

**EXPLORATION OF MATHEMATICS TEACHING STRATEGIES TO
LEARNERS WITH DYSCALCULIA IN PUBLIC DAY SECONDARY
SCHOOLS IN KERICHO COUNTY**

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E55/KER/CE/28040/2013

**A RESEARCH THESIS SUBMITTED IN FULFILLMENT OF THE
REQUIREMENTS FOR THE AWARD OF DEGREE OF MASTER
OF EDUCATION (SPECIAL NEEDS EDUCATION)**

**IN THE SCHOOL OF EDUCATION OF
KENYATTA UNIVERSITY**

JUNE, 2020

DECLARATION

I declare that this thesis is my original work and has not been presented in any other university /Institution of any certification. This research thesis has been completed by referenced source 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 reference cited using current APA system and in accordance with anti-plagiarism regulations.

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DEDICATION

I sincerely dedicate this project to my entire family and friends for their encouragement and support both financially and morally, God's love for you shall endure forever.

ACKNOWLEDGEMENTS

I humbly acknowledge God the father for granting me the gift of grace and ability to concentrate in my studies, for his divine wisdom that he gave me to carry on throughout this study. I am duly and deeply indebted to my supervisors Prof. G. Karugu and Prof. L. O. Odongo for their positive criticism and dedicating their time and attention to enable me come up with this splendid piece of work. I deeply acknowledge the management of Kericho County Commissioner Office and Kericho County Director of Education Office for participating in the study and finally Kenyatta University for their support and service they have contributed towards my studies in the institution.

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LIST OF ABBREVIATIONS AND ACRONYMS

BED	Bachelor of Education
CLD	Council for Learning Disability
DLD	Division for Learning Disability
EARCs	Educational Assessment Resource Centres
GOK	Government of Kenya
LD	Learning Disability
LDAA	Learning Disability Association of America

ABSTRACT

Mathematics all over the world plays a pivotal role in individual or learner's lives, it is a bridge to science, technology and other subjects offered in any formal educational system. Mathematics has long been recognized worldwide as important in the understanding of other subjects like chemistry, biology, and physics. Learning disability is a dynamic and expanding condition that is found across all ages. The purpose of this study was to investigate the mathematics teaching strategies used in teaching mathematics to learners with dyscalculia in Kericho County. Guided by Jean Piaget's theory, the study adopted a descriptive design which used mixed model research with both qualitative and quantitative approaches. The study was carried out in Kericho County. Semi-structured questionnaires were used to carry out the study. The pilot study was done in 35 randomly selected public day secondary schools in different localities within the County to effectively analyze the methodologies of teaching the subject in the region. Data from the research instruments, namely mathematics teachers' questionnaires and mathematics students' questionnaires was coded and analyzed using the Statistical Package for Social Sciences (SPSS v25) to obtain descriptive statistics. To ensure validity, face and content validity was conducted. Also, the Cronbach Coefficient Formula was applied to guarantee reliability. The results revealed that thirty eight percent (38%) of the mathematics teachers in Kericho County assessed students' records to identify dyscalculia problem. The findings also revealed that 19 out of 300 randomly sampled students, which represent 6.3% of the total sampled students, suffered from dyscalculia. Further, lack of experienced special needs teachers and poor cooperation from the relevant stakeholders such as parents, guardians, and other staff among others were major challenges that teachers faced when dealing with dyscalculic learners. Also, reviewing the previous lessons and maximizing the use of homework were some of the major interventions that helped in increasing dyscalculic learners' performance. Besides, some of the major teaching strategies include peer tutoring and ensuring presence of mathematics symbols and terms displayed in mathematics lessons. The study concluded that majority of the students who score less than 25% marks were struggling with mathematics and not dyscalculic. Also, majority of the teachers may have confused dyscalculic students with those who struggled. The researcher recommends that progressive records should be used to establish if the learners are dyscalculic or they are merely struggling with mathematics. The government should ensure a conducive environment to enhance performance of dyscalculic students. It should also ensure that schools have enough teachers with special needs skills.

CHAPTER ONE

INTRODUCTION AND BACKGROUND OF THE STUDY

1.1 Introduction

This chapter includes an overview of the background to the study, statement of the problem, the purpose of the study, objectives of the study and research questions. The chapter also discusses significance, limitation, and assumptions of the study. Finally, a conceptual framework model is presented.

1.2 Background to the Study

Mathematics study is recognized worldwide as the most important subject in most fields of human endeavors. Its usefulness in science, technology, commerce, economics, education and even humanities is almost at par with the importance of education as a whole (Tella, 2017), it is also key in the understanding of other subjects such as chemistry, biology, and physics. This implies that for one to function well in the society and in this era of the technological age, he/she must possess relatively good mathematics knowledge. There exists an impregnable link between mathematics and other science subjects (Kiplagat, Role, & Makewa, 2012). Learners' competency in numeracy and literacy in early grades affects their academic achievement more generally in later years and affects how they master other subjects (Wayne & Youngs, 2003). Mathematics in the world plays a pivotal role in student lives, it is a bridge to science, technology and other subjects offered in any formal educational system. For example, the teaching of the practical aspect of chemistry can hardly be achieved without the knowledge of mathematics.

Dyscalculia is a condition that causes increased complexities for affected learners to grasp basic mathematical concepts. Dyscalculic learners may have difficulty understanding simple number concepts, lack an intuitive grasp of numbers and have problems learning number facts and procedures. Even if they produce a correct answer or use a correct method, they may do so mechanically and without confidence. Dyscalculia and dyslexia can occur independently of each other or together. The strategies for dealing with dyscalculia will be fundamentally the same irrespective of whether or not the learner is also dyslexic (Landerl & Butterworth, 2004). There are a number of factors which can affect the learning of mathematics (Meltzer, 2002). These may occur in isolation or may interact to create a potential learning difficulty. With appropriate help, most of the difficulties associated with these factors can be alleviated or circumvented.

In Kericho County, students affected with dyscalculia and dyslexia are drawn from disparate socio-economic backgrounds. The students were identified based on their individual performance in the subject of mathematics as well as the input of teachers regarding their overall subject performance. In this case, continuous assessment tests play a pivotal role in identifying a student's aptitude towards solving mathematical problems. Sustained and severely low performance on mathematics tests by some students in the County points to the prevalence of learning difficulties.

One of the sources of mathematics difficulty may be as a result of teaching strategy applied to each learner. According to Onwumere (2009), every learner is unique and learns in a particular approach. Onwumere stated that any teaching which does not take into account learners limiting factors rarely succeeds. The researcher further noted that

teachers who realize the learning needs of their pupils are more empowered to provide the kinds of instructions their learners need. Identifying the root cause of a pupil's struggle to learn, provides a starting point for understanding why a particular strategy is efficient for the learner (Onwumere, 2009). Mathematics difficulty might be as a result of developmental dyscalculia which is a specific learning disability affecting the usual acquisition of mathematics skills (Shalev, 2004).

According to Butterworth, Varma, and Laurillard (2011), developmental dyscalculia has an estimate of about 5% to 7% in United Kingdom (UK). The UK government concluded that developmental dyscalculia is presently given low priority compared to developmental dyslexia. Butterworth, Varma, and Laurillard (2011) insist that at the moment, dyscalculia is not broadly known by teachers, educational authorities and research funding agencies. The researchers acknowledge that recognition would likely be the beginning for enhanced prospects for learners with dyscalculia. This calls for an urgent societal need to remediate failing learners in order to accomplish a level of numeracy at which they can function adequately in the modern work place (Butterworth, Varma, and Laurillard, 2011).

According to Martin (2000), learners who do not get their educational needs met in mathematics, not only fail to perform well academically but also fail to trust their own mathematical sense. Prevatt, Welles, Li, & Proctor (2010) posit that when these students are faced with any element of mathematics, significant anxiety in their performance and behaviour is noted. In most African nations, very little is known about dyscalculia. Learners with dyscalculia are quite often referred to as low achievers, slow learners or

lazy by teachers and parents (Nyaga, 2012). The teachers normally ignore them and concentrate on those who do not experience such disabilities. Poor performance in mathematics has continued to be witnessed despite various government initiatives put in place. For instance, the Government of Kenya with the help of JICA introduced a project called SMASSE (Strengthening Mathematics and Science) in primary schools in 2006 (Mutambuki, 2014).

The aim of SMASSE was to improve teachers' competence by improving their pedagogical content knowledge and skills in order to attend to learners appropriately, hence improving their abilities in mathematics and science. Nevertheless, SMASSE programme could be appropriate in dealing with mathematical difficulties, but not in mathematical disabilities (Waititu & Orado, 2009).

Although the prevalence of reading problems on the one hand and mathematics learning problems on the other hand seems to be equal (Kenney, Hancewicz, Heuer, Metsisto & Tuttle, 2005), this is not reflected in the amount of research focusing on each field (Saxe, 2015). Far more research is carried out in the field of reading, while the field of mathematics remains underdeveloped. The present study tackles this shortcoming by focusing on mathematics learning difficulties (dyscalculia). Moreover, taking into account research indicating that especially early interventions are effective, we focus on mathematics learning difficulties in secondary education.

The aim of the current study is two-fold. First, on the basis of teachers' pedagogical content knowledge, an effort is made to develop an overview of mathematics learning difficulties in secondary education. Second, an attempt is made to analyze the

implementation of a specific available teaching strategies which are used to assist students with learning difficulties.

1.3 Statement of the Problem

Mathematics performance in Kericho County has been on the decline in the last five years. That is between 2013 to 2017. Data from the six subcounties indicate that the highest mean was 3.36 while the lowest mean was 2.77. This means majority students failed to qualify to proceed for further education to pursue mathematics and science oriented courses such as medicine, engineering and technological courses. This becomes a problem to the society in that a good percentage of the population may become unemployed and dependent. In an ideal situation students should proceed to TVET or Universities to study and become either employed or self employed. Poor performance in mathematics could be associated with many problems including having many students with dyscalculia. Research findings from this study may be used to help improve mathematics performance since appropriate strategies will be recommended. Further challenges faced by tutors would be addressed leading to better performance. The government too may use findings to make appropriate policies for purposes of intervention.

1.4 Purpose of the Study

The purpose of this study was to explore the mathematics teaching strategies used in teaching mathematics to learners with dyscalculia in Kericho County.

1.5 Objectives of the Study

This study was guided by the following objectives:

- i. Probing the methodologies used by teachers in teaching mathematics to learners with dyscalculia conditions in in public day secondary schools in Kericho County.
- ii. Investigating the teachers opinions on existing dyscalculia conditions and identification procedures they used in public day secondary schools in Kericho County.
- iii. To find out the teachers' opinions on the possibility of dyscalculia and its prevalence in in public day secondary schools in Kericho County.
- iv. To Identify the problems encountered by teachers while tutoring mathematics to learners with dyscalculia in public day secondary schools in Kericho County.
- v. To ascertain the intervention measures which could be used to improve the process of teaching of mathematics to learners with dyscalculia in public day secondary schools in Kericho County.

1.6 Research Questions

The study was guided by the following research questions

- i) Which methodologies do teachers apply in teaching mathematics to learners with dyscalculia conditions in in public day secondary schools in Kericho County?
- ii) What are the teachers opinions on existing dyscalculia conditions and identification procedures they used in public day secondary schools in Kericho County?

- iii) What are the teachers' opinions on the possibility of dyscalculia and its prevalence in Kericho in public day secondary schools in County?
- iv) What are the problems encountered by teachers while tutoring mathematics to learners with dyscalculia in public day secondary schools in in public day secondary schools in Kericho County?
- v) What are the possible intervention measures and teaching strategies that can be undertaken to improve the teaching of mathematics to learners with dyscalculia in in public day secondary schools in Kericho County?

1.7 Significance of the Study

The results availed as a consequence of conducting this study may prove beneficial in propagating the efficacy of teaching mathematics to dyscalculic learners, not only in the focus region but also elsewhere in the country. Furthermore, the results availed may play a pivotal role in creating and raising awareness about the existence of dyscalculia as a major factor impeding the efficiency of tutoring students. Moreover, the study may prompt stakeholders to reassess the strategies used to teach mathemimatics to learners with disabilities. In so doing, the results may prove critical in facilitating the formulation of holistic and all-inclusive methods of identifying, classifying, and addressing students with learning disabilities.

The results may also be beneficial in terms of eradicating the stigma associated with poor performance in mathematical courses. Hence, this study may become one of the essential pillars on which appropriate corrective and restorative measures could be implemented in lower secondary classes as well as during the formative and progressive stages of

students in primary schools. This may, in turn, alleviate the high levels of mathematical illiteracy in the focus county and the country at large. Also, the results may assist other scholars in related disciplines to carry out their own studies.

1.8 Limitations and Delimitations of the Study

1.8.1 Limitations of the Study

The participants of this study were mathematics teachers and students from public day secondary schools in Kericho County. The findings cannot therefore be generalized to other schools.

1.8.2 Delimitations of the Study

The scope of this study was to investigate and analyze the strategies used in teaching mathematics with learners with dyscalculia in Kericho County. The sample of the study comprised day scholars' students in public schools in Kericho and not a cross section of all the students in all the all schools; this limited the generalization of the findings to all schools. The study was not concerned with mathematic's learning in other learning institutions or outside secondary schools in the County.

1.9 Assumptions of the Study

The study assumed that the respondents provided accurate and honest responses to the questions in the questionnaires.

1.10 Theoretical and Conceptual framework

1.10.1 Theoretical framework

This study was guided by the Jean Piaget theory of cognitive development, which enhances an understanding of learning dyscalculia (Shalev, 2003). According to this theory, the maturation of cognitive skills, or thinking, follows a sequential progression. An individual child's ability to learn depends on his/her current nutritional status. Any attempts to speed up or bypass the developmental process may create problems (Charlesworth, 2017). Cognitive development refers to the changes that occur in an individual's cognitive structures, abilities, and processes.

According to Driscoll (2013), cognitive development is the transformation of the child's undifferentiated, unspecialized cognitive abilities into the adult's conceptual competence and problem-solving skill. However, what exactly changes with development? Piaget believed children's schemes, or logical mental structures, change with age and are initially action-based (sensorimotor) and later move to a mental (operational) level. Further, Piaget believed the cognitive performance in children is directly associated with the cognitive development stage they are in. Each individual has a pre-set rate of growth for various human functions including cognitive abilities. Discrepancies among the various abilities indicate that the abilities are maturing at different rates with some abilities lagging in their development. Most children with learning dyscalculia experience developmental delay and/or may fail to reach the higher stages and therefore do not accomplish relevant activities at the right time.

