed and the corrections, recommendations and suggestions made by these experts were used to prepare the final copy of the instrument. The research instrument was administered by the researcher with the assistance of research assistants (Mathematics class teachers). The data generated were analyzed using Pearson Product-Moment Correlation analysis and tested at $\alpha = 0.05$ level of significance.

Presentation of Results

Relationship between Dyscalculia (sequential, verbal, practognostic, operational) and Students' learning outcome in Mathematics

The results of Pearson product moment correlation analysis carried out to examine if there is any significant relationship between dyscalculia (sequential, verbal, practognostic, operational) and students' learning outcome in Mathematics are shown Table. Is there is any



relationship between dyscalculia (sequential, verbal, practognostic, operational) and students' learning outcome in Mathematics? The data used to answer to this research question were presented in Table 1.

Table 1: Pearson Product -Moment Correlation Analysis of the Relationship between Dyscalculia (acalculia, verbal, operational/practognostic and sequential) and Students' learning outcome in Mathematics

Variables	$\Sigma X \Sigma Y$	$\Sigma X^2 \Sigma Y^2$	ΣXY	r-cal
Sequential (X1)	2648	40237	24351	0.168
Practognostic (X3)	2310	28147	19572	0.146
Verbal (X2)	2321	28721	20553	0.172
Acalculia (X4)	2313	30099	20366	0.188
Students learning outcome (Y)	1784	17739		

Significant at 0.05, df =198, critical r=0.129

The results shown in Table 1 reveal that calculated r-values for X1, X2, X3 and X4 were 0.168, 0.146, 0.172 and 0.188 in that order are found to be greater than the critical r-value of 0.129 at 0.05 level of significance with df = 198. Sequel to the result, the null hypothesis was retained from the fact that the calculated values were found to be less than the tabulated value. This signifies that there is significant relationship between dyscalculia (sequential, verbal, practognostic, operational) and students' learning outcome in Mathematics in area of the study.

Discussion of the Findings

The findings of this study has shown that there is a relationship between dyscalculia (sequential, verbal, practognostic, operational) and students' learning outcome in Mathematics. This simply signifies that dyscalculia affect students' learning outcome from the subject (Mathematics). This finding is in line with the views of Adler (2001), Farmer, Riddick and Sterling (2002), Butterworth (2003), Mazzocco and Myers (2006), Wadlington and Wadlington (2008), Rubinstein and Tannock (2010) who believed that dyscalculia has a great effect on students learning outcome.

Similarly, this finding is also in agreement with that of Rim and Igwe (2017) who researched on correlates of dyscalculia and learning outcome in Mathematics among SSII students in Obudu, C.R.S- Nigeria and found that dyscalculia significantly correlates with students' learning in the subject (mathematics).

In generally speaking, dyscalculia can cause students to become frustrated and develop negative behavioral and social problems, which then becomes the focus of any teacher in a learning process. Sometimes failures in mathematics are as a result of students' carelessness. However, this may result from lack of understanding of the factors or operation involved in solving mathematical tasks/problems.

Conclusion and Recommendations

Based on the findings of this study, the following methods or strategies should be applied to reduce the level of dyscalculia in students;



- Practice: (a) Review Frequently (b) Draw a picture to help understand the problem
- Extra time: (a) Check more examples (b) Replace a real life situation with this type of problem
- Graphicalized (a) Present the situation graphically (b) Use rhythm or music to help memorize.
- Evaluate: Tasks/problems

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