

Influence of Mathematical Dyslexia Condition on Academic Performance in Upper Primary Learners in Kenyan Public Schools

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Abstract:- The purpose of this study was to find out the influence of mathematical dyslexia condition on academic performance in upper primary learners in Kenyan public schools in Changamwe Sub County, Mombasa County. The objective of the study was to find out the influence of mathematical dyslexia on academic performance. A purposive sample of 160 learners from classes 5 to 8 learners and 43 teachers from six different schools participated in the study. Correlational Ex-Post Facto research design was used based on three major examinations done in Term 1 and Term 2. Questionnaires were used to collect data from teachers. A test re-test method was used to test the reliability of the instruments using both Cronbach's Alpha and Pearson's correlation coefficient (r) at a 5 percent critical level. Descriptive statistics of mean, frequencies, percentages, and standard deviations were used to analyze data while Pearson product-moment correlations were used to test hypotheses. The data was analyzed using Stata11 software. The study found that there was a statistically significant correlation ($p < 0.05$) between academic performance and mathematics ($r = 0.6631^*$, $p = 0.0000$). The study recommends the development of teacher training curriculum to equip them with skills to handle mathematical dyslexics.

Keywords:- Influence, Mathematical Dyslexia, Academic Performance.

I. INTRODUCTION

The term mathematical dyslexia refer to a learning disorder that affects a person's ability to perform and solve problems in math. Dyslexia condition affects the learner in understanding or comprehending text or spelling of words regardless of intelligence, age or language. It also affects how one reads word problems, understand them and interpret them with a view to find their solution. According to the International Dyslexia Association (2012), approximately 10-20 percent of the world's population has Dyslexia while 13-14 percent of the school-going children in America display signs of dyslexia (IDA, 2009). Even though dyslexia condition is recognized to be affecting learning in numerous world regions, the definite

statistics of students whose learning is affected may not be known in Africa. According to Iwan (2013), the lack of awareness and a clear description is a major impediment to the identification of learners with dyslexia. The researcher also projects that dyslexia affects 1 percent of the population in Egypt. In addition to this, the researcher projects that about 10 percent of people in South Africa. In Kenya, it is not clear what percentage is affected though the prevalence is estimated to be about 10 percent (Symthe, Everatt, Ocampo, & Gyarmathy, 2004).

Research findings in Sessional Paper No 1 (Republic of Kenya, 2005) suggests no accurate data on the number of students with learning difficulties in Kenyan primary schools. Therefore, it is not possible to accurately state the number of learners with learning difficulties in the country. Since there is no credible information on children with special needs in the nation. There is little consideration given to dyslexia as a learning disability and those learners having symptoms related to it are not catered for. Public primary schools in Changamwe Sub- County had recorded poorest performances in KCPE between the years 2012-2014. The poor performance in KCPE in the county elicited the need for this study, which attempted to establish if there was a relationship between mathematical dyslexia and academic performance. This problem could be linked to problems in acquiring basic skills in reading, writing, and mathematical skills since dyslexics also exhibit such skills (Simmons & Singleton, 2008). Research findings by Simmons and Singleton (2008) indicated that dyslexic children had difficulties in how they used sounds to process spoken language. This impediment affected their fact recall process in mathematics. Dyslexia also affects how to copy numbers thus making a student to get an incorrect answer which affects their academic performance (Libertus & Feigenson, 2013). Gersten, Beckmann, Clarke, Foegen, Marsh, and Star (2009) also support this fact by stating that dyslexia affects fluency of math-related facts, calculations and problem solving.

A. Theoretical Basis of the Study

This study was guided by the Phonological theory (Ramus, Rosen, Dakin, Day, Castellote, White & Frith, 2003). The theory attempts to explain how sound in a language is developed and used to encrypt meaning. The phonological theory talks about a shortage in a part of language system which deals with grapheme (letter) and phoneme (sound) processing. If a learner has a problem in relating the sound and symbol in a word, the learner may not read the word correctly.

B. Importance of the Problem.

The researcher's curiosity after observing children with learning difficulties and discussing the cases with other teachers, led to a deep desire to find out the causes of some pupils' dismal performance. Secondly, very few attempts had been made to find out how conditions like Dyslexia affected academic performance. Most government policies only mentioned physically disabled, mentally retarded, hearing impaired, blind and gifted under the Special Needs Education (SNE) policy. Dyslexia was not mentioned directly among the Special Needs condition in Kenya (Republic of Kenya, 2005).

C. Relevant scholarship

Dyslexics also have a problem in working memory. According to research findings from Priebe, Keenan, and Miller, (2010), stored prior knowledge affects a child's present learning. A study by Shin, Davision, Long, Chan, and Heisted (2013) supported by saying that prior knowledge and reading affected mastery of math related concepts. A study by Dyer, Mc Gladdery and Ann Jordan (2014), found that there was a correlation between students who had dyslexia and high maths anxiety. The study compared undergraduate students with and without dyslexia ($n = 71$), looking at their levels of anxiety in math and statistics as well as their overall mental health. While statistics related to anxiety and general mental health were equivalent for both reading ability groups, students with dyslexia exhibited higher levels of mathematics anxiety in comparison to those without dyslexia.