1.10.2 Conceptual Framework

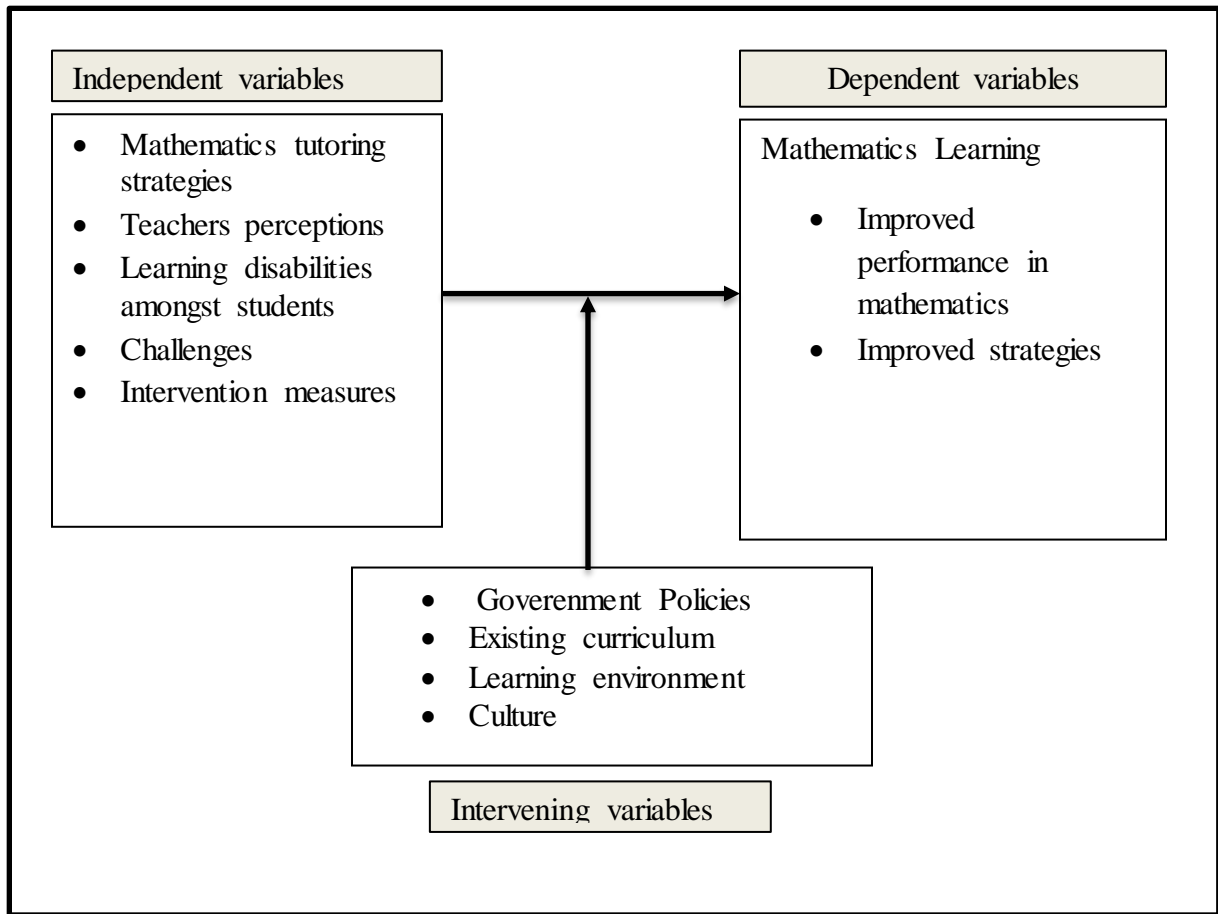


Figure 1.1: Conceptual Framework

Adapted from (Kakai, 2012)

Figure 1.1 shows the analysis of mathematics teaching strategies to students with Dyscalculia. The mathematics teachers, who are the main curriculum implementers, use particular teaching strategies in the teaching and learning process. The students on the other hand, interact with their teachers and peers during the mathematics lessons. The instructional resources facilitate the teaching of certain mathematical concepts. All these variables are conceptually linked to learning process of mathematics in secondary schools. Thus, if appropriate teaching strategies are used in the teaching and learning

process of mathematics, proper foundation for learning of mathematics in secondary school could be realized hence adequate learning of mathematics. It is in this view that the study sought to analyze mathematics teaching strategies used in learning of mathematics for learners with dyscalculia in public day secondary schools of Kericho County.

1.11 Operational Definition of Terms

Dyscalculia: A mathematical learning disability which causes mild to severe problems in understanding, expressing, and computing mathematical concepts.

Teaching Strategy: A method employed by tutors to impart the desired instructional contents to learners in a holistic and effective manner.

Achievement: Reach or attain a certain level, especially by effort. Accomplishment. Specifically, it's the level of academic performance in a given examination.

Performance: Accomplishment in a particular subject area of a course, usually by reasons of skill, hard work or interest and attitudes.

Good performance: Implies successfully attaining a certain cut-off marks in examination of a subject.

Poor performance: Means attaining marks deemed to be far below a designed cut-off mark.

Learning: Gain skill. Relatively persistent change in an individual's potential behavior due to experience. The experience a student gets when he/she is exposed to mathematics activity or any other activity aimed at causing a change in an individual's behavior.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.1 Introduction

This chapter reviews literature related to the study based on the objectives of this study, it includes an Overview of Status of LD in other countries; The Status of Learning Disabilities in Kenya; mathematics Learning Disabilities; The nature of Learning Disabilities; prevalence of Mathematics LD; challenges faced by teachers in teaching learners with mathematics LD; Measures for Educational Purposes Intervention Reviewed and finally Summary of the Literature. Literature reviewed is cited both from within Kenya and from studies done outside Kenya.

2.2 Status of Learning Disabilities

Despite the continued expansion of Educational Assessment and Resource Centres (EARCS) to all Counties in Kenya since inception in September 1984, these centres are faced with a number of challenges. Most of the screening tools and equipment used in the EARCS are for children with Visual impairment, hearing impairment, mental handicap and Physical disabilities, which are inadequate, and need revision, updating and validation. There are no diagnostic tools for assessing specific cases such as learning difficulties, giftedness, talentedness and behavioral difficulties. Hence, most learners with special needs education end up being mislabeled and given wrong placement (Republic of Kenya, 2005). A study of Cost and Financing of Special Education in Kenya sponsored by the Ministry of Education and World bank (World Bank, 2004) found out that only 0.5 per cent of the estimated 2.3 million children with special needs aged 0 to

19 years were receiving special education services in primary, secondary, integrated schools and special units. However, programmes for children with dyscalculia did not exist in both primary and secondary schools. Hence there is a need for a study to investigate the methodologies of tutoring such learners. A number of factors account for this underdeveloped state of the country's special needs education. Prior to the formulation and effectuation of the policy framework for special needs education in 2010, there was no policy or legal framework to guide special needs education in Kenya despite the various policy guidelines given by the various commissions and task forces (Kochung, 2011).

To close the legal framework gap, the Persons with Disabilities Act 2003 was introduced, however, it does not mention anything about assessment of special needs children. Other challenges facing the government in providing special needs education include identifying and rehabilitating all those with special needs, increasing budgetary support for special education, training more teachers, providing more resources and initiating integration programmes for children with learning needs in regular schools (Elimu Yetu Coalition, 2003). As a result of the challenges facing special needs education, a lot remains to be done if children with all forms of special needs are to be catered for. Teachers still need practical skills to assess and manage dyscalculia.

It is in this light that Elsa Abreau, the Headmistress of Kestrel Manor School for dyscalculia, says the resources needed are not available and at the end of it all, the job of assisting these children translates into a calling, "Unfortunately, training of teachers in special needs education is more theoretical than practical and we are having situations

where some of the teachers with special education training don't know what to do when they are finally sent out." Rasugu (2010) refers to dyscalculia as a complex emerging area probably because not much research has been undertaken in the area and recommends that the Kenya Institute of Curriculum Development (K.I.C.D.) develops guidelines for teachers to assist children with specific learning disabilities in regular classrooms, and the Kenya National Examinations Council (KNEC) take cognizance of these children and plan examination papers and schedules with these children in mind (Kenya Institute of Education, 2002).

As already noted, there are no special programmes specifically for dyscalculia like in other established special needs areas save for a few units now coming up within regular schools. Therefore, within the larger framework, dyscalculia continues to be neglected, except for some sporadic work by a handful of concerned individuals. The exact number of LD cases in Kenya is not known. However, Fletcher, Coulter, Reschly, and Vaughn (2004) estimates the figure to be between 30 per cent and 40 per cent of schools going population. Without reliable data, there is no meaningful planning that can be done to cater for the affected children. Children with learning disabilities need to be identified in order to make adequate provisions for them. Having looked at the literature, this study will address the following; establishing the presence of dyscalculia, the nature and prevalence of dyscalculia, intervention measures in place and lessons to learn from developed countries.

According to Van Steenbrugge, Valcke, & Desoete (2010) two types of learning problems can be distinguished: a learning disability is situated in the child's own

cognitive development, whereas the cause of a learning difficulty is situated outside the child or in another problem in the child. In this study, we focus on mathematics learning difficulties. Or as post “Individuals who exhibit learning difficulties may not be intellectually impaired; rather, their learning problems may be the result of an inadequate design of instruction in curricular materials”.

In the literature, no concrete numbers are reported about the prevalence of mathematics learning difficulties. In contrast, the prevalence of mathematics learning disabilities is estimated at approximately five to eight percent (Karagiannakis, Baccaglini-Frank, & Papadatos, 2014). Compared to the large number of studies focusing on student with learning disabilities, little systematic evidence-based approaches are available about learners with learning difficulties. The present study is presented as a concrete starting point to develop such a line of research.

Although research stresses that the diagnosis of a learning disability can only be drawn from a global assessment of the child including learning and the school context (Dyson, 2003), the diagnosis is principally based on a (combined) use of diagnostic tools Van Steenbrugge et al. (2010) while neglecting the knowledge and the experiences of the mathematics teacher. Therefore, in the present study, an effort is made especially on the teachers’ knowledge of and experiences with mathematics learning difficulties.

2.3 Learning Disabilities and Dyscalculia

Learning disabilities (LD) refer to a set of central nervous system disorders that affect an extensive range of academic and functional skills (Beauchemin, Hutchins, & Patterson, 2009). According to Tuchura (2016), LD is a neurologically based disorder in which the

nerve-cell connections fail to function properly. The learning disabilities occur due to the intended information not reaching a specific target in the brain. The condition leads to unanticipated under-achievement in learners whose intelligence is average or above average. Learning disability is one of the least understood and most disputed disabling condition that affects children. Kavale and Forness (2012), record that the field continues to be beset by persistent, and occasionally contentious disagreement about the definition of the disorder, diagnostic criteria practices, treatment procedures and education policies.

According to Sleeter (2010), America has made achievements in the field of learning disabilities (LD) in four major areas. First, more children are currently being served in LD programs than in any other area of special education. Secondly, labelling LD students as culturally deprived was dropped and thirdly, pressure for learners to achieve in specific tests was elevated. Finally, the degree of inclusion of LD students across all social stratification was increased significantly (Sleeter, 2010). Chow and Priebe (2013) observe that institutions for people with learning disabilities existed in the Netherlands at the end of the 19th century with large institutions being built after the 2nd World War. All people with learning disabilities get some care from care providers in institutions, in the community or in special schools where they have their daily care and activity in day care centers for children/adults.

The government and professional groups embrace four concepts in the process of care provision: the concept of Tailor-Made Care, the Quality of Care Act, the personal contract and the individual care plan along with the coordinating role of the case manager. Whereas Sweden has provided for pupils with dyscalculia since 1866 when the

first special school was established for pupils with dyscalculia, the law for people with dyscalculia came into force in 1944, which provided for children and young people with mild dyscalculia. Another law followed it in 1954. With the inception of the Act concerning support and service for persons with certain fundamental impairment (Disability act) in 1994, local authorities have taken over responsibility for support and provision of services for persons with dyscalculia (Chow & Priebe, 2013). However, it is significant to point out that what happens in developed countries is in sharp contrast to the situation obtaining in developing countries where learning disabilities is an emerging new area.

2.4 Strategies Employed by Teachers to Teach Mathematics in Kericho

In Kenya, mathematics is one of the three mandatory subjects that must be studied by all students regardless of their race, religion, or place of origin. The other subjects are English, and Swahili. The elevated level given to the subject of mathematics highlights its criticality in effectuating the successful completion of the secondary school curriculum, which is followed by all secondary schools in Kenya implementing the 8-4-4 system. The procedures of teaching mathematics in Kericho are as follows;

2.4.1 Lectures

This is by far the most prevalent methodology of teaching mathematics in the county. Lectures encapsulates the tutor issuing verbal instructions to teach and explain basic concepts of different units. Teachers conventionally use this strategy to explain matrices, algebra, trigonometry among others. Although this method is quite useful, it is severely limited to basic concepts.

2.4.2 Inductive Strategy

This method follows scientific principles whereby teachers may opt to teach mathematical concepts moving from the known to the unknown. Also, teachers can use examples which turn to formulae and rules. In this method, students must be very observant to comprehend the step-by-step approach. While this method is excellent in simplifying advanced mathematical concepts, it may not be suitable to serve the learning interests of all students, primarily because all students do not perform at the same level.

2.4.3 Deductive Strategy

In this methodology, teachers may choose to begin with general and then proceed to specific mathematical concepts. Similarly, teachers can start by teaching rules and then examples. Most teachers in the county, and indeed the country, seem to favor this approach because its applicability to all students is perceivably higher than that of other methods. Nevertheless, the usability of this method is still reduced if one or more students suffers from dyscalculia.

2.4.4 Analytical Strategy

Also called descriptive methodology, teachers simplify mathematical problems by breaking them up into small, manageable sections and then proceed to compute the solution. This method is effective in helping students to comprehend the relationship between different mathematical operators as well as the order in which they should be applied.

2.4.5 Solving Problems Strategy

This method is designed to spur the development of the student's reasoning abilities. This method is widely employed in the county. Despite its overall usefulness, it fails to account for the fact that a student's propensity to reason out difficult or less obvious problems is not the same. This is further worsened by the fact that lack of effective classification often mixes learners with learning disabilities together with those without.

2.5 Prevalence of Mathematics Learning Disabilities

In most cases, the classroom teacher is usually the first to notice signs of learning disabilities and refers students for special education assessment. In addition, the teachers assist in gathering assessment information and in the coordination of special services. Students may be identified as learning disabled at any age, but most are noticed during the elementary years (Charlesworth, 2017). There are two major indicators of learning disabilities. First, students appear capable but experience extreme difficulty in some areas of learning. This is a discrepancy between *expected* achievement and *actual* achievement. For example, a young child may be verbal, appear bright, but be very slow to learn to say the alphabet, write his or her name, and count to 20. The second indicator is variation in performance; there is a discrepancy among different areas of achievement. A class four child may perform well in math but read and spell poorly. In addition to these two main indicators of learning disabilities, teachers should watch for several other signs.

According to Narh (2017), outstanding examples cited are: Severe difficulties in reading, writing, spelling and arithmetic, distinguishing left from right, up and down, front and back, perceptual and language weaknesses, some clumsiness in hand and eye tasks;

Visio-spatial difficulties in recognizing and distinguishing written symbols; difficulties in reproducing letters or groups of letters correctly; confusing or reversing letters; speech-sound difficulties in synthesizing words from their component sounds and complexities in relating words to meanings. Most of these children show a history of late or slow speech development; often with continuing minor articulatory defects and hesitancy in verbal expression; Association difficulties such as in associating speech sounds with their symbols in reading and writing; Difficulty in spatial orientation—they bump into things, and cannot estimate distances.

Moreover, California Association for Neurologically Handicapped Children, an affiliate of the National Association for Children and Adults with Learning Disabilities, cited other signs seen in children with dyscalculia as: a) Guessing constantly when reading; b) Trouble understanding or following instructions; c) Difficulties expressing thoughts; d) Trouble understanding time and distance; e) Short attention span: easy distractibility (Hannel, 2013).

The disability manifests itself in each age group (preschoolers, elementary children, adolescents and adults) with different intervention and teaching strategies being required for each age group. Substantial numbers of children with dyscalculia are identified in the age range of 9 through 14. Most children are not identified until age 9 when dyscalculia becomes apparent as they enter school and fail to acquire academic skills in areas like reading, mathematics, writing and other school subjects (US Education Department, 1998).

Zumeta, Zirkel, and Danielson (2014) emphasized the importance of developing checklists and testing measures by schools to help teachers identify students with disabilities. The researchers developed a Pupil Rating Scale as a screening tool for dyscalculia, which has since become a research instrument included in an extensive investigation of the incidence and nature of dyscalculia in public schools in the United States of America. Besides identifying signs of dyscalculia, it is important to know the root causes of learning disabilities among children for effective intervention measures.

2.6 Challenges Faced by Teachers in Teaching Learners with Dyscalculia

Ajzen and Fishbein (2005) define attitude as a positive or negative emotional relationship with predisposition towards an object, institution or person. This points to another definition, by Mehdipour and Balaramulu (2013) who defines attitude as enduring non-verbal features of the social and physical world, and they are acquired through experience and exert a directive influence on behavior. These two definitions reveal that an attitude can be understood as an emotion that has an influence on the behavior of human being. The Attitude may be expressed verbally for instance “I like mathematics”. Sometimes, it is expressed in varieties of actions like refusing to do homework or not participating in class during lessons.

Dyscalculic students’ attitudes towards mathematics and their teachers determine results. If the attitude is negative, students with mathematics learning disabilities are likely to perform poorly and vice versa. Students with mathematics learning disabilities need to develop a positive attitude towards each other, mathematics as a subject and their

teachers in order to enhance the development of a strong foundation for learning of mathematics (Mata, Monteiro, & Peixoto, 2012).

