

An Appraisal of Sciences and Mathematics Dyslexia and Dyscalculia Syndrome among Secondary Schools Students

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Abstract This study investigated the impact of student's dyscalculia and dyslexia on the teaching and learning of science and mathematics among secondary school students. A descriptive research of survey was adopted for the study. The instrument used to collect data was a structured questionnaire (SQ) designed to elicit response from 200 students that were selected randomly from schools. Data collected were analysed using chi-square. The findings revealed that teachers' students' relationship has a significant effects on dyslexia and dyscalculia among secondary school students. Based on the findings, it was recommended that, teachers should discover the best method that will bring the best performance out of their students. However, continuous assessment and individual differences in learners should be prioritized.

Keywords: *mathematics, dyscalculia dyslexia anxiety, situational interest*

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1. Introduction

Dyslexia is a learning disability that affects learner's ability to read and to comprehend mathematics language. This also affects other aspects of student's lives, including their scientific and mathematical abilities. Hence, dyscalculia is an impair ability to learn basic mathematics. It is one of the most crucial problems of learning sciences and mathematics in our secondary schools. In other words, dyslexia and dyscalculia are the prevalent emotional, psychological, physiological and sociological problems associated with sciences and mathematics learning. Baloglu and kocak (2006) expressed that approximately 60% of dyslexics have problems with mathematics. Often, this is mistaken as another learning difficulty called dyscalculia.

Dyscalculia is the manifestation of vague and unpleasant emotion experienced in a learner which interferes with the manipulation of numbers and solving of sciences and mathematics problems. Many 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. Oginni and Owolabi (2013) maintained that mathematics language is 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 sciences and mathematics.

Dyslexia is most prevalent among secondary school students. Studies by Sukri et al (1996) and Jasmani et al (2005) found that majority of students have moderate levels of dyslexia when it comes to learning of non science subjects. Anxiety and unstable innate tendencies has become a serious concern in explaining dyslexia and dyscalculia issue. Evidence of students' poor attitude and high levels of dyslexia and dyscalculia towards sciences and mathematics is highly reflected in their performance in recent times. Poor grades of result in mathematics especially in the "West African Examination Council (WAEC), "National Examination Council" (NECO) and declining scores in "Unified Tertiary Matriculation Examination (UTME) call for concern among scholars. National Bureau of Statistics, (2007) attributed this to several factors among which dyslexia has taken a centre stage.

Dyslexia and dyscalculia in Mathematics has been attributed to the feeling of tension, helplessness, mental disorganisation, and dread one has when required to manipulates numbers and shapes and solving of scientific and mathematical problems (Ashcraft and Faust, 1994). Norwood (1994) emphasized that dyslexia and dyscalculia did not appear to have a single cause but it was the result

of many different factors such as truancy, poor self image, poor coping skills, teacher attitudes and emphasis on learning through drill without understanding. However, Greenwood (1984) stated that the principal cause of dyslexia and dyscalculia has been in teaching methodologies. The problems dyslexia and dyscalculia could be minimized if teachers apply the problem solving process to the teaching of sciences and mathematics (Greenwood, 1984).

Many students found learning sciences and mathematics boring, meaningless, and un-involving (Mitchell, 1993). Lack of motivation and other cognitive variables helps to explain the low level of students' competence in science subjects like Physics and Chemistry. A report on the future of science education (National Research Council, 1989), stated that when mathematics acts as a filter, it does not only filters students out of careers in sciences, but frequently out of school itself. Since mathematics is the core of sciences. Lack of confidence when working in mathematical situations is described by Stuart (2000) as the cause of dyslexia and dyscalculia.

Tobias (1978) believed that word problems are the heart of science subjects. Learners need higher levels of reasoning to solve sciences and mathematics problems, otherwise learners may grow up avoiding mathematics and sciences. Tobias, (1978). Newstead (1998) found that when students were asked to perform and provide explanations in front of teacher or peers, constructive arguments by the peers and careful guidance by their teacher of sciences help to minimize ambiguity that could cause dyslexia and dyscalculia. Kogelman (1982) submitted that experience of learners when punished or humiliated in class was very damaging. Newstead (1998) concluded that learners learn how to do sciences and mathematics before they are able to explain problems and communicate it proficiently.

Dyslexia and Dyscalculia is quite varied both in symptoms and causes. *Dyslexia causes children to struggle with reading* Often the symptoms when encountering mathematics anxiety are physiological such as sweaty palms, nausea, heart palpitations, a hot tingling feelings, stomach aches or stomach cramps and tightening muscles (Clawson, 1991; Godbeg, 1997; Perry, 2004).

