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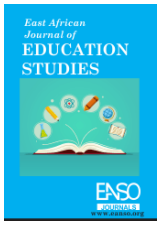

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Original Article

Dyscalculia in Kenyan Schools: Implications for Transition to Higher Education and Employment: Literature Review

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ABSTRACT

This article delves into the impact of dyscalculia on the transition to higher education and employment opportunities, examining both the global context and the specific case of Kenya. It highlights the crucial role of mathematics in everyday life and underscores the significant prevalence of dyscalculia, affecting a considerable portion of the population worldwide, with estimates ranging from 3% to 6%. In the Kenyan context, studies have indicated a prevalence rate of 6.4% among primary and secondary school students. The article sheds light on the challenges many students encounter in pursuing their desired career paths due to the prerequisite of mathematics as a determining factor for qualification in certain fields. Recognising the importance of early detection, the article emphasises the criticality of diagnosing dyscalculia at an early stage, starting as early as preschool, in order to implement timely interventions that can mitigate its impact. Furthermore, the article stresses the necessity of providing adequate training to teachers, enabling them to effectively support learners with specific learning difficulties such as dyscalculia. It highlights the importance of differentiated teaching methods that cater to the unique needs of dyscalculic learners. By employing multisensory approaches and leveraging assistive technology, educators can employ strategies that assist learners in overcoming the challenges associated with dyscalculia. In conclusion, this article underscores the significance of dyscalculia on the journey toward higher education and employment, both globally and specifically in Kenya. By raising awareness about the prevalence of dyscalculia and advocating for early diagnosis and intervention, as well as providing teachers with the necessary training and resources, we can enhance the opportunities for learners with dyscalculia to succeed in their academic pursuits and future careers.

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INTRODUCTION

Mathematics is widely recognised as the most important subject across various fields, including science, technology, commerce, economics, and education. It serves as a foundation for understanding other subjects such as chemistry, biology, and physics. Acquiring accurate arithmetic skills has become essential for functioning in today's technical society (Tella, 2017).

Dyscalculia, a specific learning disability in mathematics, hampers individuals' ability to grasp arithmetic concepts. It is not a reflection of intelligence but rather a difficulty in acquiring vital mathematical concepts necessary for arithmetic activities. Dyscalculia is associated with challenges in numeral understanding, recalling mathematical knowledge, accurate computation, and a comprehensive understanding of arithmetic (Glynis, 2013).

According to Aremu and Taiwo (2014); Nfon (2019); Park (2015); Mokotjo (2017), the significance of mathematics and dyscalculia extends to the socioeconomic well-being of individuals. Proficiency in mathematics contributes to scientific and technical development, impacts an individual's socioeconomic status, self-confidence, and overall character, and opens doors to self-sufficiency and career prospects.

The term "dyscalculia" originated from the Greek and Latin languages, meaning "counting badly" (Khing, 2016). It encompasses a range of conditions that result in specific challenges in mathematics, such as difficulty with number learning, arithmetic computation, and understanding numerical facts.

According to the American Psychiatric Association (2013), dyscalculia is a specific learning impairment characterised by difficulties in numeral comprehension, mathematical memory, accurate computation, and arithmetic understanding. Dyscalculic individuals often struggle with number comprehension, place value, and the sequential arrangement of numerals. They may face difficulties with tasks involving reading, writing, and understanding the sequence and placement of numerals. Specific interventions are necessary to prevent academic failure and support dyscalculic individuals in their educational journey (Trott, 2018). In Kenya, mathematics holds great importance in the school curriculum, affecting both day-to-day living and career opportunities. Unfortunately, substandard performance and negative perceptions surrounding mathematics hinder many learners from pursuing their desired careers. The Kenya Universities and Colleges Central Placement Service (KUCCPS) uses mandatory subjects, including English, Kiswahili, and mathematics, as criteria for admission to higher education institutions. This results in learners being unable to pursue their desired programs despite meeting the minimum admission requirements (Ndori, 2023).