Montague and Jitendra (2006) pointed out that some students with mathematics learning disabilities are blamed for having negative attitude towards mathematics yet most of them are not motivated to change that attitude. Students with mathematics learning disabilities would therefore have some measures of success in mathematics lessons if they are motivated to develop positive attitude towards it. Soares, Evans, & Patel (2018), argued that students with mathematics learning disabilities develop negative attitudes towards mathematics as they move from lower classes to upper classes. He notes that pupils' attitudes towards mathematics are usually positive in early years of primary schooling but these decreases as they progress to upper classes. This view is supported by Taiwo (1972) who suggests that students attitudes towards mathematics decreases as they climb higher because most of them have a general belief that mathematics is a very difficult subject that can only be understood by bright and hardworking students with mathematics learning disabilities.

Kopcha (2012) also observed that what students with mathematics learning disabilities learn and how they learn is very closely tied to their attitude about the school and the subjects that are taught. Hale et al. (2010) also pointed out that the image of mathematics has been that of adult subject such that it becomes very easy for a child to be discouraged right from the start. This implies that if s/he misses the first essential steps, s/he will have great difficulties in catching up, even if this interest is awakened at a later stage. This clearly demonstrates that student's feelings and perception about mathematics is a major

factor affecting his or her attainment and realization of full potential. Once students with mathematics learning disabilities are motivated, they develop positive attitudes towards both the subject and the teachers and this will lead to the understanding of what they are taught from the lower levels in secondary schools.

Rukangu (2000) also supports this view by pointing out that poor performance in mathematics in national examinations could be due to the unproven belief that the subject is difficult. Although Watson, Taiwo and Rukangu seem to give a pointer that student's performance in mathematics changes with their attitude formation. However, these authors do not focus on mathematics learning in secondary which could be affected by attitude formation. This study was set out to investigate learners' attitude towards mathematics and their teachers in relation to adaptation to mathematics learners.

Dennis, Berch, & Mazzocco (2009) stated that it is the attitudes developed by the students with mathematics learning disabilities which are likely to stimulate or stop further study of mathematics. This shows that it is the attitudes that students with mathematics learning disabilities develop that are highly involved in the learning and retention of mathematical concepts. Psychologists and most educators are in agreement that attitudes play an important role in the learning process (Karagiannakis, Baccaglini-Frank, & Papadatos, 2014). Teachers and all those involved in the education of children, therefore have a responsibility of helping students with mathematics learning disabilities to develop a positive attitude towards mathematics. This study sought to find out teaching techniques that teachers can adopt in order to help develop positive attitudes towards mathematics. If students with mathematics learning disabilities attained attitudes of

appreciation of mathematics at different levels in secondary schools, they will enjoy the subject, get satisfaction in understanding it and feel rewarded when they attain mathematical competence. This study, therefore, sought to assess how the students with mathematics learning disabilities attitude towards mathematics and their teachers enhanced their adaptation to the teaching and learning of mathematics in secondary schools.

2.6.1 Mathematics Teachers' Attitudes towards Learners

Attitude focuses on the individual's prevailing tendency to respond favorably or unfavorably to an object, person or group of people, institutions or events. Mathematics teachers have the challenge of promoting practices in which teachers are encouraged to give up a degree of their control over mathematical activity. This allows students with mathematics learning disabilities to initiate their own techniques to solve problems and grapple with contradictions (Reston, 2000). Answering to mathematics reform some scholars Peressini, Borko, Romagnaro, Knuth, & Willis (2004) suggested that teachers have to engage students with mathematics learning disabilities in rich, meaningful tasks when teaching. This means students with mathematics learning disabilities' thinking whether shared orally or in writing, must be used by teachers to guide the classroom in exploration of important mathematical ideas.

However, there are other factors such as the decisions that teachers make, the methods they use, and the attitudes displayed, that are relevant to performance on mathematical tasks that influence the direction and outcome of student performance (Blazar, 2017). It is often believed that the attitude of a teacher could influence their actions in the classroom,

which becomes critical to student learning. In other words, a teacher's attitude regarding mathematics and students with mathematics learning disabilities is related to attitudes towards the teaching of mathematics, which in turn, has a powerful impact on mathematics learning (Domino, 2009). According to Jenkins, Williams, Moyer, George, & Foster (2016), there should be a shift to a problem solving approach that requires a deeper change that greatly depends on the teacher's beliefs. The researcher further asserted that the practice of teaching mathematics depends on the attitudes and practices that are mainly affected by beliefs, emotions, social context and content knowledge. The study focused on determining mathematics teachers' attitudes and practices with a focus on mathematics learning disabilities in secondary schools.

2.7 Intervention Measures for Educational Purposes

If learning disabilities are suspected, the teacher may refer students for special education assessment. Parents are notified of the reasons for referral and presented with an assessment plan prepared by the educational team. If consent is given for special education evaluation, the team begins to collect information about the student (Burrell, 2000). There are a number of intervention strategies for children with learning disabilities. However, it should be noted that there is no specific teaching method or technique, which can be used as a cure, thus teachers should apply a wide range of instructional materials and techniques (Eison, 2010). The following is an overview of the techniques that have been discussed by Narh (2017).

2.7.1 Special Services

When assessment is complete, the teacher, parent/guardian, local education authority (and the student, if possible), can plan the student's Individualized Educational Program (IEP). While the resource room is the most typical placement for learning disabled students, self-contained special classes are provided for those with comprehensive learning needs. Whereas some students with LD receive assistance in oral language development from speech-language clinicians' others receive counselling from the school counsellor, social worker or school psychologist.

2.7.2 Task Analysis

Task analysis involves breaking down a task into several components, which in turn are divided into sub-components. In teaching a task, which requires manual manipulation, a child observes how a model or master performer performs the task and tries to imitate (Grabe & Stoller, 2013).

2.7.3 Precision Teaching

This technique uses a chart on which the teacher records the progress in the child's behavior in relation to the desired or target behavior. The graph is called *The Class Behaviour Chart*. The child's daily progress on a given task is recorded and also the rate of performance.

2.7.4 Behavior Modification

This is an effective measure in remediating learning problems, eliminating undesirable behaviors and establishing desirable ones. In addition to these techniques that are to be

used in class, there are other interventions, which can be administered outside the school, which are outlined below:

2.7.5 Administration of Drugs

Hyperactive children are constantly in motion, restless and impulsive. Physicians tend to treat these characteristics by prescribing drugs to calm them. Though some caution has to be taken in the treatment of hyperactivity, drugs have nonetheless been found to produce substantial academic and behavior improvements.

2.7.6 Dietary Management

Another controversial approach used in the treatment of hyperactivity is the management of diet (Arnold, Lofthouse, & Hurt, 2012). Some chemicals found in food, including additives and food coloring, cause children to become hyperactive. However, Narh (2017) cast some doubt that diet management can reduce hyperactivity in the child.

2.8 Summary

The literature reviewed confirms that the definition of learning disabilities is debatable. Despite this, there is evidence from the literature that learning disabilities indeed exist among learners who appear capable but experience extreme difficulty in some areas of learning such as orientation, reading, writing, spelling, comprehension, and arithmetic. Owing to controversies surrounding the definition, there is no known cause of learning disabilities. However, the literature outlines a number of possible causes, which include: educational factors, environmental factors, psychological factors, and physiological factors. Limited research has been conducted in other countries with the consequence that teachers may not be aware of the manifestations or the prevalence of learning disabilities.

Most of the research that has been conducted in Kenya is mainly on reading difficulties. Considering that dyscalculia is regarded as a complex emerging area in the country, its nature and prevalence is hardly known. This study was an attempt to fill the apparent research gap in Kenya by conducting a research study in schools located in Kericho county with an attempt to evaluate the nature of dyscalculia, prevalence of mathematics LD, the challenges facing teachers in the area of study and lastly to give possible interventions and strategies that should be used to help in this problem. Literature has also shown that most common teaching strategies include task analyses, behavior modification, precision teaching, and dietary management. Challenges include teacher students ratio and challenges of both students and teachers.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter outlines the procedures and strategies that were used to collect and analyze data. It focuses on research design, variables, location of the study, target population, sampling techniques and sample size, description of research instruments, description of pilot study and an outline of methods and techniques that were used to collect, analyze and present data.

3.2 Research Design

This is a mixed method research that assumed descriptive survey. Descriptive survey is best suited to investigate if an association or relationship between the variables were strong enough that the researcher could conclude that independent variables affected dependent variable (Orodho, 2005). The design was considered appropriate for this study because it allowed the researcher to get information on strategies that may be used by teachers, for enhancing mathematics performance to learners with dyscalculia in day public secondary schools in Kericho County by finding out what is actually happening on the ground.

3.2.1 Variables

The independent variables include teachers perceptions, strategies challenges and intervention dependent variable in this study is mathematics learning.

3.3 Location of the Study

The study was carried out in public day secondary schools in Kericho County between the months of July and September in the year 2018. According to records from various subcounty education offices, students have consistently performed poorly in mathematics in KCSE for the last five years. That is between 2013 and 2017 calling for need to investigate whether dyscalculia could be a possible cause.

3.4 Target Population

Target population includes the individuals or group to which you wish to generalize your outcomes (Tuchura, 2012). The target population in this study comprised of all secondary school students in Kericho. However, the study specifically dealt with the accessible 117 public day secondary schools in Kericho County. In the accessible schools, there were two hundred and sixty-four (264) mathematics teachers and nine thousand six hundred and two (9,602) students, of whom five thousand five hundred and thirty-five (5,535) were boys and four thousand and sixty-seven (4067) were girls.

3.5 Sampling Techniques and Sample Size

3.5.1 Sampling Techniques

Stratified random sampling was used. In this kind of sampling a population is divided into subgroups called strata and a sample is selected from each stratum. In this case the strata were the subcounties. Schools were then picked in such a way that the subcounties were proportionally represented. Teachers were purposively selected from the sampled schools depending on whether they teach the selected class or not.

3.5.2 Sample Size

The sample size is determined by a prior calculation of the sample size required to meet specified confidence limits for the population values. According to Gorard (2001) a sampling fraction of between 10-20% of total population in descriptive research is acceptable. A total of thirty-five (35) secondary schools were selected from one hundred and seventeen (117) secondary schools in the County. Twenty-nine (29) mathematics teachers were selected for the study out of the 264 mathematics teachers in the county. This constituted approximately 11% of the total mathematics teachers' population. Similarly, three hundred (300) form three and four students, who had scored less than 25% marks in mathematics in the previous year, were selected from approximately two thousand six hundred and two (2,602) of the student population from the thirty five selected schools.

Table 3.1: Sampling Frame

Category	Population	Sample	Percentage
Schools	117	35	30%
Mathematic teachers	264	29	11%
Students	2602	300	11%

NB: Data from County Director, Ministry of Education Office Kericho County; November 2015

3.6 Research instruments

Data was collected using the following two instruments:

3.6.1 Mathematics Teachers' Questionnaire

Mathematics teachers' questionnaire was used to obtain data from mathematics teachers in secondary schools. The data were used to identify the symptoms that teachers thought were dyscalculic, challenges that they faced when dealing with students with learning disabilities. The questionnaire captured items about the background information of the respondents while the other sections captured other items as developed on the basis of the research questions. The questionnaire was administered to randomly selected mathematics teachers. Their responses enabled the researcher to find out what they would do to enhance dyscalculic students' learning of mathematics.

3.6.2 Mathematics Students' Questionnaire

MSQ was used to obtain data from mathematics students in secondary schools. The data were consequently used to identify attitudes formed by these students towards mathematics learning and also identified factors reinforcing such attitudes. This questionnaire was administered to the selected Form Three and Form Four students in the selected public day secondary schools. Upper secondary classes were selected to best capture the level of LD based on the degree of complexity associated with the mathematics taught to students in the levels. The questionnaire contained two major sub sections that included the general information about the student, school and students' feelings towards mathematics. A 5-point Likert Attitudes Scale ranging from "strongly agree" to "strongly disagree" was used to determine students' feelings (Likert, 1967). The Likert Scale contained two sub categories of items namely, items on mathematics as a subject and items on mathematics teachers and their teaching methods.

3.7 Pilot Study

This was done to determine the validity and reliability of the instruments. The instruments were piloted in five secondary school that were randomly selected. The five schools were selected to give the best possible representation of LD students and teaching procedures in the County. The pilot schools were not included in the main study. The researcher administered the questionnaires to the mathematics teachers and students of Form Three and Form Four in the selected schools. The pilot study helped to locate ambiguities, reveal flaws in the questions and inadequacies in the content. This in turn led to evaluation and improvement of the questionnaires. The pilot study also helped the researcher to develop the necessary experience in using the instruments before the main study. The pilot data collected was analyzed and the results used to modify the questionnaires.

3.7.1 Validity of the Study Instruments

Validity, according to Borg and Gall (1989) is the degree to which a test measures what it purports to measure. In this study, face validity and content validity of the instruments were considered. To improve the face validity of the instrument, the pilot study questionnaires were scrutinized to identify items that seem unclear or ambiguous to the respondents. Such items were reviewed and reworded, thereby improving the face validity of the instruments. According to Borg and Gall (1989), content validity of an instrument is improved through expert judgment. As such, the researcher sought for assistance from the supervisors and other university lecturers, who are peers in research, to ensure the validity of the instrument.

3.7.2 Reliability of the Study Instruments

The researcher determined reliability of coefficient of all instruments after piloting using the Cronbach Coefficient Formula because the data was majorly collected in a scale format. The formula is as shown below:

$$\alpha = \frac{n}{n-1} \left[\left(1 - \frac{\sum s^2}{\delta^2} \right) \right]$$

Where α = reliability coefficient, n = number of items in the tool, δ^2 = variance in the obtained test scores, $\sum s^2$ = sum of the variance of the single items. Further, α value of 0.7 and above indicates an acceptable level of reliable scale (Cooper & Schindler, 2008).

Five schools were selected for the pilot study to establish if the research tool had an acceptable level of reliability. To establish if the scale items were of the same pattern, a Cronbach's alpha was used to determine the internal consistency. The reliability analysis was done using SPSS v25 to compute the Cronbach's alpha. The value of Cronbach's alpha lies between 0 and 1 and is used to demonstrate the reliability of the items in the dichotomous or multi-chotomous scales and questionnaires. The alpha's values that are close to 1 indicate high levels of reliability. In fact, a value of 0.7 and above indicates an acceptable level of reliable scale (Cooper & Schindler, 2008). The item, *challenges faced by teachers*, had the highest reliability ($\alpha = 0.892$) while the item with the lowest acceptable reliability ($\alpha = 0.703$) was *learners' ways of improving mathematics performance*.

Table 3.2: Reliability test results

Item	Cronbach's Alpha
Learners ways of improving mathematics	0.703
Learners' views on how math teachers motivate/demotivate them	0.741
Dyscalculia signs	0.798
Challenges faced by teachers	0.892
Intervention measures	0.724
Strategies	0.839

3.8 Data Collection Procedures

After obtaining research permit from the University and the Ministry of Education, the researcher contacted the principals of the sampled schools to seek appointments with each of them. The researcher then visited the sampled schools first to familiarize with the school authority and explain the purpose of the study. Secondly, the researcher made the necessary arrangement for actual administration of the instruments and data collection. Repeated familiarization visits were done before the actual visit for data collection. During each visit the researcher talked and mixed freely with both teachers and students in the effort to try and minimize Hawthorne effect. The researcher then collected data by issuing the research instruments to mathematics teachers and Form Three and Form Four students. The two sets of questionnaires were administered when the teachers and students were relaxed enough to provide reliable information.

3.9 Data Analysis

Data collected was analyzed both qualitatively and quantitatively. Qualitative data was obtained from the open-ended items in both the students and teacher questionnaires. The

data were grouped into different categories/themes consistent with the research objectives and deduction and generalizations were made using patterns and trend of responses. Quantitative data was obtained from closed ended items in the student and teacher instruments. The data were entered on the spreadsheet and coded in the computer. SPSS v25 was used to analyze the data.

3.10 Logistical and Ethical Considerations

A research permit was sought from the National Commission of Science, Technology And Innovation (NACOSTI) to allow collection of data in Kericho County secondary schools. The researcher also sought authorization from the graduate school. Similarly, ethical approval was sought from the Ethics Review Committee. Thereafter, permission was sought from the Kericho County Education Officer. The researcher also sought permission from the respective school principals before talking to teachers, parents and students. Before the actual issuing of questionnaires, the consent of mathematics teachers and students was sought; the information collected was treated with confidentiality.