Sometimes the symptoms are psychological, such as paralysis of thought, extreme nervousness, inability to hear the teacher, tendency to become upset by noises, inability to concentrate or loss of concentration, preoccupation with intrusive thoughts and worries, and a general sense of uneasiness (Ashcraft & Kirk, 2001; Godbeg, 1997; Perry, 2004).

The causes of dyscalculia are varied. "Anxious students have difficulty in learning mathematics in the first place, difficulty in using or transferring knowledge from one concept to another, and difficulty demonstrating their knowledge on tests" (Slavin, 2003). Some causes "includes under-preparedness, absences from school, parents perpetuating the myth that mathematics ability is hereditary, and negative past experiences with teachers" (Godbeg, 1997). Dyscalculia has been related to personality type, a negative attitude towards mathematics, mathematics avoidance, mathematics background, instructor's behaviour, level of mathematics involvement, lack of confidence, and negative school experiences (Bursal & Paznokas, 2006).

A number of factors have been described as the causes of dyslexia and dyscalculia. Norwood (1994) described dyslexia as the inability to handle frustration, excessive school absences, poor self-concept, parental and teacher attitudes towards mathematics and emphasis on learning mathematics through drill without understanding. Lack of confidence when working in mathematical situations has been described by Stuart (2000) as the cause of mathematics anxiety. Hodges (1993) argues that failure or success in mathematics may be related to individual learning styles and more specifically with the coupling of learning styles and the way in which material is presented.

2. Effects of Dyslexia and Dyscalculia on Students

Dyslexia and dyscalculia often compounded over time and can affect students in a variety of ways. Dyslexia and dyscalculia can begin at any age of schooling even as young as elementary school, but most students commonly have negative experiences between seventh and tenth grades (Clawson, 1991). Unless addressed directly, this anxiety often continues or even worsens through high school, college and adulthood.

Dyslexia and dyscalculia is not only difficult for the students to deal with, but it compounded into lack of understanding of major concepts. This can close doors for students in their chosen careers if they are studying mathematics either directly, or indirectly. Lack of understanding of basic mathematical principles can be attributed to inability to solve chemistry, engineering, and other scientific problems (Bursal & Paznokas, 2006). It also prevents students from acquiring logic and reasoning skills that can be used in variety of areas, even outside the realm of mathematics (Paznokas, 2006).

3. Methodology

The design of the study is descriptive research design. This is because, it describes systematically the behaviour and characteristics of a given population or area of interest factually and accurately. Also, the design is considered appropriate for this study because the study does not involve manipulation of variables. The population of the study consist of all students of senior secondary school (SS1) of both public and private secondary school in Ado-Ekiti Metropolis in Nigeria. Simple random sampling technique was used to select the subject. The sample of the study consisted of two hundred (200) students who were randomly selected from four different schools, two of which are public secondary schools, while the other two were private secondary schools. The instruments used for this study was a questionnaire. The questionnaire was divided into two sections; section A contains items designed to elicit personal data of the respondents such as sex, age, class and departments. Section B, contains items on the effects of anxiety on the teaching and learning of mathematics among secondary school students. The instrument was presented to the researcher's supervisor for critical examination and verification in order to ensure the face and content validity of the instrument. The instrument was thoroughly examined and the corrections

and suggestion made by the supervisor was used to prepare the final copy of the instrument for administration. The research instrument was administered by the researchers with the help of class teachers.

4. Research Questions

This study sought to provide answers to the following research questions

1. Does positive self-esteem lead to a significant reduction in dyslexia and dyscalculia?
2. How can the application of different teaching method combined with the use of teaching aids gives room for self expression and a reduction in dyslexia and dyscalculia?
3. Did dyslexia and dyscalculia have any significant effects on students' poor performance in mathematics?
4. How can effective communication between the teacher and the students' leads to a reduction in dyslexia and dyscalculia among secondary school students'?
5. Did emotional disturbance have any significant effect on students' thinking ability and an increase in dyslexia and dyscalculia?

Research question 1: Does positive self-esteem lead to a significant reduction in dyslexia and dyscalculia?

