PREDICTORS OF MATHEMATICS PERFORMANCE AMONG LEARNERS WITH DYSCALCULIA IN PUBLIC PRIMARY SCHOOLS IN STAREHE, NAIROBI CITY COUNTY, KENYA

BY
PETRONILLA KAHENYA
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NOVEMBER, 2021
DECLARATION

I declare that this project is my original work and has not been presented in any other university/institution for consideration. This project has been complemented by referenced sources duly acknowledged. Where text, data (including spoken words), graphics, pictures or tables have been borrowed from other sources, including the internet, these are specifically accredited and references cited in accordance in line with anti-plagiarism regulations.

Sign: ………………………… Date: ……………………………

Petronilla Kahenya
E/55/CE/27619/2014

Supervisors: This project has been submitted for appraisal with our/my approval as University supervisor(s).

Sign: ………………………… Date: ……………………………

Dr. Jessina J. M. Muthee
Department of Early Childhood & Special Needs Education
Kenyatta University

Sign: ………………………… Date: ……………………………

Dr. Mathew Karia
Department of Early Childhood & Special Needs Education,
Kenyatta University.
DEDICATION

I dedicate this research work to my beloved family.
ACKNOWLEDGEMENTS

I give glory to God for enabling me to successfully undertake this course.

I also extend my vote of thanks to several people who have been of great help in executing this research. First is to my supervisors Dr. J. Muthee and Dr. Mathew Karia who have been guiding and correcting me all along the process. It was through their useful guidance that this project met the requisite standards.

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ABBREVIATIONS AND ACRONYMS

DI: Direct Instruction

DS: Dyscalculia Screener

KCPE: Kenya Certificate of Primary Education

MKO: More Knowledgeable Other

MLD: Mathematical Learning Disabilities

MOEST: Ministry of Education, Science and Technology

MSES: Mathematics Self-Efficacy Scale

NACOSTI: National Commission for Science Technology and Innovation

OECD: Organization for Economic Cooperation and Development

PISA: Program for International Student Assessment

SNE: Special Needs Education

SPSS: Statistical Packages for Social Sciences

U.S/U.S.A: United States of America

WISC-III: Wechsler Intelligence Scale for Children - WSIC III

WJ IV: Woodcock – Johnson IV

ZPD: Zone of Proximal Development
ABSTRACT

The aim of this study was to assess the predictors of Mathematics performance among learners with dyscalculia in public primary school in Starehe Sub-County in Nairobi City County. Persistent underperformance in Mathematics is evident across Kenya and Starehe Sub-county is no exemption. Several learners suffer from dyscalculia which undermines their Mathematics performance but the disability is usually undetected. Therefore, most interventions designed to improve Mathematics performance do not adequately address the needs of dyscalculic learners. The objectives of this study were to: investigate the Mathematics performance of learners with dyscalculia in public primary schools in Starehe sub-county; determine the influence of teacher factors, teaching methods, learner characteristics and availability of teaching and learning resources on Mathematics performance of dyscalculic learners in public primary schools in Starehe sub-county. The study was guided by social development theory on learning by Vygotsky (1978). The study was a mixed method research applying descriptive survey design. The target population was class seven pupils and their Mathematics teachers in 4 public primary schools in Starehe Sub-County. A sample size of 42 class seven pupils and 8 class seven Mathematics teachers will be used. Purposive sampling technique was used to select teachers where only Mathematics teachers for class seven were sampled. Simple random sampling technique was used to select the learners. Data from the teachers was collected using a questionnaire. On the other hand, data from the pupils was collected using Dyscalculia screening tool (Wechsler Intelligence Scale for Children - WSIC III); Mathematics Self Efficacy Scale (MSES); Cognitive abilities assessment tool (Woodcock – Johnson IV); and Fennema-Sherman Mathematics Attitude Scales (FSMAS). School records were also examined to assess pupils’ Mathematics performance. Quantitative data was analyzed through descriptive statistics of frequencies, percentages and mean through the help of Statistical Package for Social Sciences (SPSS). Qualitative data was analyzed by organizing it into themes corresponding to the study objectives and used to enhance the quantitative findings. Findings revealed that the mean score performance in Mathematics for learners’ with dyscalculia for the three terms investigated was 52.9% compared to 69.8% for learners without dyscalculia. Negative correlations were found between Mathematics performance and other learners’ characteristics including cognitive abilities (r = -0.089; p = 0.632), and Mathematics attitude (r = 0.111; p = 0.551). However, there was a weak positive correlation of 0.017 between Mathematics performance and Mathematics self-efficacy. Most of the teachers (62.5%) asserted that adequacy of teaching and learning resources greatly affected the pupils’ Mathematics performance. The research concludes that screening pupils for dyscalculia is rarely done in most public schools. However, pupils with dyscalculia still perform quite well in Mathematics although their performance is relatively lower than that of pupils without dyscalculia. The study recommends among other measures that the government through the Ministry of Education should consider organizing for on-job training for primary school teachers on Mathematics learning disabilities.
CHAPTER ONE
INTRODUCTION AND BACKGROUND TO THE STUDY

1.0 Introduction

This chapter presents the background of the study, statement of the problem, purpose of the study, research objectives, research questions, significance of the study, scope of the study, limitations of the study, assumptions of the study, theoretical and conceptual frameworks and operational definition of terms.

1.1 Background to the Study

Learning disability generally refers to a disorder in one or more of the basic psychological processes involved in understanding or in using spoken or written language, which may manifest as an imperfect ability to listen, think, speak, read, write, spell or do mathematical calculations (Amiripour, Bijanzadeh, Malkhalifeh, & Najafi, 2012). Dyscalculia is a kind of Mathematics disability that manifests as major difficulties in basic calculations and numerical memory (Nfon, 2016). The term dyscalculia has its origin from Greek and Latin. The prefix “dys” comes from Greek which means “badly” while “calculia” comes from the Latin “calculare”, meaning “to count” (Khing, 2016). Different people often use other names to refer to dyscalculia. Some generally refer to it as a “mathematics learning disability,” doctors sometimes call it a “mathematics disorder,” while most parents identify it as “mathematics dyslexia” (Nfon, 2016). Some also label it as ‘number blindness’ (Kirthika & Raja, 2015).

Mathematics disability such as dyscalculia may have a major negative effect on a person’s life given that, Mathematics is fundamental in human life by virtue that it is
essential in everyday activity in most modern cultures (Libertus, Feigenson & Halberda, 2011). As Enu, Agyman and Nkum (2015) explain, Mathematics impacts on all facets of human life at various levels. It is also acknowledged as essential for scientific and technological development in any society (Kiwanuka, Van Damme, Noortgate, Anumendem & Namusisi, 2015). Children who lack good foundation in Mathematics skills in their elementary learning may be hindered from pursuing quality careers like architecture, medicine, and engineering among others (Mbugua, Muthaa, & Nkonke, 2012). Nevertheless, there are significant variations in mathematical competence among people which starts in early development stages (Libertus, Feigenson & Halberda, 2011). Lack of knowledge in Mathematics such as caused by dyscalculia may make one have difficulties in the modern society in many areas of life and find it impossible to handle many life issues (Acharya, 2017). It is thus no surprise that Mathematics is a compulsory subject in elementary (primary and secondary) education levels in many countries worldwide.

It is thus apparent that a learner suffering from dyscalculia stands the risk of being disadvantaged in their later life. Unfortunately, as Tuchura (2016) highlighted, there is a common perception in both children and adults that Mathematics is a difficult subject which usually makes Mathematics learning disabilities (MLD) to be undetected. Thus, pupils with dyscalculia are at a risk of suffering a myriad of challenges in their life that could have been prevented (Hannel, 2013). This defies the global agenda of ensuring everyone enjoys the right to education advocated in various international policy instruments over time including: the UN Convention on the Rights of the Child (1989); the 1990 world declaration on Education for All; the Dakar framework for action (2000);
and the UN Convention on the Rights of Persons with Disabilities (2006) among others (Mwangi & Orodho, 2014). It is therefore critical that dyscalculia be detected early enough in the life of the child and appropriate interventions put in place to ensure he/she is not disadvantaged in any way.

It is quite hard to establish the prevalence of dyscalculia worldwide. As Thaker (2015) explains, scientists cannot precisely state the population of children or adults with dyscalculia. However, although there is no central data bank for research data on dyscalculia, approximately 6% to 7% of elementary school children are likely to have dyscalculia while about 56% of kids with reading disorder also have poor mathematics achievement (Nfon, 2016). Therefore, it is critical to identify the occurrence of Mathematics learning disabilities and put in place strategies and put in place measures to enhance their Mathematics performance.

Children with dyscalculia have been known to display anxiety when faced with mathematical tasks (Rubinsten & Tannock, 2010). A child’s struggle with mathematics can be confusing to them, especially if they are doing well in other subjects. Nfon (2016) explains that sometimes, pupils with dyscalculia will spend their time in fear and panic during arithmetic class, just at the sight of their arithmetic teacher. This can lead to anxiety and low self-esteem consequently deteriorating their performance. Data from the Program for International Student Assessment (PISA), which tests 15-year-olds’ academic achievement worldwide, shows that math anxiety is negatively related to math performance both within and across countries (Foley, Herts, Bargonovi, Guerriero, Levine & Beilock, 2017).
From a global perspective, performance in Mathematics especially in the upper primary level of education is generally poor in most countries – both developed and developing countries. Data from the latest PISA report on Mathematics performance for 15 years old learners confirms this whereby, the mean score for majority of the countries was below the average mean score of 490 points (OECD, 2016). Vania and Xin (2014) highlighted that, most countries in East Asia (such as Hong Kong, Japan, Korea, China and Singapore) records high Mathematics performance in international rankings like PISA compared to other countries in the World. This is evident in the 2015 PISA report, whereby majority of the leading countries were from East Asia where Singapore was the best with a mean score of 564 points; more than 70 points above the OECD average. It was followed by Hong Kong (mean score = 548); Macao-China (mean score = 544); Chinese Taipei (mean score = 542); and Japan (mean score = 532). Several developed countries had a mean score below the OECD average. For instance the U.S and Israel had an equal mean score of 470, while Brazil had a mean score of 377 (OECD, 2016). Some of the factors attributed to the good Mathematics performance in East Asian countries include good teaching strategies; quality instructions; good teacher-student relationship; strong family support; and good school climatic attributes such as disciplinary climate among others (Ma, Jong & Yuan, 2013).

In Africa, Mathematics performance is quite wanting in most countries. For instance, in South Africa, De Villiers (2010) asserted that, adults often claim incompetent in Mathematics. This was also echoed by Spaull (2012) who affirmed that Mathematics performance in South Africa is abnormally poor. In Cameroon, Nfon (2016) revealed that students perform poorly in Mathematics compared to other subjects. An examination of
their primary school records indicates that the problems started right at the initial basic education level and since these problems were not taken seriously, they escalated to dyscalculia (Nfon, 2016).

In Nigeria, Israel ad Olubunmi (2014) conducted an investigation on the impact of students’ dyscalculia and dyslexia on the teaching and learning of science and mathematics among secondary school students. They used a descriptive research survey and a structured questionnaire eliciting response from 200 students. The findings showed that teacher/student relationship has a significant effect on dyscalculia among secondary school students. It has also been affirmed that Mathematics performance is poor and this is worsened by cases of dyscalculia and dyslexia.

In the East Africa, performance in Mathematics is also low. In Uganda for instance, it has been affirmed that students consistently perform poorly in the subject and this has even made the country to lose some economic advantage (Kiwanuka, Van Damme, Noortgate, Anumendem & Namusisi, 2015). In Rwanda, poor Mathematics performance is quite common too as exposed by Gichuru and Ongus (2016). In Tanzania, Yusta, Karugu, Muthee and Tekle (2016) conducted a study on the impact of instructional resources on mathematics performance with dyscalculia in integrated primary schools in Arusha City. The study employed a descriptive design and a target population of 92 respondents’ included head teachers and subject teachers. The results showed that graphic resources were the most commonly used by teachers. The study findings further showed that all the five main types of instructional resources including audio, visual, audio-visual, graphic and realia resources were either inadequate or lacking. However, Yuta et al. (2016) only
focused on secondary schools and therefore their findings could not be generalized to primary schools. Yusta (2015) also highlighted poor performance in Mathematics among students in Tanzania. Yusta actually warned that, the Tanzanian government needed to come to the realization that there is a Mathematic learning crisis and prioritize on implementing measures to improve performance (Yusta, 2015).

A local study conducted in Kenya on the influence of learning support strategies on academic performance of learners with dyscalculia in Nairobi County and revealed that differentiated assessments and tests was the highest indicator of influence on the academic performance of learners with dyscalculia (Nyaga, 2012). However, Nyaga’s study only focused on the general learning of learners under British national curriculum based preparatory schools in Nairobi country. A recent study conducted by Chepkorir and Muthee (2021) on intervention measures and teaching strategies enhancing Mathematics teaching to dyscalculic learners in public day secondary schools in Kericho County revealed that 19 out of 300 randomly sampled students suffered from dyscalculia. Finding further showed that the use of homework and maximizing the use of homework were some of the major interventions that assisted in improving performance of dyscalculic learners.

Mathematics performance has been relatively poor and appallingly low all over the country (Karigi & Tumuti, 2015). A national survey conducted in 2012 by Uwezo fund revealed that more than two thirds of children at the lower primary classes lacked basic numeracy skills (Magoma, Waithaka & Mwoma, 2018). Obiero (2018) also asserted that poor Mathematics performance in primary, secondary, and tertiary level of education has
continued to be reflected in national examinations over the recent past. Poor performance in Mathematics especially in primary school education has been noted over the recent years where the means score in Mathematics has been relatively declining as highlighted in Table 1.1.