CHAPTER FOUR

DATA PRESENTATION, ANALYSIS AND DISCUSSION

4.1 Introduction

The chapter presents the study findings, interpretations and discussions as guided by the following study goals;

- i. Probing the Students' Issues in learning mathematics and the methodologies used by teachers in teaching mathematics in Kericho County.
- ii. Investigating the teachers opinions on existing dyscalculia conditions and identification procedures they used in public day secondary schools in Kericho County.
- iii. To find out the teachers' opinions on the possibility of dyscalculia and its prevalence in Kericho County.
- iv. To Identify the problems encountered by teachers while tutoring mathematics to learners with dyscalculia in public day secondary schools in Kericho County.
- v. To ascertain the intervention measures which could be used to improve the process of teaching of mathematics to learners with dyscalculia in public day secondary schools in Kericho County.

4.2 General and Demographic information

4.2.1 General information

The research experienced difficulties while travelling across the sampled schools. There were difficulties in accessing students who had scored less than 25% marks in the past

one year, the mathematics teachers in the selected school, however, offered great assistance. Questionnaires were distributed to the selected twenty-nine (29) mathematics teachers and three hundred (300) form three and four students. All the participants filled and submitted the filled questionnaires to the researcher.

4.2.2 Distribution of Students and Teachers by Gender

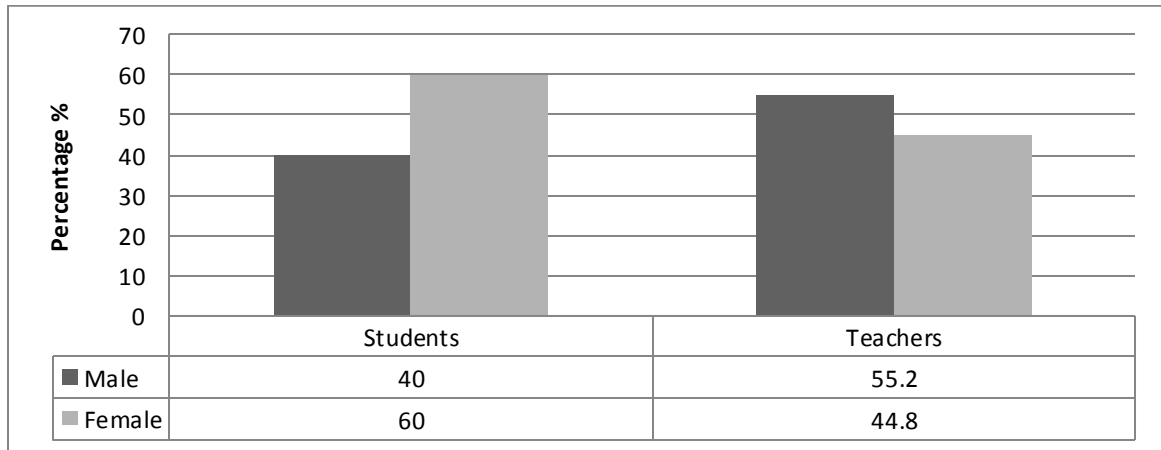


Figure 4.1: Gender representation among the students and teachers

As presented in figure 4.1, female students were more than their male counterparts. Their number was 180, which represented 60% of the 300 students that were sampled as shown in. It clearly indicates that there is a gender imbalance among the students in Kericho County. The findings give an opportunity for the government to make the necessary interventions to ensure that the number of male students is at par with that of their female counterparts. Majority (55%) of the mathematics teachers were male. The of the female mathematics teachers in Kericho County was almost at par with that of their male counterparts.

Table 4.1: Age of the teachers

Age Bracket	Frequency	Percent
36-50 years	13	44.8
21-35 years	9	31
51 years and above	5	17.2
20 years and below	2	6.9
Total	29	100

Table 4.1 shows that Only 2 teachers fell into the age bracket of 20 years and below, which represents approximately 7% of the sampled teachers. Teachers under the 21 – 35 years age bracket were approximately 31%. The majority (45%) were in the 36 – 50 years bracket, which shows that the majority of the teachers had some years of experience in teaching mathematics based issues in public day secondary schools in Kericho County. About 17% of the teachers had 51 years and above, which indicates a considerable working experience. It was also revealed that the teachers under the last category had less than 10 years before retiring from the Teachers Service Commission (TSC) employment. Additionally, they have great insight regarding the identification of various issues that students face when learning mathematics.

Table 4.2: Teachers qualification

Qualification	Frequency	Percent
B.Ed.	16	55.2
Diploma in Education	4	13.8
B.A or B.Sc. with PGDE	4	13.8
B.A or B.Sc.	3	10.3
Others (e.g. untrained or other professions)	2	6.9
Total	29	100

As shown in table 4.2, fifty five (55%) of the sampled teachers had attained Bachelor of Education (B.Ed.). This shows that the majority of mathematics teachers had the right

qualifications and were up to the task to teach the students competently. About 14% of the mathematics teachers had attained either Bachelor of Arts (B.A.) or Bachelor of Science (B.Sc.) and had pursued a Postgraduate Diploma in Education (PGDE). This also brings a different level of expertise to the education sector. About 10% of the mathematics teachers had either Bachelor of Arts (B.A.) or Bachelor of Science (B.Sc.) with no further training as teachers. Such teachers may be instrumental to students understanding of applied mathematics but they may not have the fundamental skills that teachers should have when assisting the poorly performing students. About 14% of the teachers had attained a diploma in education while there were about 7% of the teachers who were untrained or possessed other qualifications other than B.Ed, B.A or B.Sc. with PGDE, B.A or B.Sc, and a diploma in education. Such professional qualifications may include certificate holders in any other field other than education.

Table 4.3: Teaching experience

Teaching experience	Frequency	Percent
10 and above years	14	48.3
Between 6-9 years	8	27.6
Between 4-5 years	4	13.8
Between 1-3 years	3	10.3
Total	29	100

Table 4.3 shows that the minority of the teachers had a teaching experience of 1–3 years. This shows that the other teachers had over 3 years of teaching experience and thus they may have had enough time to familiarize themselves with teaching mathematics, especially to students with learning difficulties. Teachers with 4–5 years of experience comprised of approximately 14% while about 28% had a teaching experience of 6–9 years. Majority of the sampled teachers had over 10 years of teaching experience. The

teachers who fall into this category understand their work substantially well. Further, they are able to detect the students who experience difficulties in mathematics and apply the necessary intervention measures depending on the symptoms and signs of dyscalculia. Therefore, Kericho County has a number of experienced teachers who can deal with students with different challenges in learning mathematics.

Table 4.4: Classes attended by gender

Class	Male	Female	Total	Percent
Form 4	11	5	16	55.2
Form 3	5	8	13	44.8
Total	16	13	29	100

Table 4.4 shows that, male teachers mainly taught the Form 4 students while their female counterparts mainly taught the Form 3 students. About 55% of mathematics teachers taught Form 4 and 69% of these teachers were male. Additionally, 62% of the teachers who taught the Form 3 students were female. A gap therefore, exists regarding the number of male and female teachers who taught the Form 4 students.

4.3 Different Students' Issues in Learning Mathematics and the Methodologies Used by Teachers in Teaching Mathematics

The first objective of the study sought to probe the Students' Issues in learning mathematics and the methodologies used by teachers in teaching mathematics in Kericho County. The learners were questioned about the different ways which they used to improve their mathematics performance.

Table 4.5 shows that, although 41% of the students strongly agreed that they consulted their mathematics teachers for guidance, the mean scale for the first question was about 2,

which indicated that on average, the students agreed that making use of their teachers was useful regarding their mathematics improvement. Mueller, Yankelewitz, & Maher (2014) also asserts that there is a great benefit when learners utilize their mathematics teachers to the maximum.

Table 4.5: Learners ways of improving mathematics performance

Question	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree	Mean	Std. Dev.
I consult my teacher for guidance	124	123	19	28	6	1.9	1.01
I undertake mathematics experiments in class	64	62	72	44	58	2.9	1.41
I enjoy conducting mathematics experiments	47	73	0	120	60	3.24	1.42
I participate actively in your mathematics lessons by asking questions, answering, solving problems	61	64	59	71	45	2.9	1.37
I solve other mathematical sums apart from those given in class	98	130	1	42	29	2.2	1.31
I solve mathematics problems quicker when I discuss them with my peers	109	120	14	21	36	2.1	1.32
I participate actively in class	38	39	0	128	95	3.68	1.37
I enjoy doing exercises and homework	28	41	12	120	99	3.74	1.3
I do self-assessment frequently	32	39	15	116	98	3.7	1.33
I understand mathematics better when my teacher uses teaching aids	123	94	20	34	29	2.1	1.33
I try to ask myself questions about statements in the textbooks	109	14	10	18	15	1.9	1.04
I have a study timetable for mathematics	11	25	5	101	158	4.23	1.08
I consult peers regularly	64	112	6	63	55	2.78	1.46

Table 4.5 shows different reactions that were observed from the responses given during the administration of questionnaires. Apart from making use of their teachers ($M=1.9$, $SD=1.01$), there were other ways that seemed to work for students to improve their performance. About 43% of the students believed in solving other mathematical sums apart from those given in class ($M=2.25$, $SD=1.31$). Forty percent (40%) believed in utilizing group discussions with peers, which helped them to solve mathematical problems quicker ($M=2.18$, $SD=1.32$). Additionally, the literature shows that group work can improve mathematics performance tremendously (Freeman *et al.*, 2014). Also 41% of the sampled students, felt that the use of teaching aids during a mathematics class helped them to improve their mathematics performance ($M=2.17$, $SD=1.33$).

About 24% were undecided on whether they undertook mathematics experiments in class ($M=2.9$, $SD=1.41$). Others about 40% disagreed that they enjoyed conducting mathematics experiments ($M=3.24$, $SD=1.42$). The 24% were hesitant to state if they participated actively in the mathematics lessons by asking questions, answering, solving problems ($M=2.92$, $SD=1.37$). Finally, 37% agreed that they consulted their peers regularly ($M=2.78$, $SD=1.46$).

Table 4.6: Learning method that helps best in learning mathematics

Learning method	Frequency	Percent
Teacher lecturing to me (One on one)	120	40
Working in a group	115	38.3
Reading and solving problems alone	65	21.7
Total	300	100

Table 4.6 presents the results for the learning methods that helped students to learn mathematics in the best way. The learners were asked about the different learning methods that helped them best in learning mathematics. Forty (40%) said that they learned best when they engaged their mathematics teachers directly. About 38% responded that they learned mathematics best when they were engaged in group work. Only 22% of the learners had believed that they learned mathematics best by reading and working alone. However, such responses are contrary to the findings of Freeman *et al.* (2014) where working alone seemed not to be an effective learning method.

Table 4.7: Responses on whether learners are free to discuss during the mathematics class

Response	Frequency	Percent
Yes	158	52.7
No	142	47.3
Total	300	100

Table 4.7 shows students responses on their freedom to discuss mathematics during the mathematics class. Approximately 53% were free to discuss mathematics during the session. Smith *et al* (2009) and Sofroniou and Poutos (2016) explained that when learners are allowed to discuss during the mathematics class, they develop a problem-solving critical thinking while appreciating their colleagues' views on different matters. Learners are able to consolidate their thinking and thus create an effective communication that enables mathematical ideas to flow smoothly.

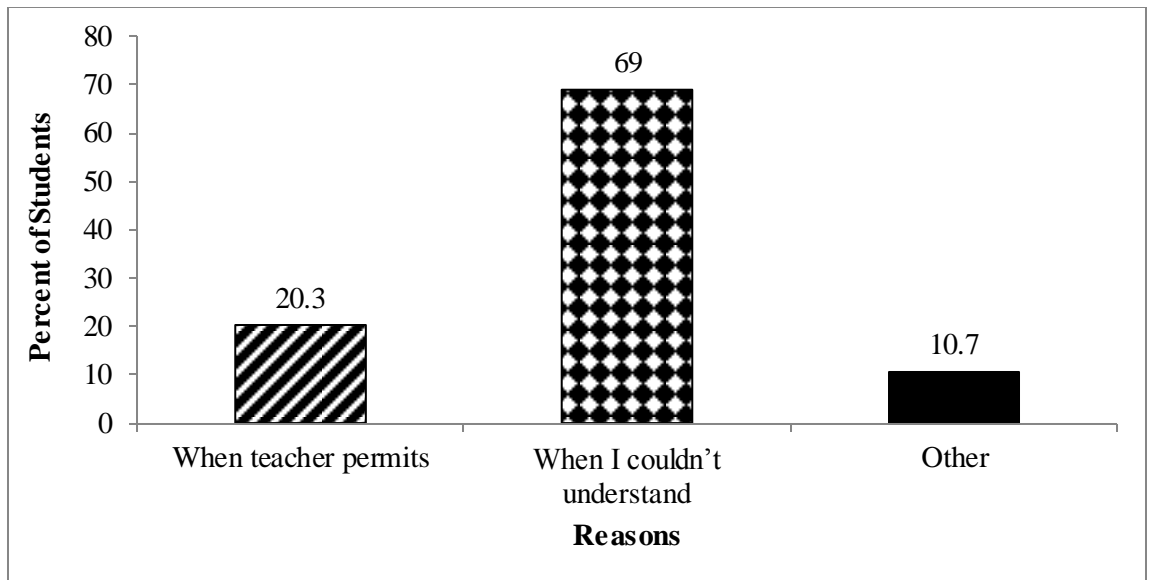


Figure 4.2: Reasons for discussions during the mathematics class

Figure 4.2 shows the students reasons behind the discussions during mathematics class. Majority, about 69%, discussed during the mathematics class when they could not understand some of the concepts that their teachers taught. This is in line with the findings of Lovell (2002), who explained that learners may possibly tend to articulate their ideas publicly especially if they encounter a hiccup in the process of learning. Figure 4.3 also shows that about 20% of the students only discussed mathematics during class when their teachers allowed them to do so. Minority (11%) of the students gave other reasons such as; confirming from the fellow students if they had the proper understanding of a problem, helping the fellow weak students, and helping the learner to have a robust memory of concepts when they discuss with their colleagues among others.

In order to evoke students' attitudes about their mathematics teacher, a series of questions were given. Mixed reactions were captured depending on how the student felt about their

teachers regarding several aspects. Students views on the way their mathematics teachers either motivated or demotivated them in and out of the class.

Table 4.8: Views of students towards their mathematics teacher

Questions	Never	Sometimes	Always	Mean	Std. Dev.
Explains the work well and from time to time repeats where it is not clear	47	176	77	2.1	0.64
Answers questions in class thoroughly	87	178	35	1.83	0.62
Knows the content very well	113	100	87	1.91	0.81
Gives homework, marks and returns the next day	111	102	87	1.92	0.81
Arranges to meet students outside class to discuss mathematics problems	87	175	38	1.84	0.63
Encourages me to participate in mathematics lessons	99	96	105	2.02	0.83
Organized when teaching	78	169	53	1.92	0.66
Gives too much homework	102	94	104	2.01	0.83
Is against me, does not mark my assignment	219	71	10	1.3	0.53
Arranges to have homework revised	23	85	192	2.56	0.63
Is very fast when teaching thus I don't understand some concepts	95	115	90	1.98	0.79
Discourages weak students by ignoring them	20	96	184	2.55	0.62
Concentrates on bright students	34	86	180	2.49	0.69
Responds rudely to students' questions	207	60	33	1.42	0.68
Is harsh and moody in class	167	97	36	1.56	0.7

In Table 4.8, about 59% of the learners felt that sometimes their mathematics teachers explained the work well and occasionally repeated the unclear areas ($M=2.1$, $SD=0.64$). Additionally, approximately 59% of the learners believed that mathematics teachers sometimes explained the concepts thoroughly ($M=1.91$, $SD=0.81$). On the contrary, about

38% of the learners indicated that the mathematics teachers never understood the content abundantly clear ($M=1.92$, $SD=0.81$). Besides, there was about 37% of the learners who responded that teachers never gave homework, marked and returned the next day ($M=1.92$, $SD=0.81$) while about 58% of the learners stated that sometimes teachers arranged to meet students outside of classroom to discuss mathematics problems ($M=1.84$, $SD=0.63$). Similarly, about 35% percent of the learners indicated that their mathematics teachers always encouraged individual students to participate in mathematics lessons ($M=2.02$, $SD=0.83$). In addition, roughly 56% of the learners believed that teachers were sometimes organized when teaching ($M=2.01$, $SD=0.83$). Also, nearly 34% of the learners recorded that teachers never gave too much homework ($M=2.01$, $SD=0.83$) while approximately 38% of the learners thought that sometimes teachers were very fast when teaching thus the learners did not understand some concepts ($M=1.98$, $SD=0.79$). Unfortunately, close to 60% responded that teachers always concentrated on the bright students ($M=2.49$, $SD=0.69$). Interestingly, about 56% of the learners thought that the teachers were never harsh and moody ($M=1.56$, $SD=0.7$).