Table 1. Contingency table for the expected frequency

		SA	A	D	SD	TOTAL
1	Low Self esteem causes dyscalculia and dyslexia	173	224	277	326	1000
2	dyscalculia and dyslexia affects Learning styles	435	303	138	124	1000
3	Degree of performance in mathematics could be measure through dyscalculia syndrome	265	298	174	263	1000
4	Teachers students relationship catalysis dyscalculia and dyslexia	318	249	142	291	1000
5	Emotional intelligence could be identified through dyscalculia and dyslexia	325	321	199	155	1000

Table 2. Positive self-esteem lead to a significant reduction in dyscalculia and dyslexia

	O	E	(O-E)	(O-E) ²	(O-E) ² /E
SA	35	50	-15	225	4.5
A	45	50	-5	25	0.5
D	55	50	5	25	0.5
SD	65	50	15	225	4.5
TOTAL	200	200		χ^2	10

$Df = (n-1) = 4 - 1 = 3$

At α level of 0.05, the chi-square tabulated value for 3df is 7.83. since the calculated value (which is 10) is greater than the chi-square tabulated value, it shows clearly that positive self-esteem lead to a significant reduction in dyscalculia and dyslexia.

Research question 2: How can the application of different teaching method combined with the use of teaching aids gives room for self expression and a reduction in dyslexia and dyscalculia?

Table 3. Chi-square table for learning style and dyslexia and dyscalculia

	O	E	(O-E)	(O-E) ²	(O-E) ² /E
SA	87	50	37	1369	27.38
A	61	50	11	121	2.42
D	28	50	-22	501.8	10.04
SD	25	50	-25	635	12.7
TOTAL	200	200		χ^2	52.54

$Df = (n-1) = 4 - 1 = 3$

At α level of 0.05, the chi-square tabulated value for 3df is 7.83. Since the calculated value is greater than the chi-square tabulated value, therefore effective learning styles, through the application of different teaching methods, with the use of teaching aids turns mathematics concepts from abstract to real situation, which eventually give rooms for self-expression, which leads to low level of dyslexia and dyscalculia.

Research Question 3: Did dyslexia and dyscalculia have any significant effects on students' poor performance in mathematics?

Table 4. chi-square table for students' performance in mathematics

	O	E	(O-E)	(O-E) ²	(O-E) ² /E
SA	53	50	3	9	0.18
A	60	50	10	100	2
D	35	50	-15	225	4.5
SD	52	50	2	4	0.08
TOTAL	200	200		χ^2	6.76

$Df = (n-1) = 4 - 1 = 3$

At α level of 0.05, the chi-square tabulated value for 3df is 7.83. From Table 3, it is clear that the calculated value is less than the chi-square tabulated value; it therefore indicates clearly that poor performance lead to lack of interest and discouragement in mathematics, which eventually increases tension.

Effective communication between the teacher and the students with a reduction in the use of punitive measure such as open disgrace, insults, raining of abusive words and the use of cane when a student miss a concept in mathematics class lead to a reduction in mathematics anxiety.

Research Question 4: How can effective communication between the teacher and the students' leads to a reduction in dyslexia and dyscalculia among secondary school students'?

Table 5. Chi-square table for teachers – students' relationship

	O	E	(O-E)	(O-E) ²	(O-E) ² /E
SA	64	50	14	196	3.92
A	50	50	0	0	0
D	28	50	-22	484	9.68
SD	58	50	8	64	1.28

$Df = (n-1) = 4 - 1 = 3$

At α level of 0.05, the chi-square tabulated value for 3df is 7.83. Since the calculated value (14.88) is greater than the chi-square tabulated value, therefore positive attitudinal disposition of teacher towards the students whenever they miss a concept in mathematics class rather than punitive measure such as curses, open disgrace, insults, raining of abusive words and the use of cane lead

to freedom of expression, which stimulate the students to try more. This eventually leads to a reduction in the level of fear, apprehension, tension and mathematics anxiety.

Research Question 5 Did emotional disturbance have any significant effect on students' thinking ability and an increase in dyslexia and dyscalculia?

Table 6. Chi-square table for emotional intelligence and mathematics anxiety

	O	E	(O-E)	(O-E) ²	(O-E) ² /E
SA	65	50	15	225	4.5
A	64	50	14	196	3.92
D	40	50	-10	100	2
SD	31	50	-19	361	7.22
TOTAL	200	200		χ^2	17.64

$$Df = (n-1) = 4 - 1 = 3$$

At α level of 0.05, the chi-square tabulated value for 3df is 7.83. Since the calculated value is greater than the chi-square tabulated value, it shows that emotional disturbance such as frustration, worried, fear etc increases the level of mathematics anxiety.