Table 1.1: Mathematics Mean score in KCPE from 2012 to 2016

<table>
<thead>
<tr>
<th>Year</th>
<th>Mathematics Mean Score (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>56.30</td>
</tr>
<tr>
<td>2013</td>
<td>52.86</td>
</tr>
<tr>
<td>2014</td>
<td>52.04</td>
</tr>
<tr>
<td>2015</td>
<td>56.16</td>
</tr>
<tr>
<td>2016</td>
<td>45.39</td>
</tr>
</tbody>
</table>


It is thus apparent that poor Mathematics performance is quite a problem in most countries worldwide. While different factors could contribute to poor or good performance in Mathematics (Ma, Jong & Yuan, 2013), Mathematics learning disability is often ignored or undetected as aforementioned, due to the common perception in children and adults that Mathematics is a difficult subject (Tuchura, 2016). This implies that most of the interventions initiated are often based on other factors believed to affect Mathematics performance, apart from Mathematics learning disabilities. As such, these interventions may make little or no impact at all on learners with such disabilities. Dyscalculia as already highlighted is one of these often unnoticed disabilities. It is thus critical that learners with dyscalculia be identified in the different schools at different levels, and the influence of different factors on their Mathematics performance
established. It is only then that well informed interventions can be devised that can effectively improve the Mathematics performance of learners with dyscalculia. It is against this background that this study assessed the predictors of Mathematics performance among learners with dyscalculia in public primary schools in Starehe Sub-County, Kenya.

1.2 Statement of the Problem

Dyscalculia is a condition related to problems of understanding mathematics and quantitative thinking where learners hardly make sense of numbers and math concepts. It is a mathematical disability which causes acute difficulties in learning mathematical concepts and facts. Thus children suffering from this condition generally lack understanding of how mathematical problems are supposed to organize in a page. Even if they produce a correct answer or use a correct method, they may do mechanically and without confidence. Dyscalculia in Mathematics has been attributed to the feeling of tension, helplessness, mental disorganization and dread one has when required to manipulate numbers and shapes and solving mathematical problems. Most interventions designed to improve Mathematics performance do not adequately fit dyscalculic learners; thus, they only improve Mathematics performance of some learners, while the overall class/school Mathematics performance improvement remains minimal. Apparently therefore, dyscalculic learners are at risk of being disadvantaged in their future life as they may lack good Mathematics skills makes one have difficulties in several areas of life and be unable to handle many life issues. It is thus imperative that occurrence of dyscalculia be investigated in different schools to provide insights on factors affecting the
Mathematics performance of the dyscalculic learners, hence inform the right interventions to undertake which was the gist of this study.

In Nairobi County where this study was conducted, poor Mathematics performance has been reported in public primary schools in Starehe Sub-County. Yet, while some studies have been done on learning disabilities and Mathematics performance in Nairobi County and Kenya at large, few have investigated the occurrence of dyscalculia and the factors influencing the Mathematics performance of dyscalculic learners in Starehe sub-county. Thus, there is scarcity of empirical evidence to guide on appropriate intervention to address these learners’ needs. This study therefore sought to bring to the limelight the predictors of Mathematics performance among learners with dyscalculia in public primary schools in Starehe sub-county and provide insights to inform on the necessary intervention to improve these learners’ Mathematics performance.

1.2.1 Purpose of the Study

The purpose of this study was to assess the predictors of Mathematics performance among learners with dyscalculia in public primary schools in Starehe sub-county, Nairobi City County. This will be based on teacher, teaching methods, learner characteristics and availability of teaching and learning resources and how they impact on Mathematics performance of learners with dyscalculia.
1.2.2 Study Objectives

Study was guided by the following objectives:

i. To find out the Mathematics performance of learners with dyscalculia in public primary schools in Starehe sub-county, Nairobi City County.

ii. To assess the impact of teacher factors on Mathematics performance of learners with dyscalculia in public primary schools in Starehe sub-county, Nairobi City County.

iii. To explore the impact of teaching methods on Mathematics performance of learners with dyscalculia in public primary schools in Starehe sub-county, Nairobi City County.

iv. To assess the impact of learner characteristics on Mathematics performance of learners with dyscalculia in public primary schools in Starehe sub-county, Nairobi City County.

v. To investigate the influence of availability of teaching and learning resources on Mathematics performance of learners with dyscalculia in public primary schools in Starehe sub-county, Nairobi City County.

1.2.3 Research Questions

i. What is the performance of learners with dyscalculia in Mathematics in public primary schools in Starehe sub-county, Nairobi City County?

ii. What is the impact of teacher factors on Mathematics performance of learners with Dyscalculia in public primary schools in Starehe sub-county, Nairobi City County?
iii. What is the impact of teaching methods on Mathematics performance of learners with Dyscalculia in public primary schools in Starehe sub-county, Nairobi City County?

iv. How do learner characteristics impact on Mathematics performance of learners with dyscalculia in public primary schools in Starehe sub-county, Nairobi City County?

v. How does availability of teaching and learning resources influence Mathematics performance of learners with dyscalculia in public primary schools in Starehe sub-county, Nairobi City County?

1.3 Significance of the Study

Results of this study are beneficial to teachers, parents, learners and curriculum developers. The learners with dyscalculia may benefit from the results of the study since the findings helps to inform on intervention that may help in improving their Mathematics performance, as well as helping them to have confidence in mathematics and enhanced Mathematics skills. Teachers can also gain useful insights from the study that may help them adopt effective teaching methods to ensure that Mathematics performance of learners with dyscalculia is improved.

The findings of this study are also useful to the Ministry of Education, Science and Technology (MOEST) in formulating and implementing ideal policies that would support education for learners with dyscalculia to accommodate them in their learning system with no discrimination. Finally, it is this study provides basic data on dyscalculia in Kenyan primary schools. It also adds onto the existing knowledge in literature on the
predictors of Mathematics performance for learners with Mathematics learning disabilities, specifically dyscalculia. Therefore, the study findings are beneficial to academicians who may want to further research on this field.

1.4 Limitation and Delimitation

1.4.1 Limitation
The participants of this study were Mathematics teachers and head teachers from public primary schools in Starehe Sub-County in Nairobi City County. This study only covered public primary schools leaving out secondary schools and therefore the findings cannot be generalized to all schools. Some respondents may also have been dishonest and untruthful while giving out information which could contribute to some degree of error in the study findings.

1.4.2 Delimitation
The study focused on predictors of mathematics performance among learners with dyscalculia in public primary schools. The study was confined to four public primary schools in Starehe Sub-County, Nairobi City County. The study targeted class seven pupils in the targeted primary schools. This is because they were better positioned to respond to the questionnaires easily and for the sake of learners identified with dyscalculia in that class, appropriate interventions suggested implemented, the Mathematic performance of affected pupils might be improved in time before they move to their secondary level education.

1.5 Assumptions
This study was based on the following assumptions:
i) Respondents were honest in answering the questions in the research instruments administered to them.

ii) Data collected was adequate for developing meaningful conclusion and recommendations in line with the study objectives.

1.6 Theoretical and Conceptual Framework

1.6.1 Theoretical Framework

The study was guided by social development theory of learning by Vygotsky (1978). This theory asserts two major themes concerning social interaction, the more knowledgeable other (MKO), and the zone of proximal development (ZPD). The process of cognitive development is influenced by social interaction and learning between learners and others who are more knowledgeable. Based on the context of this study, more knowledgeable other (MKO) refers to the Mathematics teacher with higher ability level than the learner who impacts learning through social interaction. The ZPD is the difference between a student’s ability to perform a task independently and the ability to perform under guidance and collaboration from an adult. For instance, the emphasis of teacher factors with reference to such aspects as experience and qualifications would help to enhance the performance of learners with dyscalculia in Mathematics because they are more knowledgeable basing on skills and ways of handling learners with such condition.

The ZPD tries to define a bridge between what is known and the unknown. According to Vygotsky, the learner is able to progress in their cognitive development if the capable adult supports and encourages him/her to do so. Thus using effective teaching approaches teachers would be able to help the child facing challenging tasks to master
them individually, through guidance and encouragement. Walqui (2006) refers to this assistance as scaffolding as used by other theorists.

This study relied on social development theory of learning because a close interaction between the teacher and the pupils facilitates close observation of the child’s areas of Mathematics learning disabilities. Learners with dyscalculia take an active role and require a skillful educator, where MKO can identify learners with MLD. This has been successfully used by other scholars like Tuchura (2016). The same belief also applied to learners with dyscalculia on how they select what to understand in a given content that is being taught by a teacher in class.
1.6.2 Conceptual Framework

Figure 1.1 illustrates the conceptual framework for this study.

**Independent Variables**

- **Teacher factors**
  - Teaching experience
  - Academic qualifications
  - Teacher’s attitude
  - Teacher’s workload

- **Teaching methods**
  - Peer tutoring
  - Direct instruction
  - Strategy instruction
  - Cooperative learning
  - Scaffolding

- **Learner characteristics**
  - Mathematics self-efficacy
  - Attitude towards mathematics
  - Cognitive abilities

- **Teaching/learning resources**
  - Visual resources
  - Audio resources
  - Audio-Visual Resources
  - Graphics resources
  - Real object resources
  - Assistive technology

**Dependent Variable**

**Mathematic Performance**
- Improved numerical skills
- Improved arithmetic concepts
- Grades/Scores in Mathematics

**Intervening Variable**
- Classroom environment

**Figure 1.1:** Conceptual Framework Showing Teacher and Learner Related Predictors of Mathematics Performance among Learners with Dyscalculia

**Source:** Researcher (2018)

**Key**

- Study-variables
- Non-variables
In this study, the conceptual framework illustrates that Mathematics performance is influenced by four major factors including: teacher factors, teaching methods, learner characteristics, and teaching and learning resources. The degree of influence is affected by the classroom environment. In this regard, teacher factors, teaching methods, learner characteristics, and teaching and learning resources will constitute the independent variables while Mathematics performance will be the dependent variable. Classroom environment on the other hand will constitute the intervening variable.
1.7 Operational Definition of Terms

Mathematics learning disabilities: These are inabilities to master one or many of the concept of mathematics (Furlong, McLoughlin, McGilloway & Geary, 2016). In this study, they are considered as the various mathematics disorders that affect an individual's ability to acquire arithmetic skills.

Teaching methods: They refer to a series of related and progressive acts performed by the teacher and students to achieve learning objectives (Abanador, Buesa, Remo & Manibo, 2014). In this study, these are the strategies a teacher uses to put learning content across to the children.

Predictor: Refers to a factor that upon adjustment influences the outcome in another factor (Reed & Wu, 2013). In this study, predictor refers to a variable that influence the change in pupils’ Mathematics performance.

Performance: Refers to how well an activity is done (Cambridge Dictionary). In this study, performance refers to a pupil’s score/achievement in an examination in terms of attainable marks.

Public Primary school: Refers to public primary school is maintained out of public funds (Republic of Kenya, 2012). In this study, it refers institutions of basic learning sponsored by the government where learners access free education.
**Teacher factors:** Refer to as teacher factors as a teacher’s collective personal and professional characteristics that affect student’s learning discourse (Haider & Hussain, 2014) define. In this study, they refer to teacher specific attributes that are often linked to their teaching ability.

**Dyscalculia:** Refers to the inability to understand the meaning of numbers and or apply math principles to solve problems (Sudha & Shalini, 2014) define it as. In this study, dyscalculia refers to a Mathematics learning disability manifesting as major difficulties in basic calculations and numerical memory.
CHAPTER TWO
REVIEW OF RELATED LITERATURE

2.1 Introduction

This chapter explores relevant literature to the study. The areas covered are dyscalculia; Mathematics performance for learners with dyscalculia; teacher factors for learners with dyscalculia; teaching methods for learners with dyscalculia; and learner factors. This chapter also identifies gaps in existing literature that were addressed in this study.

2.2 Dyscalculia Diagnosis/Identification among Learners

Different authors have defined dyscalculia in various ways. Sudha and Shalini (2014) define it as severe math problems. This problem involves various mathematics concepts. According to Kirthika and Raja (2015), dyscalculia is a brain condition that usually results into an individual not making sense of some math concepts. It has also been perceived as the manifestation of vague and unpleasant emotions experienced in a learner which interferes with their ability to manipulate numbers and solve scientific and Mathematical problems (Israel & Olubunmi, 2014).

Symptoms of dyscalculia may vary from one child to another, but the most common is poor “number sense” (Nfon, 2016). Some students with dyscalculia cannot grasp basic number concepts; they find it very hard to learn, memorize or remember basic number facts (Kirthika & Raja, 2015). Sudha and Shalini (2014:9) highlight several symptoms of dyscalculia including: ‘difficulty working with numbers; confused by math symbols; difficulty with basic facts (adding, subtracting, multiplying and dividing); often reverses
or transpose numbers (36: 63); difficulty with directions; difficulty with estimation and approximation; and slowness in giving answers to math questions.’

There are three major methods that are often used to assess dyscalculia. They include, Standardized tests, Direct observation, and The Dyscalculia Screener (DS) (Sudha & Shalini, 2014). However, there is wide spread debate surrounding the true nature of dyscalculia, which makes it difficult and challenging to diagnose and challenging to determine its prevalence (Cowen, 2010). This could explain why there is no central data bank on its prevalence worldwide (Nfon, 2016). Nonetheless, as Mazzocco, Feigenson and Halberda (2011) reported, many children suffer from dyscalculia despite adequate schooling.

A study by Uwezo (2010) revealed that about 22% of pupils in Kenyan primary schools had numeracy problems. In yet another study by Uwezo in 2013, 11% of pupils in class eight could not solve a class two level mathematical division question (Opiyo, 2013). This implies that it is probable that quite several students suffer from dyscalculia but it is yet to be established in most schools. Thus, it is necessary for researchers to assess the common characteristics of learners with dyscalculia in different schools. In this regard, this study sought to establish the common characteristic of dyscalculia among the class seven pupils in the public primary schools in Starehe Sub-County.

### 2.3 Mathematics Performance for Learners With Dyscalculia

Literature is quite clear that math anxiety in dyscalculic children is associated with poor mathematical knowledge and low course grades (Ashcraft & Krause, 2007). Ashcraft and
Krause (2007) explain that learners who fear mathematics often lack the confidence to do well in the subject (Ashcraft & Krause, 2007). Galadima and Yusha’u (2007) investigated the mathematics performance of senior secondary school students in Sokoto State. The findings revealed the existence of learning disabilities in Mathematics and confirmed no gender difference in Mathematics performance among learners with these disabilities. In contrast, Adaramola (2012) confirmed significant gender difference after investigating the effects of concept mapping on Mathematics performance and interest of students with dyscalculia in secondary school mathematics in Nigeria.