The results reveals that on average, 73% of mathematics teachers were never against the learners and that they marked their assignments ($M=1.3$, $SD=0.53$). Similarly, 69% of the teachers never responded rudely to students' questions ($M=1.42$, $SD=0.68$). The two responses were encouraging regarding the motivation of students. However, Kakai (2012) found that about 73% and 69% of mathematics teachers were against some learners and responded to students' questions rudely respectively in Bungoma South Subcounty, Kenya. Kericho County, therefore, has mathematics teachers who generally have a fairly cheering relationship with learners. Roughly 64% of the learners stated that teachers

always arranged to have homework revised ($M=2.56$, $SD=0.63$). This is expected from all the trained teachers. As such, Carr (2013) encouraged the use of homework as a tool to improve the performance of weak learners. On the other hand, about 61% of the sampled students said that their mathematics teachers always ignored some of the students and thus demotivated them ($M=2.55$, $SD=0.62$).

4.4 Dyscalculia Signs and Identification Procedures by Teachers in Kericho County

The second objective sought to investigate the teachers opinions on existing dyscalculia conditions and identification procedures they used in public day secondary schools in Kericho County. Mathematics teachers were interviewed concerning the symptoms that they observed from their students. Mixed reactions were recorded and summarized as shown in Table 4.11. Larger percentage of the responses from the mathematics teachers show a consensus with the common symptoms that the researcher suggested.

Table 4.9: Dyscalculia symptoms

Symptoms	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree	Mean	Std. Dev.
Students lack interest in working in numbers	10	14	1	3	1	2	1.07
The learners have anxiety when working with math	7	11	2	5	4	2.59	1.4
Students with dyscalculia cannot master the timetables correctly	13	8	0	5	3	2.21	1.45
Low self-esteem makes the students not to ask questions because they do not understand	9	14	1	4	1	2.1	1.11
Such learners cannot perform simple mental calculations	14	12	1	2	0	1.69	0.85
Sometimes the learners cannot copy numbers correctly	11	13	2	2	1	1.93	1.03
The learners do not note that arithmetic such as 6+9 is the same as 9+6	15	12	1	0	1	1.62	0.86
They are not able to interpret word problems	13	13	1	1	1	1.76	0.95
They do not understand mathematical processes	13	9	3	3	1	1.97	1.15
Always confusing mathematical terms such as equals, sums, and total	6	14	3	5	1	2.34	1.11
Rarely finish a mathematical procedure	7	11	5	4	2	2.41	1.21
Rarely understand the mathematical abbreviations, procedures, and formulae	13	10	1	3	2	2	1.25
Having difficulties in all matters of graphs e.g. axes	13	12	1	2	1	1.83	1.04
Majorly uses fingers to count due to poor memory	14	11	2	1	1	1.76	1
Cannot easily differentiate between right and left	5	6	4	6	8	3.21	1.5

From Table 4.9, it is evident that about 83% of the students with possible dyscalculia lacked interest in working with numbers ($M=2$, $SD=1.07$). Dias *et al.* (2013) described

the condition as attention deficit hyperactivity disorder. Additionally, learners with dyscalculia were reported not to master the timetables correctly ($M=2.21$, $SD=1.45$). Chinn (2013) also reported that learners with dyscalculia have difficulties mastering numbers and timetables. Memorizing the numbers is also associated with issues such as forgetting the sequencing of mathematical instructions and explanations of the concepts taught in class. Further, approximately 79% of the mathematics teachers that were sampled believed that low self-esteem made the students not to ask questions because they did not understand what was being taught ($M=2.1$, $SD=1.11$). Teachers should help the students to raise their self-esteem to improve their personal and academic development.

There was a strong feeling that learners with dyscalculia could not perform simple mental calculations ($M=1.69$, $SD=0.85$). In fact, about 48% strongly agreed with the same. Mammarella *et al.* (2013) also reported that students with dyscalculia have problems solving simple mental calculations and to give the exact answers. Also, it was also evident that learners with dyscalculia may not copy numbers correctly ($M=1.93$, $SD=1.03$). This was also reported by Chinn (2013).

The majority (52%) of the mathematics teachers strongly agreed that learners with dyscalculia did not note that arithmetic such as $6+9$ was the same as $9+6$ ($M=1.62$, $SD=0.86$). Also, there was almost an agreement that learners with dyscalculia were not able to interpret word problems ($M=1.76$, $SD=0.95$). Similar observations were made by Tambychik & Meerah (2010) and it was explained that this was in connection with dyslexia. Additionally, about 62% of the teachers indicated that learners were not able to

finish all mathematical processes as required ($M=1.97$, $SD=1.15$). Doyle (2010) reported that this could be a problem of attention deficit disorder. About 48% of the respondents strongly agreed that dyscalculic learners were confusing mathematical terms such as equals, sums, and total ($M=2.34$, $SD=1.11$). Similarly, 38% agreed that dyscalculic learners rarely finished mathematical procedures ($M=2.41$, $SD=1.21$).

The majority about 45% of the sampled mathematics teachers strongly agreed that dyscalculic learners rarely understood the mathematical abbreviations, and formulae ($M=2$, $SD=1.25$). Oginni and Olugbuyi (2014) attributed such symptoms to anxiety and avoidance of mathematics. Similarly, there was a strong agreement among the majority (45%) of the teachers on the issue of dyscalculic learners having difficulties in all matters of graphs, for instance, when interpreting the axes ($M=1.83$, $SD=1.04$). Such a finding was reported by Mammarella *et al.* (2013). In addition, about 48% of the sampled teachers strongly agreed that learners with dyscalculia majorly used fingers to count due to poor memory ($M=1.76$, $SD=1$). Finally, though 28% the majority of respondents on that dyscalculic symptom issue strongly disagreed that dyscalculic learners could not easily differentiate between right and left ($M=3.21$, $SD=1.5$), the mean scale shows that the teachers were almost undecided on the same issue.

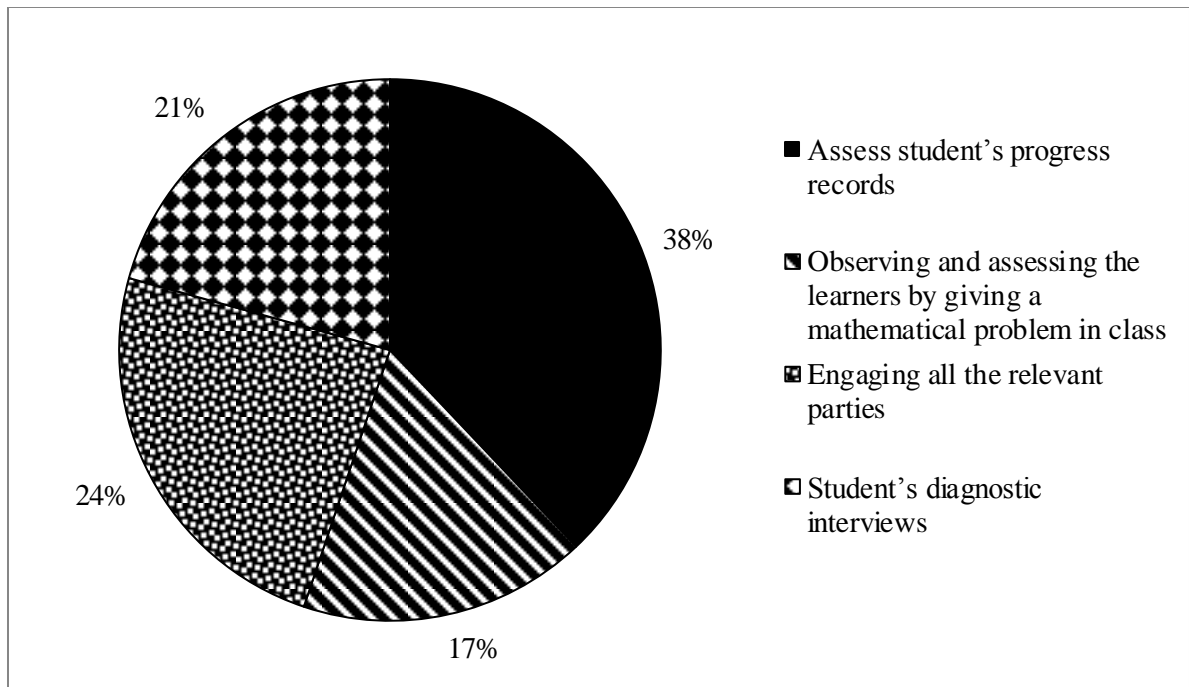


Figure 4.3: The procedure that a mathematics teacher uses to identify dyscalculia among learners

Figure 4.3 presents the procedures used in identifying students with dyscalculia. According to the results, the majority (38%) of the mathematics teachers in Kericho County assessed students' records to identify dyscalculia problem. The records show students past performance in mathematics compared to other subjects. This gives the teachers an idea of whether the students are generally weak academically or if they predominantly have flaws in undertaking mathematical problems. Ramaa & Gowramma (2002) also advocated for the use of students' progress records when identifying dyscalculic learners in India.

The minority (17%) of the teachers identified dyscalculia through observing and assessing the learners by giving mathematical problems in class. The procedure may be effective but teachers may sometimes be overwhelmed by the increasing number of

students in Kenyan secondary schools. The procedure, therefore, is possible in a class with few students that the teachers will have enough time to assist.

Approximately 24% of the teachers engaged all the relevant parties such as parents, guardians, the school administration, and government agents among others to identify dyscalculia among the learners. A holistic approach may be the most effective because the students' strengths and weaknesses are assessed inside and outside the school environment. Cunningham (2016) supported the move regarding the involvement of all the relevant parties to the improvement of students' performance in mathematics in Ireland secondary schools.

About 21% of the teachers used students' diagnostic interviews to identify dyscalculia in Kericho County. Students who perform dismally are in such cases subjected to clinical interviews and discussions that pertain to counseling in order to assist them in establishing an almost ideal intervention that can address the likely dyscalculia (Mundia, 2017). Students are also subjected to portfolio assessment in the presence of their teachers so that they can respond to some questions related to mathematical problems. A parent-teacher association is also critical during the diagnostic interviews (Mundia, 2017).

4.5 Dyscalculia Prevalence in Kericho County

The third objective of the study sought to find out the teachers' opinions on the possibility of dyscalculia and its prevalence in Kericho County. The initial step in the process of identifying dyscalculia prevalence in Kericho County was through assessment of adequacy in attendance during mathematics class.

Table 4.10: Assessment of adequate attendance

Attendance	Frequency	Percent
Adequate (up to 100%)	264	88
Inadequate	36	12
Total	300	100

Table 4.10 presents the results of the assessment of adequate attendance among the sampled students. The process of identification of dyscalculia prevalence in Kericho County involved a multi-phase procedure. The researcher personally engaged the sampled Form 3 and Form 4 teachers in an unstructured interview, using the students' records, to establish the prevalence of dyscalculia in Kericho County. The attendance records were first used to identify the adequacy of the sampled students' school attendance. The records revealed that 264 out of 300 students that had attained less than 25 percent marks in the past one year, which represent 88% of the sampled students, had an adequate school attendance of up to 100%.

The second step involved collecting mathematics teachers' opinions on whether they had an idea of auditory/visual and sensory/emotional functioning issues among the sampled students with adequate performance.

Table 4.11: Teachers' opinions for the possibility of dyscalculia

Teachers' opinions	Frequency	Percent
No auditory/visual and sensory/emotional issues	158	59.8
Auditory/visual and sensory/emotional issues	106	40.2
Total	264	100

Table 4.11 presents the findings on teachers knowledge about the students’ family, social, and religious backgrounds. At this point, about 106 students, which comprises of about 40% of the sampled students with adequate school attendance were having auditory/visual and sensory/emotional functioning issues or they had family backgrounds that could not support the learners’ academic progress. Such issues may include domestic violence, poverty, and drug usage among others. There was a possibility of tracing dyscalculia among such students.

The third step involved a test of intelligence. The 106 students who had a possibility of having dyscalculia due to auditory/visual and sensory/emotional issues were subjected to Raven’s test of intelligence.

Table 4.12: Raven’s test of intelligence results

Raven’s test	Frequency	Percent
Not Pass Raven's Test (below the first quartile)	74	69.8
Pass Raven's Test	32	30.2
Total	106	100

Table 4.12 shows the results after simple to moderately difficult Raven Progressive Matrices (RPM) tests were given to the students who had auditory/visual and sensory/emotional problems. It involved discussing few items that were similar to those in the tests. For instance, the students were asked to complete the patterns by selecting missing pieces from some options outside the figures so that certain figures could be complete., about 74 students failed the Raven’s test by scoring below the first quartile or the 25th percentile. This represents 25% of the total sampled students in Form 3 and Form 4. Gopal & Sindhya (2017) also used Raven’s test for the prevalence of dyscalculia

among upper primary school students of Thiruvananthapuram district of India and found that about 19% of the sampled students had failed the test by scoring below the 25th percentile. The last step involved confirmation of dyscalculia among the students who had failed Raven's test of intelligence.

Table 4.13: Dyscalculia test

Dyscalculia	Frequency	Percent
No Dyscalculia	55	74.3
Proven Dyscalculia	19	25.7
Total	74	100

Table 4.13 presents the summary of the findings for dyscalculia prevalence assessment is presented in The process involved an examination of notebooks coupled with dyscalculia tests. For instance, the students were tested for simple mental mathematics, they were made to memorize numbers, and the teachers asked them to do time estimations between two close periods. Additionally, they were tested on the difficulty of reading simple graphs X and Y axes. They were also tested if they would skip numbers when reading mathematical problems. All the resources were made available to the students to ensure that lack of resources was not a factor that contributed to dyscalculia among the students. It was revealed that 19 students, which represent 6.3% of the total sampled students, had proven to suffer from dyscalculia.

It includes the students who were involved and those that were not involved in every process. The findings reveal that about 93.7% have other issues that contribute to their failure in mathematics and thus necessary interventions should be rendered accordingly. Therefore, only 6.3% of the students in Kericho County should be treated as dyscalculic

and thus they should receive the relevant attention from all the relevant stakeholders including parents, teaching staff, government agencies, and non-governmental organizations (NGOs) among others. This will ensure that a holistic remedy to dyscalculia is guaranteed as by Cunningham (2016). It may take some time and commitment but the impact may be robust.

Table 4.14: Summary results of the dyscalculia prevalence assessment

The process of assessing the prevalence	Students involved	Students not involved
Teachers opinions on dyscalculia; sensory/emotional and auditory/visual functioning among students	106	158
Adequate school attendance from the register (Up to 100%)	264	36
Examining the note books with dyscalculia tests (e.g. mental math, memorizing numbers, time estimation, difficulty in reading graphs, and skipping of numbers when reading among others)	19	55
Raven’s test of intelligence (students below the first quartile)	74	32

Other studies have reported similar findings regarding dyscalculia prevalence. For instance, Tuchura (2016) found that about 8.89% of the students in regular primary schools in Nyandarua County were suffering from dyscalculia. In addition, Butterworth *et al.* (2011) reported that developmental dyscalculia in the United Kingdom (UK) ranged between 5% and 7%. Similarly, dyscalculia prevalence of 7.3% was reported by Gopal & Sindhya (2017) among upper primary school students of Thiruvananthapuram district of India. Therefore, dyscalculia in public day secondary schools in Kericho County fell within the range of other researchers’ findings elsewhere.