5. Discussion

The analysed data revealed a lot of factors which leads to a high level of mathematics anxiety among secondary school students. From the results gathered, it was observed that negative self-esteem leads to a high level of mathematics anxiety. The findings revealed that self-condemnation lead to self-defeat, poor performance and failure in mathematics.

The results revealed that understanding mathematics concept instead of cramming the solution through the application of different teaching methods leads to a reduction in the level of mathematics anxiety. It shows the important role of teaching aids on learning process because it transform the concepts from abstract to real situation which stimulate the students interest.

The findings show that the degree of performance in mathematics and mathematics anxiety are related. Poor performance lead to lack of interest which subsequently lead to high level of mathematics anxiety. This agreed with the views of Ma and Xu,(2004), Norwood, (1994), Reynolds (2000) , Salako and Amato (1995) that low grade or failure in mathematics could also led to mathematics anxiety or increased existing levels of anxiety for mathematics.

The result also revealed that students –teachers relationship has a significant level on mathematics anxiety among secondary school students. It show that positive attitudinal dispositions of the teacher towards the students whenever they miss a concept in mathematics class rather than punitive measure such as curses, open disgrace, insults, raining of abusive words and the use of cane lead to freedom of expression, which encourage the students to try more. This also depicts the view of Kogelman (1982) that experience of learners when punished or humiliated in mathematics class was very damaging. It also agreed with the views of Pianta and Walsch, (1996), Rutter (1997) that teachers student relationship impact positively on students, developing a sense of self and promoting resiliency in them.

The result also shows that emotional intelligence such as emotional disturbance, frustration, worried, fear increases the level of mathematics anxiety. These results agreed with the views of Ashcraft and Faust (1994) that highly anxious mathematics individuals will be less fluent in computation, less knowledgeable about mathematics and less likely to have discovered special strategies and relationship within the mathematics domains.

6. Conclusion

Based on the results of the study, the following conclusions are drawn. Self judgment and determination goes a long way in the learning outcomes of students. If the students view themselves positively, believing that they have the ability and the potential to perform excellently well in mathematics, this will inject some strength and interest in them. Hence, positive learning outcomes in mathematics are likely to be obtained.

Self condemnation on the other hand destroy the students confidence and lower there morals. These accelerate the rate of fear, tension and anxiety which leads to poor learning outcomes in mathematics.

Teacher's method of presenting behavioural objectives goes a long way in determining the performance of the students. The method used by the teacher either boost the students morale in mathematics or discourage them, depending on the knowledge of the subject matter, preparation on the part of the teacher, presentation and the nature of the teaching aid employed in the process.

Poor performance weakens the morale of the students which results to lack of interest. Poor performance was caused by series of mistakes and mistakes on the other hand was a result of fear, uneasiness, tension and frustration. All these lead to high level of mathematics anxiety.

Positive teacher's students relationship increases the level of freedom of the students or increases their level of closeness and interaction with the teacher. This closeness encourages the students to ask questions and express their opinion because the assurance is there that even if they miss it the teacher will definitely correct their mistakes. This positive relationship encourages the students to try more problems, which leads to a reduction in the level of mathematics anxiety.

Emotional disturbance during mathematics class leads to less frequent in mathematical computation and manipulation of numbers and more mistakes. However, this result in poor performance in mathematics which results in discouragement and finally high level of mathematics anxiety.

7. Recommendations

Based on the findings of this study, the following recommendations were made:

One-on-one instruction is essential for all children - especially those with learning difficulties. Create a set study time after school when you'll be available to help your student with homework.

Students should belief in themselves and try to exhibit positive self-judgement. If the students belief that they can, it will increase their strength, encourage them to try several problems and their intelligence ability will be open

up to receive new concepts. Teachers should not relent on their effort in finding the best method that will bring the best performance out of the students. The importance of teaching aids should not be undermined. Right/wrong answers should be discouraged; rather, emphasis should be laid on steps taking while marking mathematics exercise so as to reduce poor performance to the barest minimum. Continuous assessment should also be encouraged and various techniques should be adopted in conducting the continuous assessment. Various method such as project work, take home assignment, open book test etc. Should be employed so as to reduce failure to the barest minimum. Students should try to avoid situation that can create emotional imbalance. In case of an inevitable situation, students should relax by playing games, watching films or listening to music to ease their tension before coming back to solve mathematics problems. Finally, teachers should try to bear the issues of individual difference while attending to his students. He/she should try to counsel their students whenever they notice something strange like fear, worrying, frustration or any sort of emotional disturbance in their students that can hinder absolute concentration.

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