The unimpressive Mathematics performance among secondary school students with Mathematics learning disabilities has been attributed to many factors including: poor teaching approach; learner’s lack of confidence in the subject (Basturk & Yavuz, 2010); and heterogeneous classroom where students of different abilities are taught together (Abakpa & Iji, 2011). Many researchers also identify inherent unfairness in school-based assessment which may be as a result of teachers’ incompetency in assessment, as well as psycho-cultural factors among others as being responsible for this anomaly (Asim, 2007).

Butterworth (2003) advised that in order for one to excel in Mathematics, there is need to comprehend Mathematical concepts. Unfortunately, Mathematical concepts are introduced at a fast rate and learners do not have adequate time to fully grasp and practice them, thus get confused and overwhelmed (Cawley & Foley, 2001). Mercer and Miller (2003) add that without adequate Mathematical resources and instructions by teachers, pupils with Mathematics learning disabilities may continue to suffer frustration and failure. Hudson, Henderson & Hudson (2015) observed that many Mathematics teachers
fail to teach numbers properly in primary schools. In addition, the Tanzania Education Network has also revealed that the poor learning environment, shortage of teachers in primary schools, and inadequate teaching and learning materials largely contribute to poor Mathematics performance especially among learners with Mathematics learning disabilities (Yusta, 2015).

It is thus apparent from existing literature that Mathematics performance is quite poor among learners with Mathematics learning disabilities in most areas. However, most of the studies that have been conducted have focused on Mathematics learning disabilities in general without a detailed investigation on the specific disabilities such as dyscalculia. Most of these studies have been conducted outside Kenya and therefore there is very scarce information regarding Mathematics performance of dyscalculic children in the specific Kenyan schools in general. This study therefore assessed Mathematics performance of learners with dyscalculia in public primary schools in Starehe sub-county.

2.4 Teacher Factors Pertaining to Learners with Dyscalculia

2.4.1 Teacher’s Professional Qualifications

According to the Bureau of Labor Statistics U.S.A, children with learning disabilities should be taught by teachers equipped well with skills, and knowledge on appropriate strategies in teaching (Njuguna, 2012). Since Dyscalculia is a component of Mathematics learning disability, teachers who have such students should be professionally trained in special needs education. According to Yusta (2015), most teachers in integrated primary schools in Tanzania have special education training at different levels but not in learning disabilities, which is a major obstacle for them to effectively teach learners with
Another study by Kibuthu (2016) in Nyeri Central Sub-County revealed that majority of the teachers were trained in special needs education. Njeru (2012), found that 55% of the respondents had professional training on handling dyscalculics and 44% without. This study sought to find the specialization undertaken by SNE teachers to effectively teach learners with dyscalculia. It is apparent that the proportion of well qualified teachers in SNE varies in different contexts. However, findings in the reviewed studies cannot be generalized to the case of public primary schools in Starehe Sub-County since they were all conducted in other places. The reviewed studies did not investigate how the teachers’ professional qualification influences Mathematic performance of dyscalculic learners.

2.4.2 Teachers’ Experience and Teacher’s Workload

Teacher’s competence and experience in teaching learners with dyscalculia is crucial. According to Khing (2016), a child with dyscalculia requires extra support from an experienced special education teacher or other qualified therapist. Yusta (2015) while assessing Mathematics teachers for leaners with dyscalculia revealed that nearly 50% had a teaching experience of below five years. On Teachers’ Professional competence, Tuchura (2016) observed that out of 179 teachers in the sampled schools only 3 were well experienced in SNE. In a study by Kiplagat, Role and Makewa (2012), it was indicated that the number of pupils were large, which caused teachers though experienced to fail to use different teaching methods. However, the reviewed studies did not show how teachers’ experience and workload are related to the performance of dyscalculic learners. None of the studies assessed the experience of the teacher’s in handling of
learners with dyscalculia or the teacher’s workload in the public primary schools in Starehe Sub-County.

**2.5 Teaching Methods and Learners with Dyscalculia**

Several methods have been established by various studies in relation to enhancing Mathematic skills among learners with dyscalculia.

**2.5.1 Peer Tutoring**

Peer tutoring entails students learning from each other in ways which are mutually beneficial. Comfort & McMahon, 2014, state that emotional support is vital for learners with dyscalculia. According to Comfort (2011), peer tutoring strategy promotes the learning process in that, it gives the tutee an opportunity to practice and learn a targeted academic skill until mastery is realized. Kibuthu (2016) concluded on her study on determinants of peer tutoring revealed that all teachers should use peer tutoring methods in their course work as it is effective in improving the performance of the learners with learning disabilities. However, none of the reviewed studies investigated the use of peer-tutoring strategies in public primary schools in Starehe Sub-county. Additionally, they did not explore how the strategies influence the Mathematics performance of dyscalculic learners.

**2.5.2 Direct Instruction**

Direct Instruction (DI) refers to an approach to teaching where an identified skill or content to be learned is clearly presented. A study by Al-Makahleh (2011) indicated that direct instructions are brisk-paced that include: teacher modelling, group and individual responding and student practice. In another study, Azimigaroosi, Zhiean and Farahmand
(2015) in this method, teachers practice skills repeatedly at a speed established by the teacher’s understanding of their requirements and progress. However, these studies assessed the use of this method focusing on learners with special needs in general and not specifically in the case of learners with dyscalculia. They were not conducted in primary schools in Starehe Sub-County.

2.5.3 Strategy Instruction
Strategy instruction is systematic instruction and stresses on teaching learners how to learn by providing them the tools and techniques that competent learners use to understand and learn new materials or skills (Azimigaroosi, Zhiean & Farahmand, 2015). A study by Maloney, Ansari and Fugelsang (2011) asserted that learners with learning disabilities fail often to transfer the skills and behaviors acquired in the classroom to new situations. However, these studies failed to assess how strategy instruction influences the Mathematics performance of learners with dyscalculia. Thus, they provide inadequate insights on how strategy instruction as a teaching method can influence Mathematics performance of learners with dyscalculia in primary schools.

2.5.4 Cooperative Learning
According to Johnson, Johnson & Holubec, 1986, this type of learning involves team work among learners to meet a certain goal. Learning occurs through dialogue among students in social setting. Also it entails “instructional methods in which the teachers organize students into small groups, which then work together to assist one another learn academic content” (Slavin, 2011, p.344).
In Nigeria, Israel ad Olubunmi (2014) conducted an investigation on the impact of students’ dyscalculia and dyslexia on the teaching and learning of science and mathematics among secondary school students. They used a descriptive research survey and a structured questionnaire eliciting response from 200 students. The findings showed that teacher/student relationship has a significant effect on dyscalculia among secondary school students. It has also been affirmed that Mathematics performance is poor and this is worsened by cases of dyscalculia and dyslexia. Njuguna (2012) in his study concluded that most teachers used individual teaching, demonstration, group teaching and phonics among other strategies. Even so, none of the scholars in these reviewed study assessed the relationship between cooperative learning as a teaching method and Mathematics performance of dyscalculic learners.

2.5.5 Scaffolding

It is a teacher, directed, guided practice to instruction. In their study, Vaughn and Boss (2011) described scaffolding as a way adjusting and extending instruction so that the student’s prompted to develop a new skill. Scaffolding is a teaching strategy that gives individualized support based on the learner’s Zone of the Proximal Development (Chang, Sung & Chen, 2002). In scaffolding instruction, another more knowledgeable individual supports to facilitate the learner’s development. Whilst children with dyscalculia will display a variety of learning styles, Kay and Yeo (2003) denote that they are more likely to portray a more sequential learning style. Chin (2001) suggests that initially a child should be taught using their preferred style to avoid failure, but once confidence is realized, teaching should make use of complementary strategies.
A local study conducted in Kenya on the influence of learning support strategies on academic performance of learners with dyscalculia in Nairobi County and revealed that differentiated assessments and tests was the highest indicator of influence on the academic performance of learners with dyscalculia (Nyaga, 2012). However, Nyaga’s study only focused on the general learning of learners under British national curriculum based preparatory schools in Nairobi country. A recent study conducted by Chepkorir and Muthee (2021) on intervention measures and teaching strategies enhancing Mathematics teaching to dyscalculic learners in public day secondary schools in Kericho County revealed that 19 out of 300 randomly sampled students suffered from dyscalculia. Finding further showed that the use of homework and maximizing the use of homework were some of the major interventions that assisted in improving performance of dyscalculic learners. Nevertheless, the reviewed studies indicate that most of the study concentrated on secondary schools. The current study sought to feel this gap by exploring the impact of teaching methods on Mathematics performance of learners with dyscalculia particularly in public primary schools in Starehe sub-county, Nairobi City County.

2.6 Learners Characteristics and Dyscalculia

2.6.1 Mathematics Self-Efficacy

Mathematics self-efficacy may be defined as an individual’s beliefs or perceptions with respect to his or her abilities in mathematics, from understanding concepts to solving problems, in mathematics (Bandura 1997). In their study, Zeldin, Britner and Pajares (2008) indicated that self-efficacy has been linked with motivation. It has been well founded that students with higher levels of self-efficacy tend to be more motivated to learning than their peers and are more likely to persist when presented with challenges.
This study was however not conducted within Kenyan context and thus, the findings cannot be generalized to any public primary school in Kenya. In addition, the study did not assess how this influences Mathematics performance especially for learners with dyscalculia.

2.6.2 Learner’ Attitude

Students’ attitudes towards mathematics determine results. Dyscalculia can have deleterious effects on children’s emotional attitude towards mathematics. A study by Rubinsten and Tannock (2010) indicated that the difficulties children face might affect their confidence and consequently their motivation to participate successfully in activities involving mathematics. The study affirmed that children with dyscalculia display anxiety when faced with mathematical tasks. Even so, the study did not investigate in details how this influences the Mathematic performance of the dyscalculic learners.

2.6.3 Cognitive Abilities

The maturation of cognitive skills, or thinking, follows a sequential progression. Any attempts to bypass or speed up the developmental process may create problems (Lerner & Keltner, 2000). In addition, Mondoh (2005) revealed that the role of the educator is to provide material and appropriate opportunities in which learners can interact. Thus, the learning process in Mathematics should begin with motor level where the learner tackles concrete objects and then proceeds to the abstract level. However, the study did not assess the influence of the cognitive abilities on Mathematics performance of dyscalculic learners.
2.7 Availability of Teaching and Learning Resources and Learners with Dyscalculia

In their study, Jitendra, Rodriguez, Kanive, Huang, Church, Conroy and Zaslofsky (2013) affirmed that lack of teaching and learning resources for dyscalculic learners is a major cause for them to significantly lag behind their peers in Mathematics performance. According to Yusta (2015), Mathematics performance of students with dyscalculia can be improved through the use of appropriate teaching and learning resources. It is therefore necessary to improve Mathematics performance of learners with dyscalculia by availing appropriate teaching and learning resources. Otherwise, without suitable teaching and learning resources, pupils with dyscalculia may continue to face much frustration and failure in Mathematics (Mercer & Miller, 2003).

In Tanzania, Yusta, Karugu, Muthee and Tekle (2016) conducted a study on the impact of instructional resources on mathematics performance with dyscalculia in integrated primary schools in Arusha City. The study employed a descriptive design and a target population of 92 respondents’ included head teachers and subject teachers. The results showed that graphic resources were the most commonly used by teachers. The study findings further showed that all the five main types of instructional resources including audio, visual, audio-visual, graphic and realia resources were either inadequate or lacking. However, Yuta et al. (2016) only focused on secondary schools and therefore their findings could not be generalized to primary schools.

In Kenya, Njeru (2012) revealed that through the modern technology, several assistive technology resources are also available including screen magnifiers, screen readers, self-voicing applications, Text-to-speech and Speech-to-text devices, that support learners
with dyscalculia to cope with the requirements of learning numeracy in a conventional class. The teaching and learning resources enhance the learning of dyscalculic learners especially by enhancing their working memory (Hulme & Snowling, 2009).

A study by Orodho, Waweru, Ndichu and Nthinguri (2013) affirmed that adequacy of teaching and learning resources usually enable the learners to follow the teacher and assists in the understanding of the topic being taught. Herward (2009) further asserted that availability and adequacy of various teaching and learning resources can stimulate the learners’ interest and actively engage them despite their learning disabilities. Although the provides significant insights on the probable influence of availability of teaching and learning resources on dyscalculic learners’ Mathematics performance, none of the studies covered the primary schools in Starehe Sub-county. As such, the findings in these studies cannot be generalized to the public primary schools in Starehe Sub-county.

2.8 Summary of Literature Review

Existing literature indicates that dyscalculia is evident in most schools worldwide including Kenya. However, there is little information regarding its prevalence in different regions and countries. Existing studies have explored some of the teacher factors that are likely to influence Mathematics performance but they have not investigated the relationship between the factors and Mathematics performance of dyscalculic learners. Other studies have assessed various teaching methods used in different schools but have failed to examine how the different methods affect the mathematics performance of learners with dyscalculia. Scholars have made efforts to assess the various learners’ characteristics that influence their performance but they have done very little to assess the
relationship between the different learner characteristics on Mathematics performance for dyscalculic learners.

Most studies that have been done on dyscalculic learners are internationally based in the West and cannot be generalized in other local settings. There is dearth of knowledge in the existing literature regarding the occurrence of dyscalculia; Mathematics performance of the dyscalculic learners; and the influence of the various factors on their Mathematics performance in a local setting and a developing nation like Kenya.