4.6 Challenges Experienced by Teachers in Teaching Mathematics to Learners With Dyscalculia in Kericho County

The fourth objective sought to Identify the problems encountered by teachers while tutoring mathematics to learners with dyscalculia in public day secondary schools in Kericho County. Mathematics teachers faced several challenges when teaching learners with dyscalculia. They responded to the researchers question with varying degrees of agreements and disagreements while others were undecided on whether they faced the challenges or not.

Table 4.15: Challenges faced by teachers when teaching mathematics to learners with dyscalculia

Challenges	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree	Mean	Std. Dev.
High expectations from parents	8	11	5	3	2	2.31	1.2
Lack of motivation due to poor salary	9	4	6	5	5	2.76	1.5
Few number of experienced special needs teachers	7	15	3	3	1	2.17	1.04
Lack of enough teaching materials	2	5	1	8	13	3.86	1.36
Learners not grasping the concepts fully	4	6	7	7	5	3.1	1.32
Lack of enough special time to attend the learners	9	9	3	4	4	2.48	1.43
Learners complete lack of interest in mathematics	7	1	2	12	7	3.38	1.52
Poor cooperation from parents/guardians/other staff	15	8	2	1	3	1.93	1.31

As presented in table 4.15, Thirty eight percent (38%) of the mathematics teachers agreed that parents had high expectations such that they believed that their children's poor performance in the subject could only be solved by their teachers ($M=2.31$, $SD=1.2$). Many parents fail to understand that it takes time for dyscalculic learners to learn before they practice the learned concepts. In fact, Udoba (2014) reported that parents want the teachers to assist dyscalculic learners within a very short period of time. It depends on the learners' capability to learn in case the teachers offer their best teaching services.

Although 31% strongly agreed that they lacked motivation when teaching dyscalculic learners due to poor salary, about 21% were undecided on whether the issues of salary demotivated them or not ($M=2.76$, $SD=1.5$). Those who strongly agreed that poor salary was a demotivation to them was probably because they could spend extra time on other endeavors in search of additional money to cater for the daily needs. They believed that their salaries were lower than those of equivalent workers in the government services. The findings concurred with those of Mwenda (2015), in a study to investigate the institutional factors influencing job satisfaction among teachers in mixed day secondary schools in Imenti South district, Kenya. The researcher reported that 35.7% of teachers derived their main motivation from increases in the salaries.

About 52% of the sampled mathematics teachers agreed that the availability of few experienced special needs teachers among themselves was a challenge that they faced when handling dyscalculic learners ($M=2.17$, $SD=1.04$). Special needs teachers who could teach mathematics were sometimes lacking and this aggravated the problem of dyscalculia in public day secondary schools in Kericho County. They said that few

teachers were willing to specialize with special needs education. The results concur with those of Tuchura (2016) where 1 out of 20 regular primary teachers in Nyandarua County, which represent 5%, had been trained in special needs education and thus they were not in a good position to assist many dyscalculic learners. Dyscalculic learners require a lot of attention, which probably can be acquired from teachers who are trained in special needs education.

Most of the teachers (45%) strongly disagreed that they lacked enough teaching materials when dealing with dyscalculic learners ($M=3.86$, $SD=1.36$). Such teaching materials included dust boards, chalks, conspicuous drawings, blackboards, and books. However, all the teachers reported by Udoba (2014) revealed that they faced the problem of scarcity of teaching materials in Tanzania. They attributed the challenge to the government's low financial support on education matters that deal with learning disabilities among learners. In Kenya, although there are some attempts in policy making that assist learners with learning disabilities such as dyscalculia, such attempts are not robust enough to address the issues of the affected learners (Mwangi, 2013).

Mixed reactions were recorded about the issue of learners not grasping the concepts fully as a challenge to mathematics teachers ($M=3.1$, $SD=1.32$). Teachers who were undecided on the issue of slow learning were about 24%. A similar figure was recorded for those who disagreed that the issue of partial understanding of concepts was a great challenge to them. This is perhaps due to over 10 years of teaching that teachers public day secondary schools in Kericho County had acquired in teaching mathematics and thus they were able to deal with students with various learning disorders. However, the findings contradict

those of Gafoor & Kurukkan (2015) who found that high school students who grasped mathematical concepts slowly were part of the great challenges that the teachers faced when teaching mathematics.

About 31% of the teachers strongly agreed that lack of enough special time to attend to learners was one of the challenges they faced in the line of duty ($M=2.48$, $SD=1.43$). An equal percentage of teachers agreed that it was a challenge that they faced. Mwangi (2013) recorded that enough time should be allocated to teaching students with special needs. In public day secondary schools in Kericho County, however, learners taking mathematics are mostly treated equally in class regardless of whether they are dyscalculic or not.

The majority of respondents on the issue (41%) disagreed that learners had a complete lack of interest in mathematics ($M=3.38$, $SD=1.52$). However, other studies show that teachers agreed that learners lacked interest in mathematics and thus they lack concentration, which makes them take time to understand concepts (Kakai, 2012). Doyle (2010) says that dyscalculic learners experience anxiety when learning mathematics, which makes the learners lose interest in the subject.

Nearly 52% of the teachers strongly agreed that poor cooperation from the relevant stakeholders such as parents, guardians, and other staff among others was a major challenge that they faced when teaching learners with dyscalculia ($M=1.93$, $SD=1.31$). Adequate cooperation is relevant for dyscalculic learners to improve their mathematics performance (Chinn, 2013). Tuchura (2016) found that the cooperation between different

stakeholders was the least challenge that teachers experienced when teaching dyscalculic learners. It was attributed to their teaching experience.

4.7 Intervention Measures and Teaching Strategies to Improve the Teaching of Mathematics to Learners with Dyscalculia

4.7.1 Intervention Measures

The fifth objective sought to ascertain the intervention measures which could be used to improve the process of teaching of mathematics to learners with dyscalculia in public day secondary schools in Kericho County. Teachers were also required to respond to the possible intervention measures that would help to improve dyscalculic learners' performance. The majority strongly agreed or disagreed on the measures that were proposed by the researcher.

Table 4.16: Results of the possible intervention measures

Intervention Measures	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree	Mean	Std. Dev.
Use of ICT can help to improve performance of learners with dyscalculia	12	14	1	1	1	1.79	0.94
Use of learning areas with minimum distraction	10	14	3	2	0	1.9	0.86
A classroom with relevant and recent displays	6	13	3	2	5	2.55	1.38
Reviewing the previous lessons to improve the performance of students with dyscalculia	15	9	3	1	1	1.76	1.02
Home work and marking should be meant to improve learners diagnosis of the weak areas	5	18	3	3	0	2.14	0.83
The lesson should be planned such that learners will be allowed to verbalize their thinking	6	7	3	11	2	2.86	1.33
A conducive environment that increases interactivity among the learners with dyscalculia and the well-performing learners during the lesson	12	10	4	2	1	1.97	1.09

Table 4.16 indicates that, the majority (90%) of the teachers were in agreement that the use of ICT could, in future, help to improve the performance of learners with dyscalculia (M=1.79, SD=0.94). Use of digital dyscalculia screeners may be effective in enhancing a more ideal procedure in the disorder identification. Currently, most of the computer-based screeners are only available for students with 14 years and below (Drigas & Pappas, 2015). Nevertheless, Beacham & Trott (2005) developed *DyscalculiUM*, a computer-based screener that is able to mark the mathematical questions automatically during the screening test process and retain a record of individual scores for each of the

tested high school and undergraduate learners. Such a program may be crucial in reducing errors associated with manual dyscalculia identification tests.

The 48% of the sampled teachers agreed that the use of learning spaces with minimum distraction would help to improve the performance of learners with dyscalculia ($M=1.9$, $SD=0.86$). For instance, some of the classrooms that could comfortably host about 50 students had more than 70 students. According to Udoba (2014), learners with learning disabilities such as dyscalculia need enough space to carry out several activities. In addition, other students lacked enough desks such that three students could share a desk. Some classrooms lacked ceiling boards, doors, and windows and as such, the learners were not shielded fully from the outside weather variations.

About 45% of the teachers agreed that a classroom with relevant and recent displays created an environment that could assist dyscalculic learners to improve their performance ($M=2.55$, $SD=1.38$). In a mathematics class, learners should be surrounded by displays such as graphs to help them understand the grid lines and the axes. All the classes lacked these displays of which the dyscalculic learners could have the mathematical concepts in the displays sticking to their minds better. Generally, the majority of such displays are found in primary schools.

The majority (52%) of the teachers strongly agreed that reviewing the previous lessons to improve the performance of students with dyscalculia was crucial to the improvement of dyscalculic learners' performance ($M=1.76$, $SD=1.02$). Furlong *et al.* (2016) noted that since dyscalculia is a mental disorder, revisiting the previous lessons was an important task to allow the dyscalculic learners to develop a better grasp of a mathematical concept.

A special time should always be set to allow the teacher to engage the poorly performing learners on the previously taught items.

Nearly 62% of the teachers agreed that homework and marking should be meant to improve learners' diagnosis of the weak areas ($M=2.14$, $SD=0.83$). Carr (2013) also reported that homework reinforces the knowledge that has been acquired in class when the learners are in non-institutional environments. The researcher proceeds to say that it is unfortunate that teachers do not utilize homework as a way to improve the learners' performance. A meta-analysis carried out by Cooper & Schindler (2008) revealed that academic achievement has a strong positive correlation with the amount of homework given to students. Teachers in public day secondary schools in Kericho County are therefore in a good position to improve the performance of the dyscalculic learners through assigning homework to the learners.

Most (38%) of the teachers disagreed that the lesson should be planned such that learners will be allowed to verbalize their thinking ($M=2.86$, $SD=1.33$). This is perhaps due to intimidation that the dyscalculic learners would go through whenever they are compelled to make their thinking be heard aloud. However, Hartman (2001) and Tobiason, Heritage, Chang, Jones, & Herman (2014) believe that by allowing learners to verbalize their thinking, a substantive insight into learners' thinking development is revealed to the teachers. This is necessary for teachers in public day secondary schools in Kericho County to assist their students in changing their perspectives when tackling mathematical problems because they will not treat all the students' weaknesses in the same way.

About 41% of the sampled teachers strongly agreed that a conducive environment that increases interactivity among the learners with dyscalculia and the well-performing learners was necessary to address the issues of dyscalculia ($M=1.97$, $SD=1.09$). Sometimes mathematics teachers should dedicate some time to learners interactions through discussions. The group discussions should engage both the poorly and the good-performing student categories to allow the interaction, which should be overseen by the teachers. This is in line with the findings of Smith et al (2009) and Sofroniou & Poutos (2016) who explained that when learners are allowed to discuss during the mathematics class, they develop a problem-solving critical thinking while appreciating their colleagues' views on different mathematical problems.

4.7.2 Teaching Strategies

Teachers gave their opinions on the teaching strategies in which they felt could assist them to handle the dyscalculic learners. They seemed to either *strongly agree* or *agree* on most of the strategies that the researcher suggested. The results for this section are presented in Table 4.19.

Table 4.17: Results of the possible teaching strategies

Strategies	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree	Mean	Std. Dev.
Relevant and familiar contexts should be linked to mathematics e.g. football tables, indoor and outdoor resources	10	8	5	5	1	2.28	1.22
Moving to the higher level when a learner has understood the easier contexts; it will thus require more time to do so	10	13	3	2	1	2	1.04
Guiding the learners' practice after giving them explicit instructions in class	8	10	3	4	4	2.52	1.41
Making use of various models, images, and objects during the lesson	10	6	4	4	5	2.59	1.52
Allowing students to discuss and explain mathematical concepts to their colleagues to enhance a better understanding	11	7	3	4	4	2.41	1.48
Encouraging learners to practice using different methods and this also requires the availability of different resources	9	8	4	7	1	2.41	1.27
Sometimes using peer tutoring may assist in delivering the concepts	8	15	4	2	0	2	0.85
Using the estimate-calculate-check routine	5	10	0	6	8	3.07	1.56
Always having mathematics symbols and terms displayed in the math lesson	16	7	1	3	2	1.9	1.29
Allocation of more time in explaining the vocabularies such as minus, less, subtract and take away etc.	5	7	6	4	7	3.03	1.45
Each stage of teaching should have a special time to practice and consolidate different concepts, for instance, 5 minutes of practicing	13	8	5	3	0	1.93	1.03

Table 4.17 shows that, thirty four percent (34%) strongly agreed that the use of relevant and familiar contexts should be linked to mathematics to assist learners with dyscalculia ($M=2.28$, $SD=1.22$). Some of the practical ideas that can be implemented in the classroom include the league tables (such as in football), both inside and outside classroom resources (such as the playgrounds), real bank statements to help the students

understand the financial mathematics, and car racings among others. Chinn (2013) noted that, by linking relevant and familiar real-life contexts with mathematics, the dyscalculic learners will be able to appreciate mathematics as an applicable subject in life. Confining learners in a classroom set-up all along may contribute to the prevalence of dyscalculia.

About 45% agreed that allowing the students to move to the higher levels when they have understood the easier contexts would help in addressing some key issues associated with dyscalculia ($M=2$, $SD=1.04$). Teachers should, therefore, spend more time on the introductory stages before getting deeper into the topic. If possible, they should revisit the fundamental concepts severally. They can also demonstrate ideas using concrete materials and thereafter engage the learners in writing. Butterworth and Yeo (2004) noted that teachers should use concrete materials before introducing diagrams and pictures, which should then be introduced prior to putting down the abstract mathematical work.

Most (34%) of the teachers agreed that it was important to guide the learners' practice after giving them explicit instructions in class ($M=2.52$, $SD=1.41$). Mathematics teachers should move about in the midst of learners as they oversee how various individuals, especially the weak learners, are undertaking a given task. Freeman et al (2014) noted that when teachers engage learners directly, those that grasp the concepts slowly will improve their performance on subjects such as mathematics and engineering. Teachers should, therefore, guide the students on the way to go about some tasks so that by the time they assign the students some homework, the students will be in a position to improve on the knowledge acquired in class.

Thirty-five per cent (35%) of the teachers strongly agreed that making use of various models, images, and objects during the lesson would assist them in addressing some issues that are associated with dyscalculia ($M=2.59$, $SD=1.52$). Real objects such as a globe will assist learners to understand the mathematical problems that involve latitudes and longitudes. They can be used repetitively whenever teachers want to revisit the foundation concepts of a mathematical problem. This works well when other strategies such as the ensuring that students move to the next level once they understand the simpler concepts. A multi-strategy approach helps to improve mathematics performance for dyscalculic learners (Williams, 2013).

About 38% strongly agreed that allowing students to discuss and explain mathematical concepts to their colleagues would enhance a better understanding and performance ($M=2.41$, $SD=1.48$). Such sentiments are extensively supported in the literature (Hartman, 2001; Tobiason et al., 2014; Smith et al., 2009; and Sofroniou & Poutos, 2016). It is clear that if mathematics teachers allow the good-performing learners to explain the concepts to their colleagues, it will break the culture where learners may think that they can only learn from their teachers. As such, mathematics teachers should also use the strategy to gauge the students' understanding over a particular problem. The strategy also allows the students to brainstorm in the presence of their teachers (Smith et al., 2009).

The highest percentage (31%) of the teachers strongly agreed that encouraging learners to practice using different methods would assist the poorly performing learners to improve their performance ($M= 2.41$, $SD=1.27$). This would also require the availability of

different resources. Teachers should guide learners in various ways of choosing different methods of tackling a particular mathematical problem. Teachers should always demonstrate how the different methods are used and encourage the learners to familiarize themselves with different strategies. According to Darling-Hammond & Baratz-Snowden (2005), an effective teacher should always demonstrate different problem solutions and encourage the students to familiarize themselves with all the methods learned. This may reduce some aspects of mathematics that causes anxiety among learners.

The majority on the issue was that (52%) agreed that sometimes using peer tutoring may assist in delivering the concepts ($M=2$, $SD=0.85$). Peer tutoring involves the use of students as mathematics tutors where good-performing students are paired with poor performers, which aids in appraising acute behavioral and academic concepts (Miller *et al.*, 1996; Hott *et al.*, 2012). Mathematics teachers in public day secondary schools in Kericho County should embrace the strategy because it helps to improve the performance of learners with dyscalculia (Heron *et al.*, 1983). The tutoring may be in form of class-wide, cross-aged, one-to-one, small group instruction and home-based methods.