Studies on the prevalence of dyscalculia indicate rates ranging from 5% to 8 % (Geary, 2004). However, dyscalculia remains understudied and under-resourced compared to other learning disabilities like dyslexia. Limited research has been conducted in Kenya, further hindering the

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promotion of early identification and screening of dyscalculia in educational institutions. The impact of dyscalculia on individuals' transition to higher education and the world of work remains largely unexplored. The article aims to examine the global and Kenyan perspectives of dyscalculia, including its components, importance, aetiology, characteristics, identification, types, intervention strategies, accommodations, and influence on mathematics and individuals' academic and professional lives. Overall, understanding dyscalculia and its effects is crucial for developing appropriate interventions, supporting affected learners, and enabling them to succeed academically and in their future careers.

Concept Of Dyscalculia and Learning Disabilities

According to Khing (2016), the word dyscalculia originated from Latin and Greek languages. In the Greek language, *dys* is translated to mean badly, while *calculia* in the Latin language is translated to mean count. Thus, the word dyscalculia can be stated as counting badly. The Czechoslovakian investigator Kosc (1974) explained dyscalculia as challenges in arithmetics due to a disability to specific areas in the brain associated with arithmetic cognition with nonrelated challenges in intellectual activities. According to Glynis (2013), the word dyscalculia is utilised to explain particular challenges in mathematics and it does not imply a lack of intelligence but more of a challenge to gain vital concepts that lay a foundation for abilities needed to carry out arithmetic activities.

According to Emerson & Barbitie (2010), dyscalculia is a broad word utilised to symbolise a variety of conditions that bring about particular challenges in mathematics, including advancing dyscalculia, arithmetic impairment, number learning impairment and numeral fact disability, among other terms. Kunwar and Sharma (2020) stated that dyscalculia is a particular learning challenge that impacts an individual's capability to remember arithmetic abilities associated with computing numerals but not in every area of mathematics. According to Mangal (2007), dyscalculia is a commonly utilised word for learning challenges and problems in arithmetic faced by learners with learning impairments. It is a particular learning impairment in which learners encounter serious challenges when acquiring arithmetic abilities.

According to the American Psychiatric Association (2013), dyscalculia is a particular learning impairment and a form of hindrance in arithmetic that shows challenges in numeral understanding, recalling of mathematics knowledge, correct and definite computation, and correct arithmetic understanding.

According to the Learning Disabilities Association of America (LDA, 2022), the word learning difficulties that is also called learning impairments, is a broad term that incorporates a number of brain-related conditions in understanding and several levels of severity of such conditions. According to the Individuals with Disabilities Education Act (IDEA) (2004), the word-specific learning condition is an impairment associated with several fundamental cognitive processes concerned with comprehending or utilising language, either by speaking or writing. The condition may portray itself as difficulty in listening, thinking, speaking, writing, spelling, or performing arithmetic computations.

According to Trott (2018), dyscalculics usually have a minimal understanding of numerals and have constitutional problems with operations and numeral relations. They may have problems with place numbers and are usually routine students as theoretical comprehension of arithmetic is hard. Reading and writing numerals is difficult for them as well as comprehending the sequence of numerals and orderly placement of values in the numeral line. According to Salzer and Heine (2016), particular interventions are required in dyscalculia so as to prevent scholarly failure and failure to attend classes.

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According to Chinn& Ashcroft (2017), learning impairments in mathematics are of various types, like challenges in gaining learning protocols, theoretical processes of basic concepts, or both. According to Hornigold (2015), several learners may have trouble with given topics of mathematics, algebra or geometry and may also portray usual arithmetic problems in numbers and mathematics inadequacies, including computation.