Basing on methodologies, most studies reviewed under literature employed a maximum of two tools or one implying that their recommendations and conclusions were made from a comprehensive research. The current study used such various tools as teachers’ questionnaires, Mathematics Self-Efficacy Tool, assessment tool for learner’s attitude towards mathematics, cognitive abilities assessment tools and document analysis guide for an in-depth analysis of the concept of dyscalculic learners and respective predictors related to teachers and learners themselves.
CHAPTER THREE
RESEARCH METHODOLOGY

3.1 Introduction

The aim of this study was to assess predictors of mathematics performance among learners with dyscalculia for intervention in public primary schools. This chapter presents the methods used in the study. It contains research design, study variables, study locale, target population, sampling techniques and sample size, research instruments, pilot study, validity and reliability of instruments, data collection and data analysis procedures and ends with ethical considerations.

3.2 Research Design

This research applied descriptive survey design. This design attempts to show the status quo of study items (Cooper & Schindler, 2006). The design provides the present picture of a situation as it naturally happens (Salaria, 2012). Using the descriptive survey design can therefore help in formulation of knowledge and solutions to the existing problem. The design is thus considered appropriate for this study because it will enable the researcher to get information on assessing the predictors of Mathematics performance among learners with dyscalculia in public primary schools in Starehe Sub-County Kenya.

3.2.1 Variables

Mugenda and Mugenda (2003) refer to different classifications of variables as dependent, independent, intervening, confounding and antecedent. This study had independent variables, intervening variables and dependent variable.
**Independent Variables:** An independent variable in a study is the variable that is presumed to cause an effect on another variable (that is, the dependent variable) (Flannelly, Flannelly & Jankowski, 2014). In this regard, this study had four independent variables. The first was teacher factors (including teaching experience, academic qualifications, teacher’s attitude and teacher’s workload). The second was teaching methods (including cooperative learning, direct strategy, strategy instruction, peer tutoring and scaffolding). The third was learner factors (including mathematics self-efficacy, attitudes towards mathematics). The fourth was teaching and learning resources (visual resources, audio resources, audio-visual resources, graphics resources, real object resources, and assistive technology).

**Intervening Variable:** This is the variable that in a chain of causation in a study that is considered as a causal link between the independent and dependent variable (Flannelly, Flannelly & Jankowski, 2014). The intervening variable in the study was classroom environment.

**Dependent variable:** This is the variable whose change in a study is associated or relies on changes occurring in another variable (that is, independent variable) in the study (Kaur, 2013). The dependent variable for the study was Mathematics performance of learners with dyscalculia.

**3.3 Location of the Study**

The study was conducted in public primary schools in Starehe Sub-County (see Appendix VIII). Therefore, the study was conducted within selected public primary schools found in the sub-County. Starehe Division borders Westlands to the North West, Kasarani to the
North East, Kamukunji to the East, Makadara to the South East, and Lang’ata to the South. The researcher chose the area under study for three reasons. First, there is no proof of any study having been conducted on predictors of mathematics performance among learners with dyscalculia in public primary school in Starehe Sub-County before. Second, Starehe Sub-county was convenient, because the researcher is familiar with the area. Third, Starehe Sub-County is selected because being in a metropolitan city; learners come from different ethnic and regional backgrounds to avoid bias.

3.4 Target Population

Target population according to Cooper and Schindler (2006) refers to the total collection of elements to which the researcher wishes to make inference about. For this study, the target population was Mathematics teachers in Starehe Sub-county who teach standard seven as well as the class seven pupils in the 4 public primary schools in the Sub-County. Class seven pupils were selected for the study because they had developed Mathematics skills and hence likely to communicate effectively as they engage with the instruments. In addition, the learners in this class were not be under pressure to sit for KCPE which is done upon completion of class eight.

<table>
<thead>
<tr>
<th>Respondents</th>
<th>Target Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class seven learners</td>
<td>400</td>
</tr>
<tr>
<td>Class seven Mathematics teachers</td>
<td>60</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>460</strong></td>
</tr>
</tbody>
</table>

Source: Office of the County Director of Education, Nairobi City County.
3.5 Sampling Techniques and Sample Size

3.5.1 Sampling Techniques

The study used purposive sampling technique to select the primary schools to be included where only the 4 public primary schools in Starehe Sub-county were selected. Purposive sampling was also used to select teachers where only Mathematics teachers for class seven were sampled. However, simple random sampling was used to select teachers from double or multiple streamed schools. The Mathematics teachers were expected to have relevant information on mathematics performance.

3.5.2 Sample Size

The sample size for the study consisted of 42 class seven pupils and 8 class seven Mathematics teachers (special and regular if any) in the four targeted public primary schools. Therefore, the total sample size that was used was 50 respondents which is equivalent to 10.9% of the total population (460). This sample size was considered adequate for the study in line with Mugenda and Mugenda (2003) who asserted that a sample size of at least 10% is adequate for a study. The sample was used to make generalization on the actual population in the targeted schools. Table 3.2 illustrates the distribution of the sample size.

<table>
<thead>
<tr>
<th>Respondents</th>
<th>Target Population</th>
<th>Sample size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class seven learners</td>
<td>400</td>
<td>42</td>
</tr>
<tr>
<td>Class seven Mathematics teachers</td>
<td>60</td>
<td>8</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>460</strong></td>
<td><strong>50</strong></td>
</tr>
</tbody>
</table>
3.6 Research Instruments

Data for this study was gathered using different sets of instruments for the teachers and learners. A questionnaire was used to collect data from the class seven Mathematics teachers while a set of different instruments adapted from different scholars was used to collect data from the class seven learners based on the aspect being assessed. School records were reviewed to extract data on Mathematics performance. This is elaborated in sections 3.6.1, 3.6.2 and 3.6.3.

3.6.1 Mathematics Teachers Questionnaire

This questionnaire had two major parts. Part 1 contained items (questions) that were designed to gather the background information of the teacher. Part 2 contained items designed to gather information on teachers’ factors, classroom environment, and general Mathematics performance. This questionnaire was physically administered by the researcher to the standard seven Mathematics teachers. The use of a questionnaire was preferred in this study due to its ability to collect a huge amount of information and ensures confidentiality (Mugenda & Mugenda, 2003).

3.6.2 Interview Guide for Head Teachers

The interview guide was administered to the head teachers of the schools from which the Mathematics teachers were selected. The interview guide was administered through face to face interview. It contained open ended questions that sought to collect in depth details on the study variables being assessed in line with the study objectives.
3.6.3 Learners Research Instruments

This was a set of three instruments to assess different learner characteristics: Dyscalculia screening tool (Wechsler Intelligence Scale for Children - WSIC III) to screen pupils for dyscalculia; Mathematics Self Efficacy Scale (MSES) (Bandura, 1997) to assess pupils’ self-efficacy in Mathematics; Cognitive abilities assessment tool (Woodcock – Johnson IV) (Woodcock & Johnson, 1977) to assess the pupils’ cognitive abilities; and Fennema-Sherman Mathematics Attitude Scales (FSMAS) (Mohamed & Waheed, 2011) to assess the pupils’ attitude towards Mathematics.

3.6.4 Document Analysis Guide

To analyze the records of Mathematics performance of learners with dyscalculia, document analysis guide was used. The guide was used to facilitate quick extraction of data from the pupils’ performance records in the school. In this regard, it was used alongside the dyscalculia screening tool and the cognitive abilities assessment test whereby, the pupils’ score in the tests was matched with their respective scores in Mathematics as extracted from the school’s performance records.

3.7 Pilot Study

The researcher conducted a pilot study in one of the primary schools in Starehe sub-county. The school was selected for the pilot study because it has similar features as the schools under study. That is, the school is within the same locality as the target schools and learners in the school are from different ethnic and regional backgrounds just like the other four targeted schools. Using purposive sampling the researcher selected 1 Mathematics teacher and 2 class seven pupils. The piloting helped discover weaknesses
in the instruments like unclear questions cited by the respondents. Thus, it helped to remove ambiguity in questions and ensure they adequately collect the relevant data in the main study. This helped improve validity and reliability of the research tools for the study.

3.7.1 Validity of the Instruments

Validity is usually defined as the extent to which an instrument measures what it purports to measure (Kimberlin & Winterstein, 2008). In this study, face validity and content validity of the research tools were considered. To enhance the face validity of the instrument, the pilot study questionnaires were scrutinized to identify items that seem unclear and ambiguous to the respondents. Such items were reviewed and restructured using simplified items. For the content validity of the instruments, the researcher sought professional consultation from the supervisors and lecturers in the Department of Special Education who are well versed in the area that was being studied. The researcher harmonized the supervisors’ discussions and included relevant remarks and suggestions while developing and revising the research instruments to ascertain their content validity before collecting the data.

3.7.2 Reliability of the Instruments

Reliability is the measure of degree to which a research instrument yields consistent results or data after several trials (Kothari, 2004). To establish reliability of the instruments, the test-retest method was applied at an interval of two weeks between the first test and the second test using the same respondents. This method enabled the researcher to obtain a coefficient of reliability using Pearson product moment correlation
between pre-test and post test scores achieved. Correlation coefficient of 0.75 was considered appropriate to reliability for the instruments. Credibility and trustworthiness of data collected quantitatively was achieved through taking long time in the field, asking probing questions and triangulation.

3.8 Data Collection Techniques

The researcher obtained a research permit from the Ministry of Education for authority to carry out the research, before going to the field. Thereafter, the County Director of Education was contacted before commencement of the main study. The researcher paid a courtesy call to the sampled schools after making appointments with the head-teachers. Once the head teachers gave their consent, the researcher liaised with the head teacher to identify the class seven Mathematics teachers and briefed them about the study before administering the questionnaire to them. The teachers were given a maximum of two days to complete and return the questionnaire. As for the pupil’s, the parents’ authority were sought by the researcher through the class teachers for class seven. It is only after the parent’s consent, that screening assessment tests were administered on the learner. The pupils were first screened for dyscalculia using the dyscalculia screening tool adopted from the Wechsler Intelligence Scale for Children (WSIC III) to identify pupils with dyscalculia. The inclusion/exclusion criteria was that the learner must have sat for the end of term exams for class seven for all the three terms in the year in the same school. The researcher personally administered the screening tests to the learners where all the learners were given equal time to undertake each test. The researcher explained to the respondents how to respond to the given questions and guide them on any area they may need clarification.
3.9 Data Analysis

After completing data collection process the data was first checked for completeness and cleaned. The cleaned data was then coded. The coded data was then entered into a computer program – that is, Statistical Package for Social Sciences (SPSS) version 25, whereby the quantitative data was reported through descriptive statistics – frequencies, percentages and mean. The findings were presented using tables, bar-graphs and pie charts. Qualitative data from open ended questions were analyzed through content analysis method. In this regard, the qualitative data was organized into themes in line with the study objectives and used to enhance the discussion on quantitative findings.

3.10 Logistical and Ethical Considerations

3.10.1 Logistical Considerations

The researcher sought for approval for research from graduate school of Kenyatta University. The researcher also sought permit from the Ethical committee for research at Kenyatta University. An approval was further sought from the National Commission for Science Technology and Innovation (NACOSTI) before collecting data. The researcher also went through the Starehe Sub-County Director of Education; and heads of schools sampled to get their permit before interacting with the teachers and pupils.

3.10.2 Ethical Considerations

It was made clear to the respondents that they would be free to disengage from the study anytime they feel. For the minors who were involved in the study, the researcher had parents and teachers sign informed consent form upon full explanation of their participation requirements. That is, participants were made to understand that the study was exclusively for academic purpose only and that their participation was voluntary.
They were also assured of their freedom withdraw from the study at any point. In addition, participants were assured that any information they would give was to be treated with utmost confidentiality and would not be disclosed to any third party whatsoever. Confidentiality was ensured by storing the raw data collected in hard copy under lock and key. The soft copy of the data was electronically stored in a computer fortified with a password to avoid unauthorized access.
CHAPTER FOUR
PRESENTATION OF FINDINGS, INTERPRETATION AND DISCUSSION

4.1 Introduction

This chapter presents the findings, interpretations and discussions according to the objectives of the study. The objectives entailed:

(a) To find out the Mathematics performance of learners with dyscalculia in public primary schools in Starehe sub-county, Nairobi City County.

(b) To assess the impact of teacher factors on Mathematics performance of learners with dyscalculia in public primary schools in Starehe sub-county, Nairobi City County.

(c) To explore the impact of teaching methods on Mathematics performance of learners with dyscalculia in public primary schools in Starehe sub-county, Nairobi City County.

(d) To assess the impact of learner characteristics on Mathematics performance of learners with dyscalculia in public primary schools in Starehe sub-county, Nairobi City County.

(e) To investigate the influence of availability of teaching and learning resources on Mathematics performance of learners with dyscalculia in public primary schools in Starehe sub-county, Nairobi City County.

Results from data analysis are presented in the chapter and the findings interpreted and discussed. The chapter is organized into different sections based on the variables
investigated. A section on the teachers’ general and demographic information is first presented before the main study findings are presented.

4.2 General and Demographic Information

4.2.1 General Information

Table 4.1: Response rate

<table>
<thead>
<tr>
<th>Category</th>
<th>Target</th>
<th>Returned</th>
<th>Return rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class seven Mathematics</td>
<td>42</td>
<td>42</td>
<td>100%</td>
</tr>
<tr>
<td>Class seven pupils</td>
<td>8</td>
<td>8</td>
<td>100%</td>
</tr>
<tr>
<td>Total</td>
<td>50</td>
<td>50</td>
<td>100%</td>
</tr>
</tbody>
</table>

The study targeted to cover a sample of 50 respondents comprising of 42 class seven pupils and 8 class seven Mathematics teachers. The researcher was able to administer the questionnaire to 8 class seven Mathematics teachers as targeted and they all filled and returned the questionnaire. The researcher also administered the various research instruments for assessing the learners’ characteristics to a total of 42 class seven pupils as targeted and responses were collected from all of them. Therefore, the response rate for the study was 100%. This implies that the outcome of the results would be of great ideal from which conclusions were drawn and recommendations for the study were made to represent the study population.
4.2.2 Demographic Information

Table 4.2: Teachers' demographic information

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>3</td>
<td>37.5</td>
</tr>
<tr>
<td>Female</td>
<td>4</td>
<td>50.0</td>
</tr>
<tr>
<td>No response</td>
<td>1</td>
<td>12.5</td>
</tr>
<tr>
<td>Age-bracket</td>
<td></td>
<td></td>
</tr>
<tr>
<td>41-50 years</td>
<td>4</td>
<td>50.0</td>
</tr>
<tr>
<td>Over 50 years</td>
<td>3</td>
<td>37.5</td>
</tr>
<tr>
<td>No response</td>
<td>1</td>
<td>12.5</td>
</tr>
</tbody>
</table>

Out of the 8 teachers engaged in the study, 4 (50%) were female, 3 (37.5%) were male while 1 (12.5%) did not indicate their gender. This indicates that most of the Mathematics teachers in public primary schools in Starehe Sub-county are female. This would be more advantageous in accommodating learners with dyscalculia. This is attributed to the fact that studies are constantly upholding that female teachers have more accommodative attitudes than males especially in the developed Countries like the United States ((Upton & Harper, 2000; Hunt & Hunt, 2000). On age-bracket, half of the teachers (50%) were 41-50 years old while 37.5% were over 50 years. This means that majority of Mathematics teachers in public primary schools in Starehe Sub-county are over 40 years old.