About 34%, representing the majority of teachers, agreed that using the estimate-calculate-check routine was a good strategy to improve the performance of students with dyscalculia ($M=3.07$, $SD=1.56$). The dyscalculic students should be guided on how to do estimations before doing the calculations. They should then calculate and after a fixed period of time, teachers should check (examine) whether the whole process has been concluded successfully. Regular reminders should be used to alert the students about being time conscious. The strategy can make use of peers to improve dyscalculic

learners' performance (Hott *et al.*, 2012). Teachers can capitalize on this strategy to have their students improve independence in thinking.

Fifty-five percent (55%) strongly agreed that the mathematical performance of dyscalculic students would be improved by always having mathematics symbols and terms displayed in mathematics lessons ($M=1.9$, $SD=1.29$). The strategy is critical especially to dyscalculic learners who confuse the symbols, signs, and terms. Tambychik & Meerah (2010) explained that this was in connection with the mental disorder. Therefore, teachers should always endeavor to present the relevant mathematical symbols and vocabularies in each lesson. This may reduce the need to allocate more time in explaining the vocabularies such as minus, less, subtract, and take away among others as shown in the responses presented in Table 4.19. As such, while 24% agreed that the allocation of more time in explaining the vocabularies was a good teaching strategy, 24% strongly disagreed with the researcher's suggestion. This confirms that displaying mathematics symbols and terms in all mathematics classes is a right move to assist in the improvement of dyscalculic students' performance.

Forty five percent (45%) strongly agreed that each stage of teaching should have a special time to practice and consolidate different concepts, for instance, five minutes should be allocated for practicing the learned concepts ($M=1.93$, $SD=1.03$). According to Mwangi (2013), enough time should be allocated to teaching students with special needs. As such, teachers should spare some of their time to concentrate on dyscalculic students at each stage of learning a particular topic to enhance their mathematics performance.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

The purpose of this study was to investigate the mathematics teaching strategies used in teaching mathematics to learners with dyscalculia in Kericho County. This chapter presents summary of the main findings, conclusions, recommendations and suggestions for further research.

5.2 Summary

5.2.1 Procedures Used by Teachers in Identifying Learners with Dyscalculia

The first objective aimed at establishing the procedures used by teachers in identifying learners with dyscalculia in public day secondary schools in Kericho County. The results revealed that 38% of the mathematics teachers in public day secondary schools in Kericho County assessed students' records to identify dyscalculia problem. Additionally about 17% of the teachers, which represented the minority, identified dyscalculia through observing and assessing the learners by giving mathematical problems in class. On the other hand, approximately 24% of the teachers engaged all the relevant parties such as parents, guardians, the school administration, and government agents among others to identify dyscalculia among the learners. Finally, about 21% of the teachers used students' diagnostic interviews to identify dyscalculia in public day secondary schools Kericho County. Students who perform dismally are in such cases subjected to clinical interviews and discussions that pertain to counseling in order to assist them in establishing an almost ideal intervention that can address the likely dyscalculia.

5.2.2 Prevalence of Dyscalculia in Public Day Secondary Schools

The second objective aimed at determining the prevalence of dyscalculia in public day secondary schools in Kericho County. The process of identification of dyscalculia prevalence in Kericho County involved a multi-phase procedure. The initial step in the process of identifying dyscalculia prevalence in public day secondary schools in Kericho County was through assessment of adequacy in attendance during mathematics class. The author personally engaged the sampled Form 3 and Form 4 teachers in an unstructured interview, using the students' records, to establish the prevalence of dyscalculia in sampled public day schools in Kericho County. The records revealed that 264 out of 300 students that had attained less than 25 percent marks in the past one year, which represent 88% of the sampled students, had an adequate school attendance of up to 100%.

The second step involved collecting mathematics teachers' opinions on whether they had an idea of auditory/visual and sensory/emotional functioning issues among the sampled students with adequate performance. The teachers were asked about their knowledge about the students' family, social, and religious backgrounds. At this point, about 106 students, which comprises of about 40% of the sampled students with adequate school attendance were having auditory/visual and sensory/emotional functioning issues or they had family backgrounds that could not support the learners' academic progress. The results suggested a possibility of tracing dyscalculia among such students.

The third step involved a test of intelligence. The 106 students who had a possibility of having dyscalculia due to auditory/visual and sensory/emotional issues were subjected to Raven's test of intelligence. Simple to moderately difficult Raven Progressive Matrices

(RPM) tests were given to the students who had auditory/visual and sensory/emotional problems. About 74 students failed the Raven's test by scoring below the first quartile or the 25th percentile. This represents 25% of the total sampled students in Form 3 and Form 4.

The last step involved confirmation of dyscalculia among the students who had failed Raven's test of intelligence. The process involved an examination of notebooks coupled with dyscalculia tests. For instance, the students were tested for simple mental mathematics, they were made to memorize numbers, and the teachers asked them to do time estimations between two close periods. Additionally, they were tested on the difficulty of reading simple graphs X and Y axes. They were also tested if they would skip numbers when reading mathematical problems. All the resources were made available to the students to ensure that lack of resources was not a factor that contributed to dyscalculia among the students. The findings revealed that 19 students, which represent 6.3% of the total sampled students, had proven to suffer from dyscalculia. This reveals that about 93.7% have other issues that contribute to their failure in mathematics and thus necessary interventions should be rendered accordingly. Therefore, only 6.3% of the students in public day secondary schools in Kericho County should be treated as dyscalculic and thus they should receive the relevant attention from all the relevant stakeholders including parents, teaching staff, government agencies, and non-governmental organizations (NGOs) among others.

5.2.3 Challenges Experienced by Teachers in Teaching Mathematics to Learners with Dyscalculia

The third objective aimed at investigating the challenges experienced by teachers in teaching mathematics to learners with dyscalculia in public day secondary schools in Kericho County. Thirty eight (38%) of the mathematics teachers agreed that parents had high expectations such that they believed that their children's poor performance in the subject could only be solved by their teachers. Although 31% strongly agreed that they lacked motivation when teaching dyscalculic learners due to poor salary, about 21% were undecided on whether the issues of salary demotivated them or not. In addition, about 52% of the sampled mathematics teachers agreed that the availability of few experienced special needs teachers among themselves was a challenge that they faced when handling dyscalculic learners. Interestingly, most of the teachers (45%) strongly disagreed that they lacked enough teaching materials when dealing with dyscalculic learners. Further, teachers who were undecided on whether slow learning was a problem to them were about 24%. A similar figure was recorded for those who disagreed that the issue of partial understanding of concepts was a great challenge to them. Also, 31% of the teachers strongly agreed that lack of enough special time to attend to learners was one of the challenges they faced in the line of duty. An equal percentage of teachers agreed that it was a challenge that they faced. Perhaps that was the reason why the (41%) disagreed that learners had a complete lack of interest in mathematics. Further, nearly 52% of the teachers strongly agreed that poor cooperation from the relevant stakeholders such as parents, guardians, and other staff among others was a major challenge that they faced when teaching learners with dyscalculia.

5.2.4 Intervention Measures and Strategies

The fourth objective aimed at finding out possible interventions measures and analyzing the strategies that can be undertaken to improve the teaching of mathematics to learners with dyscalculia in public day secondary schools in Kericho County. The interventions are summarized as follows; First, 48% of the teachers agreed that the use of ICT could help to improve the performance of learners with dyscalculia. None of them was using any digital means to teach learners with dyscalculia. Second, about 48% of the sampled teachers agreed that the use of learning spaces with minimum distraction would help to improve the performance of learners with dyscalculia. For instance, some of the classrooms that could comfortably host about 50 students had more than 70 students. Third, about 45% of the teachers agreed that a classroom with relevant and recent displays created an environment that could assist dyscalculic learners to improve their performance. In a mathematics class, learners should be surrounded by displays such as graphs to help them understand the grid lines and the axes. Generally, the majority of such displays are found in primary schools. Fourth, the majority (52%) of the teachers strongly agreed that reviewing the previous lessons to improve the performance of students with dyscalculia was crucial to the improvement of dyscalculic learners' performance. A special time should always be set to allow the teacher to engage the poorly performing learners on the previously taught items. Fifth, nearly 62% of the teachers agreed that homework and marking should be meant to improve learners' diagnosis of the weak areas. Sixth, 38% of the teachers disagreed that the lesson should be planned such that learners will be allowed to verbalize their thinking. However, verbalizing their thinking gives teachers a substantive insight into learners' thinking

development. Seventh, about 41% of the sampled teachers strongly agreed that a favorable environment that increases interactivity among the learners with dyscalculia and the well-performing learners was necessary to address the issues of dyscalculia. Interactivity allows both the poorly and the good-performing student categories to engage one another while the teachers oversee the activity.

The possible teaching strategies are highlighted in this section. First, 34% strongly agreed that the use of relevant and familiar contexts should be linked to mathematics to assist learners with dyscalculia. Second, about 45% agreed that allowing the students to move to the higher levels when they have understood the easier contexts would help in addressing some key issues associated with dyscalculia. Third, most (34%) of the teachers agreed that it was important to guide the learners' practice after giving them explicit instructions in class. Fourth, more than 35% of the teachers strongly agreed that making use of various models, images, and objects during the lesson would assist them in addressing some issues that are associated with dyscalculia. Fifth, about 38% strongly agreed that allowing students to discuss and explain mathematical concepts to their colleagues would enhance a better understanding and performance. Sixth, Thirty one percent (31%) of the teachers strongly agreed that encouraging learners to practice using different methods would assist the poorly performing learners to improve their performance. Seventh, more than (52%) agreed that sometimes using peer tutoring may assist in delivering the concepts. Eighth, about 34%, representing the majority of teachers, agreed that using the estimate-calculate-check routine was a good strategy to improve the performance of students with dyscalculia. Ninth, 55% of the respondents strongly agreed that the mathematical performance of dyscalculic students would be

improved by always having mathematics symbols and terms displayed in mathematics lessons. Tenth, nearly 45% strongly agreed that each stage of teaching should have a special time to practice and consolidate different concepts, for instance, five minutes should be allocated for practicing the learned concepts.

5.3 Conclusion

The strategies used to teach mathematics in Kericho County incorporate lectures, problem solving, deductive, analytical, and inductive methods. These strategies are quite fitting but fall short of meeting the learning requirements posed by students suffering from dyscalculia. The procedures that teachers used in identifying learners with dyscalculia are very critical for an effective remedy to be prescribed. For instance, although students' progressive records are crucial to proper identification of dyscalculia, only 38% used the procedure. The records allow teachers to compare students' performance in mathematics and the other subjects to establish if they have dyscalculia or they are merely struggling with mathematics. The study concludes that majority of the teachers may have confused dyscalculic students with those who were struggling with mathematics. Also, teachers may have arrived at wrong dyscalculia identification because majority did not engage other stakeholders such as parents and guardians who have insight about the learners' conditions outside the school set-up.

The study established that about 6.3% of learners in public day secondary schools in Kericho County were dyscalculic. Teachers were sometimes reported to concentrate on the bright students, which was unfair to the poorly performing learners. Teachers who might also have treated all the students equally were also unfair. The study concludes that

the rest (93.7%) of the students were merely struggling with mathematics. The prevalence of dyscalculia in public day secondary schools in Kericho County might have been overlooked by other researchers.

The study concludes that there was little effort from parents' side to assist learners to improve their performance because they expected teachers to assist the students fully. That was a challenge that mathematics teachers experienced, which was aggravated by poor cooperation from other stakeholders. Also, some of the dyscalculia issues might not have been resolved due to lack of enough teachers who had trained in special needs education. The study also concludes that teachers might assist the dyscalculic students better if they are motivated by the salary they get, considering the extra efforts applied to the handling of dyscalculic learners.

Failure to improve the mathematics performance might have been caused by non-use of ICT in teaching learners with dyscalculia. Computer-based programs might help such learners to grasp some concepts. Students with dyscalculia as well as those who were struggling with mathematics might have suffered academic failure due to lack of learning spaces with minimal distraction. Also, students were not allowed to verbalize their thinking, which was a drawback to good performance. Shockingly, there were few mathematics teachers who did not believe in the effectiveness of group discussions in class as well as use of homework to improve learners' performance. This might have lowered students' chances of learning from their colleagues. Also, not all teachers believed in allocation of special time for students with learning disabilities. Poorly

performing learners would have improved their performance if all the teachers linked abstract mathematics to real-life familiar contexts such as playgrounds.

5.4 Recommendations

- i. The school head teachers and the head of mathematics departments should always ensure that mathematics teachers use the students' progressive records to establish if the learners are dyscalculic or they are merely struggling with mathematics. This should be reinforced by engaging all the relevant stakeholders to arrive at the right conclusion.
- ii. Teachers should tailor the existing strategies to better address the 6.3% dyscalculic students and also adequately accommodate the 93.7% of the students who are merely struggling with mathematics.
- iii. Teachers should reach out for the parents to convince them that dyscalculic learners need help from inside and outside the learning institutional set-ups.
- iv. The Ministry of Education should spearhead efforts to design inclusive curriculums which cater for the specialized learning needs of dyscalculic learners.
- v. Teachers should be trained on the complexities of dyslexia as well as be taught eventful methods of simplifying the impacts that dyscalculia introduces in the classroom.

5.5 Suggestion for Further Research

- i. The study covered public day secondary schools in Kericho County. Such a study should be replicated in other counties.

- ii. A study should be done to identify dyscalculia among upper primary schools in various Counties in Kenya to find out if other strategies can work better in teaching dyscalculic learners.

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APPENDICES

APPENDIX A: MATHEMATICS STUDENTS QUESTIONNAIRE

The purpose of this study was to explore the mathematics teaching strategies used in teaching mathematics to learners with dyscalculia in Kericho County.

Instructions

1. You **MUST** not write your name anywhere in this questionnaire.
2. The information you give concerning your view about mathematics and your teacher will be confidential, so please respond.
3. The questionnaire consists of two parts. Answer all the questions in each part.
4. Please complete the following questionnaire by answering the questions and placing a

Part 1

1 Gender

A. Male []

B. Female []

2. Age (years) _____

3. Indicate your class level. Tick (√) in the appropriate block (**only one block**)

A. Form 3 []

B. Form 4 []

4. This section has statements concerning your views about what you do to improve mathematics performance; decide carefully whether you: Strongly Agree (SA) =1; Agree (A) =2; Undecided (UD) =3; Disagree (D) =4; Strongly Disagree (SD) =5; Put a tick (√) only in one box for each statement.

Question	1	2	3	4	5
I consult my teacher for guidance					
I undertake mathematics experiments in class					
I enjoy conducting mathematics experiments					

I participate actively in your mathematics lessons by asking questions, answering, solving problems					
I solve other mathematical sums apart from those given in class					
I solve mathematics problems quicker when I discuss them with my peers					
I participate actively in class					
I enjoy doing exercises and homework					
I do self-assessment frequently					
I understand mathematics better when my teacher uses teaching aids					
I try to ask myself questions about statements in the textbooks					
I have a study timetable for mathematics					
I consult peers regularly					

5. Which learning method do you think can help you BEST to understand mathematics?

Frequency Tick (√)

- A. Teacher lecturing to me []
- B. Working in a group []
- C. Reading and solving problems alone []

6. Do you feel free to discuss with your desk mate during mathematics class? (Tick one.)

Yes []

No []

i) If yes, when do you do so? (Tick one.)

- A) Once teacher permits []
- B) Once I don't understand []
- C) Other (Please specify)

ii) If no, please state the reason.