D. Objectives of the Study

To find out influence of Mathematics Dyslexia on academic performance of upper primary pupils in public schools in Changamwe Sub County.

➤ Research Hypothesis

In order to carry out the investigation, the hypothesis below was formulated.

H_{01c} : There is no statistically significant correlation ($p < 0.05$) between Mathematics dyslexia and academic performance in upper-primary pupils in public schools in Changamwe Sub County, Kenya.

II. METHOD

The researcher used the Correlational Ex-Post Facto research design to compare how Dyslexic reading, writing and mathematics influences academic performance. This design uses data that is already collected for correlating the relationship between the variables (Kerlinger, 1986). Correlational Ex-Post Facto design used the dependent variable, overall academic performance, to examine associations with the independent variables; English composition, English language and mathematics grades. In the Correlational Ex-Post Facto design, the dependent variable, overall academic performance, was used to examine associations with the independent variables; English composition, English language and mathematics grades. Two of the examinations were done in first term (Mid Term and End Term) and one examination (Mid Term 2) was done in second term of 2015. An average was calculated for English, Mathematics, Science and Social Studies in all the three examinations and the results totaled to give the children's overall academic performance. The averages were calculated to get an objective and reliable measure for academic performance.

A. Population and Sampling of the Study

The population consisted of 8978 pupils in Classes 5 up to 8 and 387 teachers in the 20 schools (Mombasa School Milk, 2014). Out of these, 2639 pupils and 47 English language teachers from six schools were purposively selected to form a target population.

The researcher with the help of the 47 teachers of English selected a purposive sample of 225 pupils using Dyslexia Characteristics tool (Hardin Simmons University, 2014). Students who exhibited signs of dyslexia were further screened using a Bangor Dyslexia Test (Miles, 1997) to make sure those whose weak academic achievement is attributed to absenteeism, school factors and home factors are not included in the sample. This yielded a purposive sample of 160 pupils and 43 teachers who participated in the study.

B. Data Collection Tools

The researcher used the Dyslexic characteristics tool from Hardin, Simmons University to identify learners who had difficulties in reading. Further screening using the Bangor dyslexia test was then done to select only those with dyslexia symptoms. Three main examination results in the schools were used. These were two internal examinations done at mid and end of first term in 2015 and a Mid Term 2 examination done in June 2015. The data was collected between June 15 and 24, 2015. Teachers' Questionnaires were used to collect data from the teachers on some difficulties the learners had. Analysis of data was done using STATA 11 statistical package.

C. Reliability Analysis.

A Test- Retest method was used to test for reliability among 20 pupils consisting of 10 females and 10 males within a span of two weeks. Internal consistency techniques of Cronbach's Alpha were used. A coefficient of 0.6-0.7 is commonly agreed as acceptable although a reliability coefficient of 0.8 or higher is always preferred (Mugenda & Mugenda, 2003). The Bangor test showed Cronbach's Alpha scale reliability coefficient of 0.8984 while the teacher questionnaire's coefficient was 0.6002. The Test-Retest Bangor test scores had a strong positive Pearson's correlation coefficient of 0.8155. The Bangor dyslexia test and the teachers' questionnaires were then considered reliable for the study.

D. Participants of the Study

The participants were upper primary dyslexic learners from classes 5-8 purposively selected from 6 of the 20 schools in the Sub-county. 47 teachers of English also participated in the study.

➤ Sample Size

The researcher purposively selected a sample of 6 public primary schools with a population of 2639 pupils and 47 English Language teachers. The sample of 6 schools represented 31.58 % of the 20 schools.

➤ Research Design

The study used the Correlational Ex-Post Facto research design to show the relationship between Dyslexic reading, writing, mathematics and academic performance.

III. RESULTS

A. Correlation of variables in Female Pupils

Table 1: Correlation between Reading and Writing, Composition, English Language, Mathematics and Overall Academic Performance in Female pupils

	Reading	Writing	Composition	Eng. Language	Math	Overall Academic Performance
Reading	1.0000					
Sig. Level						
Observations	69					
Writing	0.4249*	1.0000				
Sig. Level	0.0003					
Observations	69	69				
Composition	0.3190*	0.6192*	1.0000			
Sig. Level	0.0075	0.0000				
Observations	69	69	69			
Eng. Language	0.6514*	0.3911*	0.5155*	1.0000		
Sig. Level	0.0000	0.0009	0.0001			
Observations	69	69	69	69		
Math	0.3483*	0.4653*	0.4113*	0.3424*	1.0000	
Sig. Level	0.0034	0.0001	0.0004	0.0040		
Observations	69	69	69	69	69	
Overall Academic Performance	0.4151*	0.5141*	0.6439*	0.6494*	0.6511*	1.0000
Sig. Level	0.0004	0.0000	0.0000	0.0000	0.0000	
Observations	69	69	69	69	69	69

*. Correlation is significant at the 0.05 level

The researcher sought to determine if there was any relationship between Reading and academic performance by gender. When Pearson's moment of product correlation was conducted for female students to determine the link between the variables, reading, writing, composition and mathematics. Reading had a statistically significant moderate positive correlation with Composition scores, $r(67) =$

0.3190, $p < 0.05$; Reading and Mathematics, $r(67) = 0.3483$, $p < 0.05$; Reading and Writing, $r(67) = 0.4249$, $p < 0.05$. A similar statistically significant moderate positive correlation was noted between Reading and Overall Academic Performance $r(67) = 0.4151$, $p < 0.05$. There was however a statistically significant strong positive correlation with English Language, $r(67) = 0.6514$, $p < 0.05$ suggesting that overall academic performance depends on the reading skills of the pupils.