4.3 Mathematics Performance of Learners with Dyscalculia

The first task was to find out the Mathematics performance of learners with dyscalculia in public primary schools in Starehe Sub-county, Kenya. The pupils were first screened for
dyscalculia using the dyscalculia screening tool adopted from the Wechsler Intelligence Scale for Children (WSIC III) to identify pupils with dyscalculia. The dyscalculia screening test had 5 questions. Each question was awarded a score 1. Learners with dyscalculia symptoms were those with a score of less than 3. The results are as indicated in Table 4.3.

**Table 4.3: Dyscalculia screening test results**

<table>
<thead>
<tr>
<th>Score</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>11</td>
<td>26.2</td>
</tr>
<tr>
<td>2</td>
<td>20</td>
<td>47.6</td>
</tr>
<tr>
<td>3</td>
<td>10</td>
<td>23.8</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>2.4</td>
</tr>
<tr>
<td>5</td>
<td>0</td>
<td>-</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>42</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>

Out of the 42 pupils assessed, 20(47.6%) scored 2 while 11(26.2%) of them scored 1. This means that a total of 31 pupils in class seven had symptoms of Mathematics difficulties (scored less than 3 out of 5) which indicated a possibility of them having dyscalculia. The rest of them (11) did not have the dyscalculia symptoms since 10 of them scored 3 while 1 scored 4. None of the pupils however scored all the 5 points in the test. The results indicate that there is a possibility of high prevalence of dyscalculia among class seven learners in public primary schools in Starehe Sub-county. This concurs with Mazzocco, Feigenson and Halberda (2011) who asserted that the number of children suffering from dyscalculia is quite high despite adequate schooling.
To investigate Mathematics performance of pupils with dyscalculia, descriptive statistics on Mathematics performance were computed (minimum, maximum and mean score performance in Mathematics and the standard deviations) for the pupils diagnosed with dyscalculia. This was done for each of the three terms in the year. Only the 31 pupils who scored less than 3 out of 5 points were represented in the analysis. The findings are presented in Table 4.4.

Table 4.4: Mathematics performance of learners with dyscalculia

<table>
<thead>
<tr>
<th>Term</th>
<th>N</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Term 1</td>
<td>31</td>
<td>15.0</td>
<td>91.0</td>
<td>55.3</td>
<td>19.95</td>
</tr>
<tr>
<td>Term 2</td>
<td>31</td>
<td>12.0</td>
<td>83.0</td>
<td>51.7</td>
<td>19.80</td>
</tr>
<tr>
<td>Term 3</td>
<td>31</td>
<td>13.0</td>
<td>86.0</td>
<td>51.6</td>
<td>19.51</td>
</tr>
<tr>
<td>Overall</td>
<td>31</td>
<td>12.0</td>
<td>91.0</td>
<td>52.9</td>
<td>19.75</td>
</tr>
<tr>
<td>Valid N (listwise)</td>
<td>31</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The overall mean score performance in Mathematics for the learners with dyscalculia was 52.9. Their performance was highest in term 1 (mean score = 55.3%) and least in term 3 (mean score = 51.6%). The findings indicate that most pupils with dyscalculia are still capable of above average performance in Mathematics. This disagrees with the findings by Ashcraft and Krause (2007) that indicated that children with dyscalculia are often associated with low grades. However, the high standard deviation (19.75) indicates that large variations exist in the pupils’ performance in Mathematics. This is also evident in the huge difference between the highest score (91.0%) and the lowest score (12.0%). To interrogate the performance further, the mean score performance in Mathematics for
pupils with dyscalculia was contrasted with that of pupils without dyscalculia. The findings are presented in Table 4.5.

**Table 4.5: Contrast in Mathematics performance of learners with and without dyscalculia**

<table>
<thead>
<tr>
<th>Term</th>
<th>With dyscalculia</th>
<th>Without dyscalculia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Term 1</td>
<td>55.3</td>
<td>69.4</td>
</tr>
<tr>
<td></td>
<td>19.95</td>
<td>9.57</td>
</tr>
<tr>
<td>Term 2</td>
<td>51.7</td>
<td>69.5</td>
</tr>
<tr>
<td></td>
<td>19.80</td>
<td>9.30</td>
</tr>
<tr>
<td>Term 3</td>
<td>51.6</td>
<td>70.7</td>
</tr>
<tr>
<td></td>
<td>19.51</td>
<td>7.60</td>
</tr>
<tr>
<td>Overall</td>
<td>52.9</td>
<td>69.8</td>
</tr>
<tr>
<td></td>
<td>19.75</td>
<td>8.83</td>
</tr>
</tbody>
</table>

Overall, mean score Mathematics performance of a learner without dyscalculia was 69.8% which was higher than mean score performance of a learner without dyscalculia (52.9%). The range of deviation in Mathematics performance of the learners without dyscalculia was relatively lower (Std. deviation = 8.83) compared to the case of learners with dyscalculia (19.75). The performance of learners without dyscalculia was higher than that of learners with dyscalculia in each of the three terms. However, while performance of learners with dyscalculia was highest in term 1 (mean score = 55.3%), learners without dyscalculia had the highest performance in term 3 (mean score = 70.7%). The findings imply that although a learner with dyscalculia is capable of performing above average in a Mathematics test, a learner without dyscalculia is still likely to perform better in the very test. This concurs with Diswantika et al. (2019) who concluded that although there are some cases of learners with dyscalculia performing excellently in Mathematics, in many cases, the performance dyscalculic learners is usually lower than that of learners without dyscalculia.
4.4 Teacher Factors and Mathematics Performance of Learners with Dyscalculia

The second objective was to assess the impact of teacher factors on Mathematics performance of learners with dyscalculia in public primary schools in Starehe sub-county, Nairobi City County. Various teachers’ factors were investigated as well as their impact on Mathematics performance of learners with dyscalculia. This was achieved by assessing the teachers’ academic qualification as well as their knowledge and skills in SNE, their teaching experience, their attitude towards teaching mathematics and their career at large, as well as analyzing their teaching workload. The extent that each of these factors affected mathematic performance of learners was then analyzed.

4.4.1 Teachers’ Academic Qualification, Knowledge and Skills in SNE

Table 4.6: Teachers' academic qualifications

<table>
<thead>
<tr>
<th>Education level</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bachelor’s degree</td>
<td>6</td>
<td>75.0</td>
</tr>
<tr>
<td>Diploma</td>
<td>1</td>
<td>12.5</td>
</tr>
<tr>
<td>AT IV</td>
<td>1</td>
<td>12.5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>8</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>
Majority of the teachers (75%) indicated that they had a Bachelor’s degree while 12.5% had a diploma and the rest 12.5% had AT IV. This means that majority of class seven Mathematics teachers in public primary schools in Starehe Sub-county have high level of education. This is critical since according to Njuguna (2012), pupils with learning disabilities require well trained teachers with high professional qualifications and knowledge on good teaching strategies.

![Pie chart showing trained/untrained teachers in SNE]

| Percent, Yes | 62.5, 62% |
| Percent, No  | 37.5, 38% |

**Figure 4.1: Trained/untrained teachers in SNE**

Most of the teachers (62.5%) asserted that they had been trained in SNE while the rest 37.5% had no training whatsoever in SNE. This implies that most of the Mathematics teachers in public primary schools in Starehe Sub-county have some skills in SNE. The findings concur with the study by Kibuthu (2016) in Nyeri Central Sub-County that revealed that majority of the teachers were trained in SNE.
Figure 4.2: Teachers' level of training in SNE

Out of the 62.5% who had been trained in SNE, 37.5% had only trained through attending workshops and seminars with only 25% having acquired a degree in special needs education. This implies that among Mathematics teachers in public primary schools in Starehe Sub-county, only a few of them have acquired formal university training in special needs education.

Figure 4.3: Teachers' perception on their level of skills in SNE

In their perception, 37.5% of the teachers rated their skills in SNE as fair while 25% rated themselves as poor in SNE skills. Even so, 25% alleged that they were good in SNE with
12.5% considering themselves excellent in SNE. This is an indication that majority of the Mathematics teachers in the schools acknowledge their inadequacy in SNE skills. This concurs with Tuchura (2016) whose findings also revealed that out of 179 teachers in the sampled schools only 3 were well experienced in SNE.

![Bar chart showing teachers' perception on their level of knowledge in MLD](image)

**Figure 4.4: Teachers' perception on their level of knowledge in MLD**

Several teachers (37.5%) rated their knowledge in MLD as moderate while 12.5% confessed they had little knowledge in MLD. There were however a few (25%) of them who alleged to have high knowledge in MLD. The findings indicate that most of the Mathematics teachers in the schools only have moderate skills in MLD. This agrees with Yusta (2015) who indicated that most teachers in integrated primary schools in Tanzania had special education training at different levels but not in mathematics learning disabilities, which is a major obstacle for them to effectively teach learners with dyscalculia.
On the number of pupils with dyscalculia in their respective classes, 37.5% of the teachers estimated that there were only 1-3 pupils with dyscalculia in their classes. 25% of them estimated the number at 4-6 pupils while another 25% estimated it at 10 pupils and above. This implies that most of the teachers believe that the number of class seven pupils with dyscalculia is relatively low. This agrees with Nfon (2016) who estimated the proportion of elementary school children likely to have dyscalculia at approximately 6% to 7%.

4.4.2 Teachers’ Experience

The teachers experience was analyzed on the basis of how long they had taught mathematics in their career. The teachers were therefore asked to indicate the number of years they had been teaching mathematics in their career as teachers. Table 4.7 below presents the findings.
Table 4.7: Teachers' experience in teaching Mathematics

<table>
<thead>
<tr>
<th>Duration of teaching Mathematics</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valid</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 – 7 years</td>
<td>1</td>
<td>12.5</td>
</tr>
<tr>
<td>7 – 10 years</td>
<td>2</td>
<td>25.0</td>
</tr>
<tr>
<td>Over 10 years</td>
<td>5</td>
<td>62.5</td>
</tr>
<tr>
<td>Total</td>
<td>8</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Most of the teachers (62.5%) alleged that they had taught Mathematics for over 10 years while 25% had taught for 7-10 years. Only 1(12.5%) had been teaching Mathematics for 3-7 years. This shows that majority of the Mathematics teachers in the public primary schools in Starehe Sub-county have more than 7 years teaching experience in Mathematics. It therefore implies that teachers’ experience varies from one context to another since the findings disagrees with Yusta (2015) who found that most of the Mathematics teachers (nearly 50%) had a teaching experience of less than 5 years.

4.4.3 Teachers’ Attitude

To investigate the teachers’ attitude towards Mathematics and career at large by presenting a set of statements to them that indicated proposed facets of a positive attitude. The teachers then indicated their agreement/disagreement with the statement on a scale of 1 to 5 where 1 was strongly disagree, 2 was disagree, 3 was neutral, 4 was agree and 5 was strongly agree. The mean and standard deviation was then calculated for the rating as presented in Table 4.8 below.
Table 4.8: Mathematics teachers' attitude towards their career

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly agree</th>
<th>Mean</th>
<th>Std. Dev</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics is my favorite subject</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>25.0</td>
<td>75.0</td>
<td>4.8</td>
<td>0.46</td>
</tr>
<tr>
<td>I enjoy teaching Mathematics</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>37.5</td>
<td>62.5</td>
<td>4.6</td>
<td>0.52</td>
</tr>
<tr>
<td>I always like to help someone who cannot understand Mathematics easily</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>62.5</td>
<td>37.5</td>
<td>4.4</td>
<td>0.52</td>
</tr>
<tr>
<td>I am happy that I was allocated to teach class seven Mathematics</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>62.5</td>
<td>37.5</td>
<td>4.3</td>
<td>0.71</td>
</tr>
<tr>
<td>Mathematics</td>
<td>-</td>
<td>-</td>
<td>12.5</td>
<td>50.0</td>
<td>37.5</td>
<td>4.1</td>
<td>0.83</td>
</tr>
<tr>
<td>I generally love my profession as a teacher</td>
<td>-</td>
<td>-</td>
<td>25.0</td>
<td>37.5</td>
<td>37.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td><strong>4.4</strong></td>
<td></td>
<td></td>
<td></td>
<td><strong>0.61</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Teachers’ attitude on average rated at a mean of 4.4 with a relatively low std. deviation of 0.61. This implies that majority of class seven Mathematics teachers in the schools have a strong positive attitude towards their job. Majority attested that Mathematics was their favorite subject (mean= 4.8) and affirmed that they enjoy teaching Mathematics (mean= 4.6), while asserting that they always like to help those who cannot understand Mathematics easily (mean= 4.4). The findings indicate a highly positive teachers’ attitude towards mathematics in the public primary schools in Starehe Sub-County, Kenya. This agrees with Awofala (2016) who revealed that mathematics teachers in Nigeria had a positive and high attitude towards mathematics.