Part 2

7. The following statements are views concerning the way your mathematics teacher either motivates or de-motivates you in and outside the class. Place a tick in the appropriate space on the right statement about your mathematics teacher, Rating is as follows: Never=1, Sometimes= 2, Always=3

Views about your mathematics teacher

Questions	1	2	3
Explains the work well and from time to time repeats where it is not			
Answers questions in class thoroughly			
Knows the content very well			
Gives homework, marks and returns the next day			
Arranges to meet students outside class to discuss mathematics problems			
Encourages me to participate in mathematics lessons			
Organized when teaching			
Gives too much homework			
Is against me, does not mark my assignment			
Arranges to have homework revised			
Is very fast when teaching thus I don't understand some concepts			
Discourages weak students by ignoring them			
Concentrates on bright students			
Responds rudely to students' questions			
Is harsh and moody in class			

APPENDIX B: MATHEMATICS TEACHERS QUESTIONNAIRE

The questionnaire aims at getting your opinion pertaining to mathematics learning dyscalculia in secondary schools in Kericho County. The information you give **IS FOR RESEARCH PURPOSE ONLY**. You may not write your name otherwise your identity will remain confidential. Feel free to give opinions in your responses. Please complete the following questionnaire by answering the questions and placing a tick (✓) in the appropriate block (only one block). Be honest as much as possible.

=====

Part 1: General Information

1. Teacher's characteristics. Tick (✓)

a) Gender: Male [] Female []

b) Age (years)

A. 20 and below []

B. 21 – 35 []

C. 36 – 50 []

D. 51 and above []

b) Teacher's professional qualification. Tick (✓)

A. Graduate in B.Ed. []

B. Graduate in B.A or B.Sc. with PGDE []

C. Graduate in B.A or B.Sc. []

D Diploma in Education

E Others (Specify) _____

2. How long have you been teaching mathematics in your current school? (Tick \checkmark where applicable)

A. Between 1-3 years []

B. Between 4-5 years []

C. Between 6-9 years []

D. 10 and above years []

3. Which forms do you teach mathematics? Form Tick (\checkmark)

A. Form three []

B. Form four []

Part 2: Dyscalculia Symptoms and Identification Procedures

2.1 Dyscalculia Symptoms

4. The following statements are views of whether you find the stated symptoms from learners with dyscalculia. Place a tick in the appropriate space on the right statement about the symptoms. The Scale: Strongly Agree (**SA**) =1; Agree (**A**) =2; Undecided (**UD**) =3; Disagree (**D**) =4; Strongly Disagree (**SD**) =5

Symptoms	1	2	3	4	5
Students lack interest in working in numbers					
The learners have anxiety when working with math					
Students with dyscalculia cannot master the timetables correctly					
Low esteem makes the students not to ask questions because they do not understand					
Such learners cannot perform simple mental calculations					
Sometimes the learners cannot copy numbers correctly					
The learners do not note that arithmetic such as $6+9$ is the same as $9+6$					
They are not able to interpret word problems					

They do not understand mathematical processes					
Always confusing mathematical terms such as equals, sums, and total					
Rarely finish a mathematical procedure					
Rarely understand the mathematical abbreviations, procedures, and formulae					
Having difficulties in all matters of graphs e.g. axes					
Majorly uses fingers to count due to poor memory					
Cannot easily differentiate between right and left					

5. Which other symptoms do you help you to identify learners with dyscalculia

2.2 Identification Procedures

6. The following are statements showing the major procedures that mathematics teachers use in identification of dyscalculia. Place a tick in the appropriate space on the right statement about the **MAJOR** procedure that you use.

A. Use of dyscalculia screener	
B. Learning assessment on student's progress records	
C. Observing and assessing the learners by giving a mathematical problem in class	
D. Engaging all the relevant parties through discussions e.g. parents, guardians, and special needs teaching staff among others	
E. Student's diagnostic interviews	

7. Do you use any other procedure to identify dyscalculia?

Part 3: Prevalence of Dyscalculia

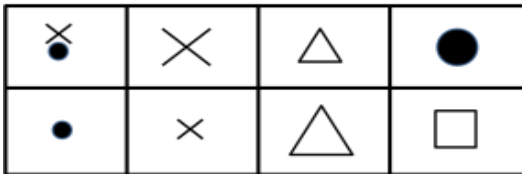
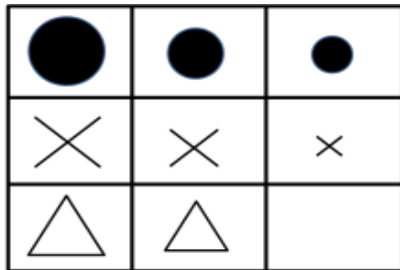
Process of assessing prevalence	Students Involved
Adequate school attendance from the register (Up to 100%)	
Teachers opinions on dyscalculia severe sensory/emotional and auditory/visual functioning among students	
Raven's test of intelligence (students below the first quartile)	
Examining the notebooks with dyscalculia tests (e.g. mental math, memorizing numbers, time estimation, difficulty in reading graphs, and skipping of numbers when reading)	

Raven's Test

A Simple Standard

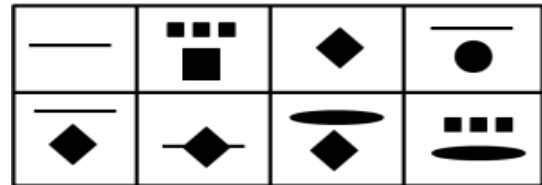
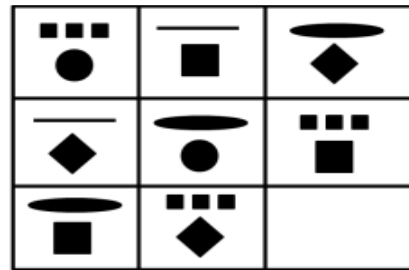
Progressive Matrices Item

Item

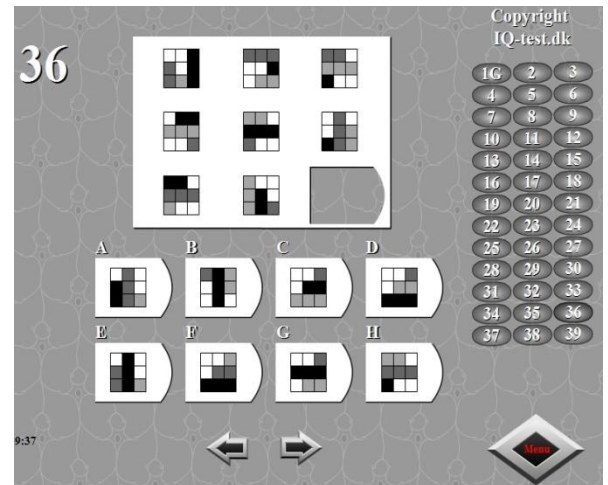
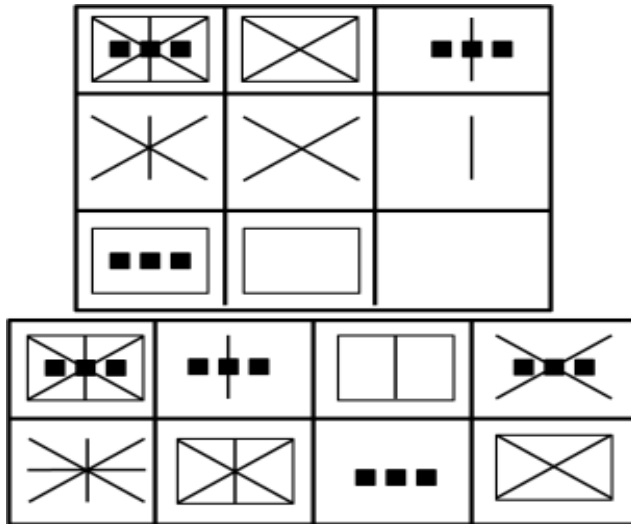


A Moderately simple

Standard Progressive Matrices



A Moderately Difficult
Standard Progressive Matrices Item
Advanced Standard Progressive Matrices Item



Part 4: Challenges Experienced by Teachers in Teaching Mathematics to Learners with Dyscalculia

8. The following statements show the challenges that mathematics teachers face in teaching learners with dyscalculia. Place a tick in the appropriate space on the right statement on your views about the challenges. The Scale: Strongly Agree (SA) =1; Agree (A) =2; Undecided (UD) =3; Disagree (D) =4; Strongly Disagree (SD) =5

Challenges	1	2	3	4	5
High expectations from parents					
Lack of motivation due to poor salary					
Few number of experienced special needs teachers					
Lack of enough teaching materials					
Learners not grasping the concepts fully					
Lack of enough special time to attend the learners					
Learners complete lack of interest in mathematics					
Poor cooperation from parents/guardians/other staff					

9. Suggest more challenges that you face while teaching learners with dyscalculia

Part 5: Possible Intervention Measures and Teaching Strategies That Can Be Undertaken To Improve the Teaching of Mathematics to Learners with Dyscalculia

5.1 Intervention Measures

10. The following statements express the views about the most effective intervention measures that mathematics teachers should use in teaching learners with dyscalculia. Place a tick in the appropriate space on the right statement on your views about the interventions. The Scale: Strongly Agree (SA) =1; Agree (A) =2; Undecided (UD) =3; Disagree (D) =4; Strongly Disagree (SD) =5

Intervention Measures	1	2	3	4	5
Use of ICT can help to improve performance of learners with dyscalculia					
Use of area with minimum distraction					
A classroom with relevant and recent displays					
Reviewing of the previous lessons to improve performance of students with dyscalculia					
Homework and marking should be meant to improve learners diagnosis of the weak areas					
Lesson should be planned such that learners will be allowed to verbalize their thinking					
A conducive environment that increases interactivity among the learners with dyscalculia and the well performing learners during the lesson					

11. As a mathematics teacher, which other interventions do you feel that they are important in enhancing the performance of learners with dyscalculia?

5.2 Teaching Strategies

12. The following statements express the views about the most effective strategies that mathematics teachers should use in teaching learners with dyscalculia. Place a tick in the appropriate space on the right statement on your views about the strategies. The Scale: Strongly Agree (**SA**) =1; Agree (**A**) =2; Undecided (**UD**) =3; Disagree (**D**) =4; Strongly Disagree (**SD**) =5

Strategies	1	2	3	4	5
Relevant and familiar contexts should be linked to mathematics e.g. football tables, indoor and outdoor resources					
Moving to the higher level when a learner has understood the easier contexts; it will thus require more time to do so					
Guiding the learners' practice after giving them explicit instructions in class					
Making use of various models, images, and objects during the lesson					
Allowing children to discuss and explain mathematical concepts to their colleagues to enhance a better understanding					
Encouraging learners to practice using different methods and this also requires availability of different resources					
Sometimes using peer tutoring may assist in delivering the concepts					
Using the estimate-calculate-check routine					
Always having mathematics symbols and terms displayed in the math lesson					
Allocation of more time in explaining the vocabularies such as minus, less, subtract, and take away etc.					
Each stage of teaching should have special time to practice and consolidate different concepts, for instance, 5 minutes of practicing					

13. As a teacher, do you have a suggestion for a possible strategy to be used in teaching learners with dyscalculia in your school?

Part 5: General Comments about Teaching of Mathematics

14. What challenges do you encounter as a mathematics teacher when teaching at different levels in your schools?

Suggest some possible solutions

Thank you

**APPENDIX C: RESEARCH AUTHORIZATION LETTER FROM KENYATTA
UNIVERSITY**



**KENYATTA UNIVERSITY
GRADUATE SCHOOL**

E-mail: dean-graduate@ku.ac.ke

Website: www.ku.ac.ke

P.O. Box 43844, 00100
NAIROBI, KENYA
Tel. 020-8704150

Our Ref: E55/KER/CE/28040/2013

DATE: 30th May, 2018

Director General,
National Commission for Science, Technology
and Innovation
P.O. Box 30623-00100
NAIROBI

Dear Sir/Madam,

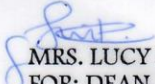
**RE: RESEARCH AUTHORIZATION FOR MS. TALAM JOSPHINE CHEPKORIR –
REG. NO. E55/KER/CE/28040/13**

I write to introduce Ms. Talam Josphine Chepkorir who is a Postgraduate Student of this University. She is registered for M.Ed. degree programme in the Department of Special Needs Education.

Ms. Talam intends to conduct research for a M.Ed. thesis Proposal entitled, "Analysis of Mathematics Teaching Strategies to Learners with Dyscalculia in Public Day Secondary Schools in Kericho County."

Any assistance given will be highly appreciated.

Yours faithfully,


MRS. LUCY N. MBAABU
FOR: DEAN, GRADUATE SCHOOL

JG/bww

APPENDIX D: RESEARCH PERMIT FROM NACOSTI

**THIS IS TO CERTIFY THAT:
MS. JOSPHINE CHEPKORIR TALAM
of KENYATTA UNIVERSITY, 229-40109
SONDU, has been permitted to conduct
research in Kericho County**

**Permit No : NACOSTI/P/18/44599/23814
Date Of Issue : 24th July,2018
Fee Received :Ksh 1000**

**on the topic: ANALYSIS OF
MATHEMATICS TEACHING STRATEGIES
TO LEARNERS WITH DYSCALCULIA IN
PUBLIC DAY SECONDARY SCHOOLS IN
KERICHO COUNTY.**

**for the period ending:
24th July,2019**



.....
**Applicant's
Signature**

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

APPENDIX E: RESEARCH AUTHORIZATION LETTER FROM NACOSTI



NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY AND INNOVATION

Telephone: +254-20-2213471,
2241349, 3310571, 2219420
Fax: +254-20-318245, 318249
Email: dg@nacosti.go.ke
Website: www.nacosti.go.ke
When replying please quote

NACOSTI, Upper Kabete
Off Waiyaki Way
P.O. Box 30623-00100
NAIROBI-KENYA

Ref. No. **NACOSTI/P/18/44599/23814**

Date: **24th July, 2018**


Josphine Chepkorir Talam
Kenyatta University
P.O Box 43844-00100
NAIROBI.

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on "*Analysis of mathematics teaching strategies to learners with dyscalculia in public day secondary schools in kericho county*" I am pleased to inform you that you have been authorized to undertake research in **Kericho County** for the period ending **24th July, 2019**.

You are advised to report to **the County Commissioner and the County Director of Education, Kericho 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.


BONIFACE WANYAMA
FOR: DIRECTOR-GENERAL/CEO

Copy to:

The County Commissioner
Kericho County.

The County Director of Education
Kericho County.

**APPENDIX F: RESEARCH AUTHORIZATION LETTER FROM KERICHO
COUNTY COMMISSIONER**



**OFFICE OF THE PRESIDENT
MINISTRY OF INTERIOR AND CO-ORDINATION OF NATIONAL GOVERNMENT**

Telegrams:
Telephone: Kericho 20132
When replying please quote
kericho@yaho.com

THE COUNTY COMMISSIONER
KERICHO COUNTY
P.O. BOX 19
KERICHO

REF: MISC.19 VOL.III (100)

20th August, 2018

Deputy County Commissioners
KERICHO COUNTY

RE: RESEARCH AUTHORIZATION –JOSPINE CHEPKORIR TALAM

Authorization has been granted to Josphine Chepkorir Talam of Kenyatta University, by the National Commission for Science, Technology and Innovation as per the letter Ref. No. NACOSTI/P/18/44599/23814 dated 24th July, 2018 to carry out research on *“Analysis of mathematics teaching strategies to learners with dyscalculia in public day secondary schools in Kericho County”* for a period ending 24th July, 2019.

Kindly accord her the necessary assistance.


Muktar Abdi, MBS
COUNTY COMMISSIONER
KERICHO COUNTY

CC: County Director of Education
KERICHO COUNTY

**APPENDIX G: RESEARCH AUTHORIZATION LETTER FROM COUNTY
DIRECTOR OF EDUCATION KERICHO COUNTY**



MINISTRY OF EDUCATION
STATE DEPARTMENT OF EDUCATION

Email: cdekerichocounty@gmail.com
When Replying Please Quote:

County Education Office
P.O BOX 149
KERICHO

REF: KER/C/ED/GC/2/VOL.II/

23rd AUGUST 2018.

TO WHOM IT MAY CONCERN.

RE: RESEARCH AUTHORIZATION – JOSPHINE CHEPKORIR TALAAM

The above Student has been authorized by National Commission for Science, Technology and innovation to undertake research on “*Analysis of mathematics teaching strategies to learners with dyscalculia in public day secondary schools in Kericho county*” for a period ending 24th July, 2019.

Accord her the necessary assistance.



PP.

FRED OSEWE
COUNTY DIRECTOR OF EDUCATION
KERICHO COUNTY.