B. Correlation of variables in Male Pupils

Table 2: Correlation between Reading and Writing, Composition, English Language, Mathematics and Overall Academic Performance in Male pupils

*. Correlation is significant at the 0.05 level

	Reading	Writing	Composition	Eng. Language	Math	Overall Academic Performance
Reading	1.0000					
Sig. Level						
Observations	91					
Writing	0.6433*	1.0000				
Sig. Level	0.0000					
Observations	91	91				
Composition	0.4208*	0.7288*	1.0000			
Sig. Level	0.0000	0.0000				
Observations	91	91	91			
Eng. Language	0.6851*	0.5284*	0.6083*	1.0000		
Sig. Level	0.0000	0.0009	0.0001			
Observations	91	91	91	91		
Math	0.3257*	0.2844*	0.2418*	0.4136*	1.0000	
Sig. Level	0.0016	0.0063	0.0209	0.0040		
Observations	91	91	91	91	91	
Overall Academic Performance	0.5288*	0.4667*	0.5320*	0.7284*	0.6662*	1.0000
Sig. Level	0.0004	0.0000	0.0000	0.0000	0.0000	
Observations	91	91	91	91	91	91

➤ Testing of Hypothesis

H_{01c} : There is no statistically significant correlation ($p < 0.05$) between Mathematics dyslexia and academic performance in upper-primary pupils in public schools in Changamwe Sub County, Kenya.

To establish whether there was correlation between the variables, the null hypothesis was tested using Pearson product-moment correlation.

Table 3: Correlation between All Variables

	Reading	Writing	Composition	Language	Mathematics	Overall Academic Performance
Reading	1.0000					
Sig. Level						
Observations	160					

Writing	0.5559*	1.0000				
Sig. Level	0.0000	0.0000				
Observations	160					
Composition	0.3867*	0.6851*	1.0000			
Sig. Level	0.0000	0.0000	0.0000			
Observations	160	160				
Eng. Language	0.6741*	0.4733*	0.5757*	1.0000		
Sig. Level	0.0000	0.0000	0.0000	0.0000		
Observations	160	160	160	160		
Mathematics	0.3363*	0.3740*	0.3195*	0.3848*	1.0000	
Sig. Level	0.0000	0.0000	0.0000	0.0000	0.0000	
Observations	160	160	160	160	160	
Overall Academic Performance	0.4876*	0.4912*	0.5790*	0.6979*	0.6631*	1.0000
Sig. Level	0.0000	0.0000	0.0000	0.0000	0.0000	
Observations	160	160	160	160	160	160

*. Correlation is significant at the 0.05 level

From the results on table 3, it was established that Reading had a statistically significant moderate positive correlation with Mathematics, $r(158) = 0.3363^*$, $p < 0.05$ meaning that as the reading ability increases the ability to read instructions and do mathematics also increases.

IV. DISCUSSION

The objective of the study was to find out the influence of Mathematics Dyslexia on academic performance of upper primary pupils in public schools in Changamwe Sub County.

The findings of the study established that there was a strong positive correlation between Mathematics and overall academic performance. The researcher sought to find out how Mathematics correlated with overall performance according to gender. In female pupils, the correlation between Mathematics and overall performance was strong and positive. Similarly, the correlation between Mathematics and overall academic performance was strong and positive among the male pupils where an increase in mathematics scores also led to an increase in academic performance. The results indicated that both genders with dyslexic characteristics experience difficulties in Mathematics, although the number of both groups of pupils in the study was not equal. The results support an earlier research done by (Lassa, 1985) which found that sex difference affects how learners perform in Mathematics. From the findings it can be seen that a problem in mathematics can lead to poor examination performance. A research done by Kay and Yeo (2008) confirmed in their study that dyslexics had problems with place values and telling months of the year or time. They also experience problems with mathematical operations as

confirmed by Simmons and Singleton (2008, 2009).

V. LIMITATIONS OF THE STUDY

The study was conducted in Changamwe Sub-County in Mombasa County which is among the 210 Sub-Counties in Kenya (2010 constitution), the findings may not reflect what is found in the other Sub-Counties due to difference in locality, age and language.

VI. RECOMMENDATIONS

The Ministry of Education should formulate policies that will address the needs of learners with dyslexia, dysgraphia and dyscalculia.

VII. CONCLUSIONS

The study found that there was a statistically significant relationship between mathematics dyslexia and academic performance.

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