4.4.4 Teachers’ Workload

Teachers’ workload was assessed on the basis of the number of lessons they had per week and the number of pupils in their respective classes.
Table 4.9: Number of lessons per week for the teacher

<table>
<thead>
<tr>
<th>No. of lessons in a week</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valid</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than 25 lessons</td>
<td>1</td>
<td>12.5</td>
</tr>
<tr>
<td>25-30 lessons</td>
<td>2</td>
<td>25.0</td>
</tr>
<tr>
<td>31-35 lessons</td>
<td>5</td>
<td>62.5</td>
</tr>
<tr>
<td>Total</td>
<td>8</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Most of the teachers (62.5%) indicated that they had 31-35 lessons per week. Only 1(12.5%) of the teachers had less than 25 lessons per week. Moreover, all the 8 teachers (100%) attested that the number of pupils in class seven in their respective schools was more than 60. This is an indication that majority of class seven Mathematics teachers have huge workload which may negatively affect their effectiveness in teaching. This concurs with Kiplagat, Role and Makewa (2012) whose study findings indicated that teachers had to struggle with high workload brought about by large number of pupils were large, which caused teachers though experienced to fail to use different teaching methods.

4.4.5 Effect of Teachers’ Factors on Pupils’ Mathematics Performance

To understand the effect of the teachers’ factors on mathematics performance, the teachers were asked to rate the extent that each of the teachers factors analyzed in sections 4.4.2 through 4.4.4 above affected mathematic performance of learners. This was rated on a scale of 1 to 5 where 5 was very great extent, 4 was great extent, 3 was moderate extent, 2 was little extent and 1 was no extent at all. Table 4.9 below presents the findings.
Table 4.10: Perception on effect of teachers' factors on Mathematics performance

<table>
<thead>
<tr>
<th>Factor</th>
<th>No extent at all</th>
<th>Little extent</th>
<th>Moderate extent</th>
<th>Great extent</th>
<th>Very great extent</th>
<th>Mean</th>
<th>Std. Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teaching experience</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>50.0</td>
<td>50.0</td>
<td>4.5</td>
<td>0.53</td>
</tr>
<tr>
<td>Teacher’s academic qualifications</td>
<td>-</td>
<td>12.5</td>
<td>25.0</td>
<td>62.5</td>
<td>-</td>
<td>3.5</td>
<td>0.76</td>
</tr>
<tr>
<td>Teacher’s attitude</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>12.5</td>
<td>87.5</td>
<td>4.9</td>
<td>0.35</td>
</tr>
<tr>
<td>Teacher’s workload</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>25.0</td>
<td>75.0</td>
<td>4.8</td>
<td>0.46</td>
</tr>
<tr>
<td>Average</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4.4</td>
<td>0.53</td>
</tr>
</tbody>
</table>

The overall effect of teachers’ factors on pupils’ Mathematics performance was rated at a mean of 4.4. There was also minimal deviations from the mean (SD= 0.53). This implies that teachers’ factors greatly affect pupils’ Mathematics performance in public primary schools. Teachers’ attitude had the highest mean (4.9) followed by teachers workload (4.8) and teaching experience (4.5). Teachers’ academic qualifications had the least mean at 3.5. The findings indicate that teachers’ attitude, teachers’ workload and teaching experience are the most critical in determining Mathematics performance among class seven pupils. This concurs with Toropova, Johansson and Myrberg (2019) who indicated that teacher characteristics including teaching experience has a significant effect on learners’ mathematics performance.

**4.5 Classroom Environment**

The condition of the classroom environment was assessed using a set of five statements pertaining to the class room conditions, which the teachers expressed their agreement or disagreement on a scale of 1 to 5 where 1 was strongly disagree and 5 was strongly agree.
Table 4.11: Perception on classrooms' conditions

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly agree</th>
<th>Mean</th>
<th>Std. Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>The classrooms in this school are in good physical condition for learning</td>
<td>-</td>
<td>37.5</td>
<td>-</td>
<td>62.5</td>
<td>-</td>
<td>3.3</td>
<td>1.04</td>
</tr>
<tr>
<td>The classrooms have good desks/chairs and lockers for pupils to use</td>
<td>-</td>
<td>37.5</td>
<td>12.5</td>
<td>25.0</td>
<td>25.0</td>
<td>3.4</td>
<td>1.30</td>
</tr>
<tr>
<td>The classrooms have good platforms/stage for use by the teachers during the lessons</td>
<td>-</td>
<td>37.5</td>
<td>25.0</td>
<td>12.5</td>
<td>25.0</td>
<td>3.3</td>
<td>1.28</td>
</tr>
<tr>
<td>The classrooms are maintained in clean and good hygiene conditions</td>
<td>12.5</td>
<td>12.5</td>
<td>37.5</td>
<td>25.0</td>
<td>12.5</td>
<td>3.1</td>
<td>1.25</td>
</tr>
</tbody>
</table>

**Average**  3.3  1.22

The classroom environment condition was rated at a mean of 3.3 with a standard deviation of 1.22. This implies that the teachers were sceptical of the suitability of the classroom environment in their schools. The teachers could not confirm whether classrooms had good desks/chairs and lockers for pupils to use or not (mean = 3.4). They also could not affirm if classrooms in the school were in good physical condition for learning or not (mean = 3.3). The findings support the findings by Chepkonga (2017) who found that there was need for improvement in classroom environmental setting to facilitate the achievement of objectives and goals of indoor learning. Such improvements according to Abanador et al. (2014) should be aimed at creating a learning environment in the classroom that facilitates positive social interaction, active involvement during learning and a self-motivating environment to the learners.
In their perception, 37.5% of the teachers alleged that classroom environment affects pupils’ Mathematics performance to a moderate extent. There were however some of them (12.5%) who considered the effect to be great with 25% others rating it as very great. The findings indicate that classroom environment exerts a considerable effect on pupils’ Mathematics performance. The findings agree with Tosto et al. (2016) who indicated that classroom environment significantly affects learners’ mathematics performance.

**4.6 Teaching Methods and Mathematics Performance of Learners with Dyscalculia**

The third objective of the research was to explore the impact of teaching methods on Mathematics performance of learners with dyscalculia in public primary schools in Starehe sub-county, Nairobi City County. The researcher first sought to determine whether teachers screen the learners for dyscalculia to understand its prevalence before they select the teaching methods they use. The results are presented in table 4.12.
Table 4.12: Teachers' screening of learners for dyscalculia

<table>
<thead>
<tr>
<th>Screening of learners for dyscalculia</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>2</td>
<td>25.0</td>
</tr>
<tr>
<td>No</td>
<td>6</td>
<td>75.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Frequency of screening learners for dyscalculia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Every term</td>
</tr>
<tr>
<td>No response</td>
</tr>
</tbody>
</table>

Majority of the teachers (75%) confessed that they never screened learners in their classes for dyscalculia. Only 25% alleged to screen learners for dyscalculia every term. This could explain why majority of them have a perception that only a few pupils have dyscalculia (as revealed in Figure 4.7).

Figure 4.7: Teaching methods used by Mathematics teachers

All the teachers (100%) affirmed that they used cooperative learning method. Majority of them also used peer tutoring (87.5%) and direct instruction (75%). However, strategy instruction and scaffolding were scarcely used by 37.5% and 12.5% respectively. The findings indicate that in teaching Mathematics to class seven pupils, most teachers in
Starehe sub-county use cooperative learning, peer tutoring and direct instruction methods. This means that these methods are quite effective for learners with dyscalculia since as earlier indicated in section 4.3, the learners with dyscalculia had performed quite well in Mathematics.

![Graph showing teaching methods effectiveness]

**Figure 4.8: Perception on the most effective teaching methods for learners with dyscalculia**

Majority of the teachers expressed that the most effective teaching method for pupils with MLD are cooperative learning (87.5%), peer tutoring (87.5%) and direct instruction (75%). The findings imply that pupils with dyscalculia are likely to learn more effectively where the teacher adopts cooperative learning method, peer tutoring and or direct instruction teaching methods. This affirms the findings by Kibuthu (2016) which recommended that use of peer tutoring method by teachers in their course work is effective in improving the performance of the learners with learning disabilities.
Figure 4.9: Perception on effect of teaching methods on Mathematics performance

The teachers unanimously affirmed that teaching methods greatly affect pupils’ Mathematics performance with 75% of them rating the effect as great, while the rest 25% rated it as very great. This is in agreement with Maat et al. (2011) who found out that teaching methods had a major effect on learners’ performance in Mathematics.

4.7 Learner Characteristics and Mathematics Performance of Learners with Dyscalculia

The fourth objective was to assess the impact of learner characteristics on Mathematics performance of learners with dyscalculia in public primary schools in Starehe sub-county, Nairobi City County. In this regard, several learners’ characteristics were assessed including Mathematics self-efficacy, Mathematics attitude, and cognitive abilities. The correlation between these learners’ characteristics and the Mathematics performance was then computed. The results are discussed in 4.7.1 through 4.7.4.
4.7.1 Mathematics Self Efficacy

Table 4.13 below describes the pupils’ Mathematics self-efficacy as assessed using Mathematics Self Efficacy Scale (MSES) by Bandura (1997).

**Table 4.13: Pupils' Mathematics self-efficacy**

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly disagree(1)</th>
<th>Disagree(2)</th>
<th>Agree(3)</th>
<th>Strongly Agree(4)</th>
<th>Mean</th>
<th>Std. Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>I often worry that it will be difficult for me in Mathematics classes.</td>
<td>28.6</td>
<td>23.8</td>
<td>40.5</td>
<td>7.1</td>
<td>2.3</td>
<td>0.96</td>
</tr>
<tr>
<td>I'm confident that I can do an excellent job on my math tests.</td>
<td>9.8</td>
<td>14.6</td>
<td>51.2</td>
<td>24.4</td>
<td>2.9</td>
<td>0.89</td>
</tr>
<tr>
<td>I get very tense when I have to do Mathematics assignment.</td>
<td>14.6</td>
<td>39.0</td>
<td>39.0</td>
<td>7.3</td>
<td>2.4</td>
<td>0.83</td>
</tr>
<tr>
<td>I worry that I will get poor grades in Mathematics</td>
<td>21.4</td>
<td>35.7</td>
<td>35.7</td>
<td>7.1</td>
<td>2.3</td>
<td>0.89</td>
</tr>
<tr>
<td>I am sure I can master the skills being taught in my math class.</td>
<td>-</td>
<td>16.7</td>
<td>59.5</td>
<td>23.8</td>
<td>3.1</td>
<td>0.64</td>
</tr>
<tr>
<td>I get very nervous doing Mathematics problems.</td>
<td>19.0</td>
<td>33.3</td>
<td>38.1</td>
<td>9.5</td>
<td>2.4</td>
<td>0.91</td>
</tr>
<tr>
<td>I have always believed that Mathematics is one of my best subjects.</td>
<td>2.4</td>
<td>9.5</td>
<td>69.0</td>
<td>19.0</td>
<td>3.0</td>
<td>0.62</td>
</tr>
</tbody>
</table>

**Average**  

2.6  0.82

The overall Mathematics self-efficacy for the pupils on average was 2.6 out of 4 with a standard deviation of 0.82. This indicates that majority of the pupils have quite high Mathematics self-efficacy. Most of the pupils expressed their confidence that they can master the skills being taught in their Math class (mean = 3.1) with minimal deviations in their responses (SD = 0.64). Most of them asserted (with a mean of 3.0) that they have
always considered Mathematics as one of their best subjects, and were confident that they
can do an excellent job in math tests (mean = 2.9). They denied having any worry that
they will get poor grades in Mathematics (mean = 2.3). The findings are congruent with
Zeldin, Britner and Pajares (2008) indicated that learners’ self-efficacy is highly linked
with their motivation in the subject.

4.7.2 Mathematics Attitude

Using the Fennema-Sherman Mathematics Attitude Scales (FSMAS), the pupils’
Mathematics attitude was as presented in Table 4.13.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly disagree(1)</th>
<th>Disagree(2)</th>
<th>Agree(3)</th>
<th>Strongly Agree(4)</th>
<th>Mean</th>
<th>Std. Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learning mathematics is enjoyable</td>
<td>-</td>
<td>11.9</td>
<td>64.3</td>
<td>23.8</td>
<td>3.1</td>
<td>0.59</td>
</tr>
<tr>
<td>I can get good grades in mathematics</td>
<td>-</td>
<td>11.9</td>
<td>57.1</td>
<td>31.0</td>
<td>3.2</td>
<td>0.63</td>
</tr>
<tr>
<td>I know I can handle difficulties in mathematics</td>
<td>4.8</td>
<td>19.0</td>
<td>64.3</td>
<td>11.9</td>
<td>2.8</td>
<td>0.70</td>
</tr>
<tr>
<td>Maths puzzles are boring</td>
<td>26.8</td>
<td>39.0</td>
<td>34.1</td>
<td>-</td>
<td>2.1</td>
<td>0.79</td>
</tr>
<tr>
<td>I would rather have someone give me the solution to a difficult math</td>
<td>28.6</td>
<td>33.3</td>
<td>33.3</td>
<td>4.8</td>
<td>2.1</td>
<td>0.90</td>
</tr>
<tr>
<td>problem than to have to work it out for myself.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>My mind goes blank and I am unable to think clearly when doing mathematics.</td>
<td>31.0</td>
<td>35.7</td>
<td>33.3</td>
<td>-</td>
<td>2.0</td>
<td>0.81</td>
</tr>
</tbody>
</table>

Average 2.6 0.74
On average, the overall Mathematics attitude was rated at a mean of 2.6 with a standard deviation of 0.74. Majority of the pupils confirmed their optimism that they can get good grades in Mathematics (mean = 3.2; SD= 0.63). They further affirmed that to them, learning Mathematics is enjoyable (mean = 3.1; SD= 0.59) and expressed confidence that they can handle difficulties in mathematics (mean = 2.8; SD= 0.70). Most of them denied allegation that their mind goes blank and they are unable to think clearly when doing mathematics (mean = 2.0; SD= 0.81). The findings indicate that the learners had a strong positive attitude towards mathematics. This concurs with Mata, Monteiro and Peixoto (2012) who found that many learners held positive attitude towards mathematics.

4.7.3 Cognitive Abilities

Cognitive abilities for the pupils were as presented in Table 4.14 as assessed using a tool adapted from Woodcock – Johnson IV (WJ-IV) test. The total score as per the tool was 5.

Table 4.15: Pupils' cognitive abilities

<table>
<thead>
<tr>
<th>Score</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3</td>
<td>7.1</td>
</tr>
<tr>
<td>2</td>
<td>24</td>
<td>57.1</td>
</tr>
<tr>
<td>3</td>
<td>7</td>
<td>16.7</td>
</tr>
<tr>
<td>4</td>
<td>8</td>
<td>19.0</td>
</tr>
<tr>
<td>5</td>
<td>0</td>
<td>-</td>
</tr>
<tr>
<td>Total</td>
<td>42</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Most of the pupils (57.1%) scored 2 out 5 while 16.7% scored 3 out of 5. The highest score attained was 4 out of 5 scored by 19.0% of the pupils. Only 7.1% scored 1 out of 5. The findings indicate that most of class seven pupils in public primary schools in Starehe
sub-county have relatively low cognitive abilities. The findings concur with Emine and Salih (2012) who found that many Turkish children had weak cognitive abilities.

4.7.4 Learner Characteristics and Mathematics Performance of Dyscalculic Learners

Pearson correlation coefficient was computed to determine the influence of learner characteristics on Mathematics performance of learners with dyscalculia. The findings are presented in Table 4.15 below.

<table>
<thead>
<tr>
<th>Mathematics performance</th>
<th>Correlations</th>
<th>Cognitive abilities</th>
<th>Mathematics Self Efficacy</th>
<th>Mathematics Attitude</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mathematics performance</td>
<td>Dyscalculia</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Dyscalculia</td>
<td>Pearson Correlation</td>
<td>.238</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sig. (2-tailed)</td>
<td>.198</td>
<td>.31</td>
<td>.31</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>31</td>
<td>31</td>
<td>31</td>
</tr>
<tr>
<td>Cognitive abilities</td>
<td>Pearson Correlation</td>
<td>-.089</td>
<td>.156</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Sig. (2-tailed)</td>
<td>.632</td>
<td>.403</td>
<td>.31</td>
</tr>
<tr>
<td>Mathematics Self Efficacy</td>
<td>Pearson Correlation</td>
<td>.017</td>
<td>-.232</td>
<td>.015</td>
</tr>
<tr>
<td></td>
<td>Sig. (2-tailed)</td>
<td>.926</td>
<td>.209</td>
<td>.935</td>
</tr>
<tr>
<td>Mathematics Attitude</td>
<td>Pearson Correlation</td>
<td>-.111</td>
<td>.313</td>
<td>.288</td>
</tr>
<tr>
<td></td>
<td>Sig. (2-tailed)</td>
<td>.551</td>
<td>.086</td>
<td>.116</td>
</tr>
</tbody>
</table>

There was a weak correlation of -0.238 between dyscalculia and Mathematics performance with a p-value (Sig.) of 0.198. Negative correlations were found between Mathematics performance and other learners’ characteristics including cognitive abilities.
(r = -0.089; p = 0.632), and Mathematics attitude (r = 0.111; p = 0.551). This indicates that Mathematics performance is negatively correlated with dyscalculia, cognitive abilities and Mathematics attitude. Even so, the relationship is insignificant at 95% confidence level since the p-values (Sig.) were greater than 0.05. The findings differ with Ekonesi and Beatrice (2017) who found that dyscalculia was significantly correlated with Mathematics performance. However, there was a weak positive correlation of 0.017 between Mathematics performance and Mathematics self-efficacy. The relationship was however insignificant too at 95% confidence level since p-value (p = 0.926) was also greater than 0.05. The findings differ with Ayotola and Adedeji (2009) who found out that there was a significant strong and positive correlation between Mathematics self-efficacy and Mathematics performance.

4.8 Teaching and Learning Resources and Mathematics Performance of Learners with Dyscalculia

The fifth objective was to investigate the influence of availability of teaching and learning resources on Mathematics performance of learners with dyscalculia in public primary schools in Starehe sub-county, Nairobi City County. In this regard, the availability of teaching and learning resources for dyscalculic learners was first investigated and the effect of their availability on mathematics performance of the learners assessed.
On average, availability of the teaching and learning resources for learners with dyscalculia was rated at a mean of 2.3. This implies that most of the resources are scarce. The resources affirmed as enough were real object resources (mean= 3.5) and visual resources (mean= 3.0). However, assistive technology resources; audio-visual resources, and audio resources were very few as reflected by the low mean of 1.4, 1.5 and 1.8 respectively. The findings concurs with Jitendra, Rodriguez, Kanive, Huang, Church, Conroy and Zaslofsky (2013) who affirmed that scarcity of teaching and learning resources for dyscalculic learners is a major cause for the learners to significantly lag behind their peers in Mathematics performance.

Table 4.17: Availability of teaching and learning resources for learners with dyscalculia

<table>
<thead>
<tr>
<th>Resources</th>
<th>Unavailable at all</th>
<th>Few</th>
<th>Enough</th>
<th>Many</th>
<th>More than enough</th>
<th>Mean</th>
<th>Std. Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visual resources</td>
<td>-</td>
<td>37.5</td>
<td>25.0</td>
<td>37.5</td>
<td>-</td>
<td>3.0</td>
<td>0.93</td>
</tr>
<tr>
<td>Audio resources</td>
<td>37.5</td>
<td>50.0</td>
<td>12.5</td>
<td>-</td>
<td>-</td>
<td>1.8</td>
<td>0.71</td>
</tr>
<tr>
<td>Audio-Visual Resources</td>
<td>62.5</td>
<td>25.0</td>
<td>12.5</td>
<td>-</td>
<td>-</td>
<td>1.5</td>
<td>0.76</td>
</tr>
<tr>
<td>Graphics resources</td>
<td>25.0</td>
<td>25.0</td>
<td>12.5</td>
<td>25.0</td>
<td>12.5</td>
<td>2.8</td>
<td>1.49</td>
</tr>
<tr>
<td>Real object resources</td>
<td>-</td>
<td>25.0</td>
<td>12.5</td>
<td>50.0</td>
<td>12.5</td>
<td>3.5</td>
<td>1.07</td>
</tr>
<tr>
<td>Assistive technology resources</td>
<td>62.5</td>
<td>37.5</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1.4</td>
<td>0.52</td>
</tr>
</tbody>
</table>

Average 2.3 0.91
Most of the teachers (62.5%) asserted that adequacy or inadequacy of teaching and learning resources affected the pupils’ Mathematics performance to a great extent. Moreover, 25% of them considered the effect to be very great although few (12.5%) considered it as moderate. The findings indicate that availability of teaching and learning resources has a great effect on pupils’ Mathematics performance in public primary schools in Starehe sub-county. This concurs with Hulme and Snowling (2009) who found that availability of teaching and learning resources greatly affect the performance of dyscalculic learners.
5.1 Introduction

In this chapter, a recap of the study findings and the inferences made are presented. Proposed recommendations are outlined and areas suggested for further research highlighted as well.

5.2 Summary

The purpose of this study was to assess the predictors of mathematics performance among learners with dyscalculia in public primary schools in Starehe sub-county, Nairobi County. A mixed method research applying descriptive survey design was applied in undertaking the research. Key findings as per the objectives were as highlighted in sections 5.2.1 through 5.2.5.

5.2.1 Mathematics Performance of Learners with Dyscalculia

A total of 31 pupils in class seven out of the 42 pupils assessed had dyscalculia as per their score (scored less than 3 out of 5) in the Wechsler Intelligence Scale for Children (WSIC III). Their mean score performance in Mathematics for the three terms investigated was 52.9% compared to 69.8% for learners without dyscalculia. There were also large variations in pupils’ individual scores in Mathematics as reflected by high standard deviation of 19.75 compared to the case of pupils’ without dyscalculia whose scores had relatively low standard deviation of 8.83.
5.2.2 Influence of Teacher Factors

Most of the teachers indicated they had taught Mathematics for over 10 years. They also expressed a strong positive attitude towards Mathematics and their teaching profession in general which on stood at a mean of 4.4 on a scale of 5. Most of them also indicated that they had 31-35 lessons per week with all of them unanimously attesting that their respective classes had more than 60 pupils. Concerning the effect of the different teacher factors assessed on pupils’ Mathematics performance, teachers’ attitude had the highest mean (4.9) followed by teachers’ workload (mean= 4.8) and teaching experience (mean= 4.5). Teachers’ academic qualifications had the least mean at 3.5.

5.2.3 Influence of Teaching Methods

The teachers unanimously affirmed that they used cooperative learning method. Majority of them also used peer tutoring with three quarters of them using direct instruction. Majority of the teachers expressed that the most effective teaching method for pupils with MLD are cooperative learning peer tutoring and direct instruction. They unanimously affirmed that teaching methods greatly affect pupils’ Mathematics performance with three quarters of them of them rating the effect as great, while the rest rated it as very great.

5.2.4 Influence of Learner Characteristics

The overall Mathematics self-efficacy for the pupils on average was 2.6 out of 4 with a standard deviation of 0.82. On average, the overall Mathematics attitude was rated at a mean of 2.6 out of 4 with a standard deviation of 0.74. Most of the pupils scored 2 out 5 in the cognitive abilities test administered to the pupils. Negative correlations were found
between Mathematics performance and other learners’ characteristics including cognitive abilities \( (r = -0.089; p = 0.632) \), and Mathematics attitude \( (r = 0.111; p = 0.551) \). However, there was a weak positive correlation of 0.017 between Mathematics performance and Mathematics self-efficacy.

### 5.2.5 Influence of Availability of Teaching and Learning Resources

On average, availability of the teaching and learning resources for learners with dyscalculia was rated at a mean of 2.3. The resources affirmed as enough were real object resources \( \text{mean}= 3.5 \) and visual resources \( \text{mean}= 3.0 \). Most of the teachers asserted that adequacy or inadequacy of teaching and learning resources affected the pupils’ Mathematics performance to a great extent.

### 5.3 Conclusion

This research concludes that in most public schools in Starehe sub-county, screening pupils for dyscalculia is rarely done. As a result, most of the teachers who teach Mathematics have a misinformed perception that there are only few cases of pupils with dyscalculia. This is further complicated by low level of skills and knowledge on MLD among the teachers. However, pupils with dyscalculia still perform quite well in their Mathematics tests although their performance is relatively lower than that of pupils without dyscalculia.

The study also concludes that although majority of the Mathematics teachers in public schools in the sub-county have a vast teaching experience, few have acquired formal training in special needs education. Consequently, they lack sufficient skills and
knowledge on MLD and how to handle pupils with MLD. The teachers have a heavy teachers’ workload in terms of large class sizes and many lessons per week. Nevertheless, they still have a strong positive attitude towards their job. Overall, teachers’ factors greatly affect pupils’ Mathematics performance in public primary schools. In particular, the study concludes that among the different teachers’ factors, teachers’ attitude exerts the greatest effect, followed teachers workload and teaching experience. Teachers’ academic qualifications also affects the pupils Mathematics performance but to a lesser extent compared to teachers’ attitude, teachers’ workload and teaching experience.

This research further concludes that the teaching method adopted by a Mathematics teacher may greatly affect pupils’ Mathematics performance. Most of the teachers in public primary schools largely adopt cooperative learning method, peer tutoring and or direct instruction teaching methods since they believe they are more effective even in the case of pupils with dyscalculia. This may be true since majority of the pupils who had dyscalculia and those who did not have dyscalculia in the studied schools were able to perform above average in Mathematics.

Moreover, it is inferred that majority of the pupils have high Mathematics self-efficacy and a strong positive Mathematics attitude. Nevertheless, they have low cognitive abilities. Even so, a weak negative relationship exists between Mathematics performance and pupils’ cognitive abilities but it is a statistically insignificant relationship. Similarly, Mathematics performance is negatively correlated with pupils’ Mathematics attitude although it is a statistically weak and insignificant correlation. On the contrary,
Mathematics performance is positively correlated with the pupils’ Mathematics self-efficacy but it is still a statistically weak and insignificant correlation.

Lastly, the research concludes that availability of teaching and learning resources greatly affects pupils’ Mathematics performance. Nonetheless, most public schools in Starehe sub-county do not have adequate teaching and learning resources for learners with dyscalculia. Apart from real object resources and visual resources, other important resources for learners with dyscalculia including assistive technology resources; audio-visual resources, and audio resources among others are scarce in the schools.

**5.4 Recommendations**

Taking into account the findings, this research proposes the following measures to be implemented:

The government through the Ministry of Education should consider organizing for on-job training for primary school teachers on Mathematics learning disabilities. In such trainings, Mathematic teachers should be sensitized of the importance of screening pupils for dyscalculia and trained on how to use different tools to screen the pupils. This may help to boost the skills and knowledge of Mathematics teachers in SNE and MLD in particular. Through them, individual schools may be able to liaise with the Ministry and the appropriate institutions concerned to ensure that the schools develop relevant teaching programs that adequately caters for the needs of pupils with dyscalculia to enhance their Mathematics performance.
The condition of the classrooms should be improved so that they can be more conducive for effective learning and teaching as well. This should entail improving their physical conditions in terms of thorough cleanliness and good hygiene, having sufficient good desks/chairs/lockers relative to the number of pupils, and having good platforms/stage to be used by teachers during the lessons.

Parents should cooperate with teachers and work together to enhance pupils’ cognitive skills. This should entail making sure that when children learn new tasks or gains new knowledge, they are engaged in rehearsals for the task both in school and at home to ensure that their memorizing and understanding of the task is enhanced. The teachers should also promote one on one exchange with the pupils to enable corrective feedback that may also help to enhance the pupils’ cognitive skills.

Allocation towards special needs education should have a special kitty that should particularly cater for provision of adequate teaching and learning resources for learners with dyscalculia. In particular, procurement of assistive technology resources; audio-visual resources, and audio resources in public primary schools should be considered to facilitate effective teaching and learning of Mathematics for pupils with dyscalculia. This could also greatly help to improve the pupils’ Mathematics performance.

5.5 Suggestions for Further Research

This study covered only public primary schools in Starehe Sub-County and may not accurately describe the situation in other schools. Similar studies should therefore be
conducted in public schools in other sub-counties to contrast the findings and check for consistency in results.

It is also important that similar studies be conducted focusing on private primary schools. This may yield further insight on dyscalculia among primary school learners and the determinants of Mathematics performance in learners with dyscalculia in private and public primary schools.

Since this study only covered upper primary pupils, there is need for further research to be conducted that should assess dyscalculia among lower primary pupils and interrogate the predictors of their Mathematics performance to enhance the conclusions derived in this study.

Studies should also be conducted to investigate school based challenges that affect pupils’ Mathematics performance among SNE learners focusing on different geographical contexts. This may help to provide deeper insights on issues that needs to be addressed in different schools to improve Mathematics performance of pupils with dyscalculia.
REFERENCES


Magoma, P. M., Waithaka, E., & Mwoma, T. (2018). Family class and parents’ level of education as determinants of pupils’ readiness to learn Mathematics in primary


APPENDICES

APPENDIX I: MATHEMATICS TEACHERS’ QUESTIONNAIRE

This questionnaire is meant to assist the researcher in gathering information on predictor of mathematics performance to learners with dyscalculia in class seven. Kindly answer each question honestly, appropriately and accurately as possible. All information given shall be treated with utmost confidentiality. Do not write your name in this questionnaire. Please answer all questions in all sections by ticking or filling the appropriate responses in the spaces provided.

PART I: Background Information

1. Name of school (Optional): ……………………………………………………………

2. Gender:   Male [ ]    Female [ ]

3. Please indicate your Age bracket:

   30 years and below [ ]  31-40 [ ]   41-50 [ ]   Over 50 years [ ]

Part 2

A) Teacher Factors

4. What is your highest level of education?

   Master’s degree [ ]   Bachelor’s degree [ ]   Diploma [ ]

   AT IV [ ]   P1 [ ]   Any other (specify)………………………………………………………………………

5. How long have you been teaching Mathematics?

   Less than 1 year [ ]   1 – 3 years [ ]

   3 – 7 years [ ]   7 – 10 years [ ]   Over 10 years [ ]

6. (a) Have you ever been trained in Special Needs Education?   Yes [ ]   No [ ].

   (b) If yes, what is the highest level of training did you attain?
Degree [ ] Diploma [ ] Certificate [ ] Month In-service [ ] Workshop & Seminars [ ]

7. How would you rate your skills in special needs education?
   Excellent [ ] Good [ ] Fair [ ] Poor [ ] Not skilled at all [ ]

8.a). Are there pupils in your class who have mathematics learning disabilities (dyscalculia)?
   Yes [ ] No [ ] I don’t know [ ]

   b). If yes, how many? .................

9. In your opinion, how can you rate your level of knowledge in Mathematics learning disabilities?
   Very high [ ] High [ ] Moderate [ ] Little [ ] None at All [ ]

10. To what extent do you agree with the following statements? (Tick appropriately)

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly agree</th>
<th>Agree</th>
<th>Neutral</th>
<th>Disagree</th>
<th>Strongly disagree</th>
</tr>
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<tbody>
<tr>
<td>Mathematics is my favorite subject</td>
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<tr>
<td>I enjoy teaching Mathematics</td>
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<tr>
<td>I always like to help someone who cannot understand Mathematics easily</td>
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<tr>
<td>I am happy that I was allocated to teach class seven Mathematics</td>
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<tr>
<td>I generally love my profession as a teacher</td>
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11. How many lessons do you have in a week? ____________________________

12. How many pupils are in class seven (where you teach Mathematics)? ________

13. From your experience, to what extent do the following factors influence Mathematics performance in this school?
<table>
<thead>
<tr>
<th>Factor</th>
<th>Very great extent</th>
<th>Great extent</th>
<th>Moderate extent</th>
<th>Little extent</th>
<th>No extent at all</th>
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<tbody>
<tr>
<td>Teaching experience</td>
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<td>Teacher’s academic qualifications</td>
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<td>Teacher’s attitude</td>
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<td>Teacher’s workload</td>
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B) Classroom Environment

14. To what extent do you agree with the following statements? **NB: 1= Strongly disagree, 2= Disagree, 3=Neutral, 4= Agree, and 5= Strongly agree**

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<th>3</th>
<th>4</th>
<th>5</th>
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<tr>
<td>The classrooms in this school are in good physical condition for learning</td>
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<tr>
<td>The classrooms have good desks/chairs and lockers for pupils to use</td>
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<tr>
<td>The classrooms have good platforms/stage for use by the teachers during the lessons</td>
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<tr>
<td>The classrooms are maintained in clean and good hygiene conditions</td>
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</table>

15. In your opinion, to what extent do you think the condition of the classrooms in this school affects the pupils’ performance?

- Very great extent [ ]
- Great extent [ ]
- Moderate extent [ ]
- Little extent [ ]
- No extent at all [ ]

D) Teaching Methods

16 a). Do you screen learners for Mathematics learning disabilities (dyscalculia) in your class?
Yes [ ]  No [ ]

b) If Yes, how often?

Annually [ ]  Twice a year [ ]  Every term [ ]  Any other (Specify) …………

17. Which teaching methods do you often use while teaching Mathematics in class seven? (NB: Tick all the applicable)

Cooperative learning ( )  Direct instruction ( )
Strategy instruction ( )  Peer tutoring ( )
Scalfolding ( )  Any other (Specify)_______________________

18. From your experience, which among the teaching methods is most effective in teaching Mathematics to learners with Mathematics learning disabilities? (Tick all the applicable)

Cooperative learning ( )  Direct instruction ( )  Strategy instruction ( )
Peer tutoring ( )  Scalfolding ( )  Any other (Specify)______________

19. From your experience, to what extent do you think teaching methods used affect pupils’ Mathematics performance your class?

Very great extent [ ]
Great extent [ ]
Moderate extent [ ]
Little extent [ ]
No extent at all [ ]

Teaching and Learning Resources

20. Kindly describe the adequacy of the following resources in your school. **NB: 1= Unavailable at all, 2= Few, 3= Enough, 4= Many, and 5= More than enough**
21. In your opinion, to what extent do you think the adequacy/inadequacy of the teaching and learning resources highlighted above affect pupils’ Mathematics performance your class?

- Very great extent [ ]
- Great extent [ ]
- Moderate extent [ ]
- Little extent [ ]
- No extent at all [ ]

D) Mathematics Performance

22. Please tick the average mean score bracket for Mathematics in the last end of term exams for class seven?

- Less than 20% [ ]
- 20 – 39% [ ]
- 40 – 49% [ ]
- 50 – 59% [ ]
- 60 – 69% [ ]
- 70% and above [ ]

23. What suggestions would you recommend to improve Mathematics performance of learners with Mathematics learning disability?

..........................................................................................................................
APENDIX II: HEAD TEACHERS’ INTERVIEW GUIDE

1) From your experience, how can you describe Mathematics performance for class seven in this school?

2) Do you assess mathematics learning disabilities among learners in this school? Please describe how you do the assessment.

3) Are you aware of any pupil in class seven in this school with mathematics learning disabilities (dyscalculia)?

4) Do you have adequate Mathematics teachers for class seven in this school? Please elaborate.

5) From your experience, do the class seven mathematic teachers in your school have adequate skills and experience to handle pupils with mathematics learning disabilities?

6) In your opinion, are the teaching methods used by class seven Mathematics teachers sufficient for learners with Mathematics learning disabilities? Please explain

7) Are there sufficient teaching/learning resources for learners with Mathematics learning disabilities in Class seven? Please elaborate

8) In your opinion, how does the curriculum influence Mathematics performance of learners with disabilities?

9) What suggestions can you give to improve Mathematic performance of learners with Mathematics learning disabilities?
APPENDIX III: PARENTAL CONSENT FORM

I declare that I have been briefed about the purpose of the study by the researcher and I understand all the requirements. In this regard, I consent to have my child engaged in the study.

Name: _____________________________

Sign __________________________________
APPENDIX IV: DYSCALCULIA SCREENING TOOL

This tool is adopted from the Wechsler Intelligence Scale for Children (WSIC III) that was developed by David Wechsler in 1949. It is administered to measure intelligence. It used for children aged 6-16 yrs.

1. Which one of these (point to the answer choices) weighs the same as this (point to the star on the left side of the question mark)?

2. Point to the weather vane.

3. How are morning and afternoon alike?

..............................................................................................................................................................................................................................................................................
4. Choose the figure in the answer row below that continues the pattern.

5. Recite the numbers below very clearly with exactly one number per second

   9 – 4 – 2 – 7 – 8 – 0 – 3
APPENDIX V: MATHEMATICS SELF EFFICACY TOOL

This tool is adopted from Mathematics Self Efficacy Scale (MSES) developed by Bandura (1997). It measures beliefs regarding the ability to perform various math related tasks and behaviours which affect the process of learning and later educational career choices.

How much do you disagree or agree with the following statements about how you feel when studying Mathematics? Tick (√) the correct response

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<tr>
<th>Statement</th>
<th>Strongly agree</th>
<th>agree</th>
<th>disagree</th>
<th>Strongly disagree</th>
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<tbody>
<tr>
<td>a) I often worry that it will be difficult for me in Mathematics classes.</td>
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<td>b) I’m confident that I can do an excellent job on my math tests.</td>
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<td>c) I get very tense when I have to do Mathematics assignment.</td>
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<td>d) I worry that I will get poor grades in Mathematics</td>
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<td>e) I am sure I can master the skills being taught in my math class.</td>
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<td>f) I get very nervous doing Mathematics problems.</td>
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<td>g) I have always believed that Mathematics is one of my best subjects.</td>
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APPENDIX VI: ASSESSMENT TOOL FOR LEARNERS’ ATTITUDE TOWARDS MATHEMATICS

This tool is adapted from Fennema-Sherman Mathematics Attitude Scales (FSMAS) (Mohamed & Waheed, 2011).

Indicate to what extent you agree with the following statements. (Item categories are "strongly agree", "agree", "disagree" and "strongly disagree"). Tick (√) the correct response.

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<thead>
<tr>
<th>Statement</th>
<th>Strongly agree</th>
<th>agree</th>
<th>disagree</th>
<th>Strongly disagree</th>
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<tbody>
<tr>
<td>a) Learning mathematics is enjoyable</td>
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<td>b) I can get good grades in mathematics</td>
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<tr>
<td>c) I know I can handle difficulties in mathematics</td>
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<tr>
<td>d) Maths puzzles are boring</td>
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<td>e) I would rather have someone give me the solution to a difficult math problem than to have to work it out for myself.</td>
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<td>f) My mind goes blank and I am unable to think clearly when doing mathematics.</td>
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APPENDIX VII: COGNITIVE ABILITIES ASSESSMENT TOOL

This tool is adapted from Woodcock – Johnson IV (WJ-IV) Test. First developed by Richard Woodcock and Mary E. Bonner Johnson in 1977. The latest version is referred as WJ IV (2014). It measures a set of intelligence test including cognitive abilities and is used for ages 2-90 years.

1. Jane, Jack and Jim sell wrapping paper to raise money for their school. Jane sold 20 rolls. Jack sold 30 rolls. Jim sold less than 6 more than Jane and 4 less than Jack. How many rolls did Jim sell?
   - [a] 26
   - [b] 27
   - [c] 25
   - [d] 30

2. Two families go bowling. While they are bowling, they order a pizza for sh 800, 6 sodas for sh 20 each, and 2 large buckets of popcorn for sh 80. If they are going to split the bill between the families, how much does each family owe?
   - [a] 500
   - [b] 450
   - [c] 510
   - [d] 400

3. Do you see these 4 boxes? In the top row the pictures go together in a certain way. Now look at the bottom row. Do you see the empty box? Which of the 4 pictures on the side goes with the picture in the bottom box the same way the 2 pictures in the top row go together?

   [a] First picture over the bubble
4. Point to the circle

[Image]

[a] Top left picture
[b] Top right picture
[c] Bottom left picture
[d] Bottom right picture

5. Look at the pictures in these boxes. The shapes in the top row go together in some way. Now look at the bottom row. Which shape do you think goes with the blue circle in the same way?
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## APPENDIX VIII: DOCUMENT ANALYSIS GUIDE

| Pupil No. | Score in dyscalculia screening test | Score in cognitive abilities assessment test | Score/Marks in Mathematics
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APPENDIX IX: MAP OF STAREHE SUB-COUNTY
APPENDIX X: AUTHORIZATION FROM NACOSTI

NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY AND INNOVATION

Ref: No. NACOSTI/P/19/91133/30347

Petronilla Wanjiru Kahenya
Kenyatta University
P.O. Box 43844-00100
NAIROBI.

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on “Predictors of performance in Mathematics among learners with Dyscalculia in Public primary schools in Nairobi City County, Kenya.” I am pleased to inform you that you have been authorized to undertake research in Nairobi County for the period ending 23rd May, 2020.

You are advised to report to the County Commissioner and the County Director of Education, Nairobi County before embarking on the research project.

Kindly note that, as an applicant who has been licensed under the Science, Technology and Innovation Act, 2013 to conduct research in Kenya, you shall deposit a copy of the final research report to the Commission within one year of completion. The soft copy of the same should be submitted through the Online Research Information System.

BONFACE WANYAMA
FOR: DIRECTOR-GENERAL/CEO

Copy to:
The County Commissioner
Nairobi County.

The County Director of Education
Nairobi County.

APPENDIX XI: PERMIT FROM NACOSTI

THIS IS TO CERTIFY THAT:
MS. PETRONILLA WANJIRU KAHENYA
OF KENYATTA UNIVERSITY, 2590-202
NAIROBI, has been permitted to conduct
research in Nairobi County
on the topic:

PREDICTORS OF
PERFORMANCE IN MATHEMATICS
AMONG LEARNERS WITH DYSCALCULIA
IN PUBLIC PRIMARY SCHOOLS IN
NAIROBI CITY COUNTY, KENYA
for the period ending:
23rd May, 2019

[Signature]
Director General
National Commission for Science, Technology & Innovation

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National Commission for Science, Technology and Innovation

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