Prevalence Rate of Dyscalculia

There are various studies on the prevalence rates, whereby according to Morsanyi et al. (2018), it was 5.7%. According to Butterworth (2002), the prevalence of dyscalculia was between 5% and 6%, while according to Geary (2004), the prevalence ranged between 5% and 8%. According to Träff et al. (2017), dyscalculia is under-studied and under-resourced in comparison with dyslexia. It is approximated that dyscalculia occurs between three and six per cent of the inhabitants and does not have any gender discrepancies in comparison to other particular learning impairments. Dyscalculia is a multifactorial condition as many components contribute to its diagnosis.

A study done in Kenya on the prevalence rate of dyscalculia by Chepkorir (2020) established that about 6.3 %of learners in public day secondary schools in Kericho County, Kenya had dyscalculia. Mariera (2021) found out that the prevalence rate was 6.4% in Muranga County, Kenya.

According to Hornigold (2015), about twenty-five per cent of learners in a classroom will likely strain due to arithmetic challenges at various times during their education. The common problems in mathematics were: remembering number facts, time tables, backward counting, decimals and percentages, time telling, and computations associated with money and fractions. Most of such challenges can be managed with extra support and thorough interventions.

RESEARCH STUDIES ON DYSCALCULIA IN KENYA

Chepkorir (2020) carried out an investigation to determine intervention strategies and tutoring methods that will promote tutoring of mathematics in the public day high schools in Kericho County. The investigation concluded that the methods used to tutor mathematics, including incorporating lessons, problem-solving, logical, rational, and inductive strategies fell short of providing the educational needs of learners with dyscalculia and the Ministry of Education should design syllabuses that were inclusive so as to cater for particular educational requirements for these individuals.

According to Nyaga (2012), who carried an investigation on the effect of education support methods on scholarly achievement of students with dyscalculia based on selected preparatory institutions using the British national curriculum in Nairobi, Kenya, found that investigations done at the university level limited in amount compared to those in primary and high school levels.

According to Waiganjo (2013), who carried out a study on the utilisation of information communication technology (ICT) to assist dyscalculic learners in Kenyan primary schools, found that not only would the use of ICT assist in improving mathematics achievement but also the incorporation of the tutor's perspective, knowledge, technological software, and hardware need to be considered to ensure proper utilisation of ICT for dyscalculic learners.

A study done by Mariera (2021) on the effect of self-assurance on mathematics achievement among learners with dyscalculia in public high schools in Murang'a, Kenya, indicated that these learners with dyscalculia have low self-assurance in several mathematical sections. Thus, it was found that there is a connection between the stage of self-assurance for mathematics and mathematics achievement. The investigator suggested frequent screening for the identification of learners with dyscalculia be

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performed in every high school. Thus, the need for creating evaluation tools to be used by tutors in learning institutions.

Kahenya (2021) conducted a study based on the effect of tutor factors on the arithmetic achievement of scholars with dyscalculia in primary public institutions in the Starehe sub-county, Nairobi. This study found out that most of the mathematics tutors in the sub-county have a lot of tutoring knowledge, but only a few had gained formal instruction in special education. The investigation suggested that the government, via the Ministry of Education, should try and arrange in-service instruction for primary school instructors on dyscalculia. In conclusion, they found out that tutor factors massively impact learners' achievement, although to a small level in comparison to tutors' perspectives, tutors' assignments, and tutoring knowledge.

According to Garbutt (2018), who carried out research on instructors' knowledge and support for students with learning difficulties for efficient inclusion education in public learning institutions in TransNzoiacounty, Kenya, found out that regardless of the tutor's knowledge of learning difficulties, this did not ensure efficient inclusion in primary public institutions as a result of lack of backing from the institution's leadership representatives. Hence the investigation suggested that tutors should be given instruction on learning difficulties (LD) while the institution's leadership should offer architectural backing for LD, and the Ministry of Education should alter the syllabus to focus on the requirements of LD students. According to Ndori (2022), in Kenya, arithmetic is one of the most vital units in the school syllabus as it plays a major role in day-to-day living. Substandard performance and negative perception in the unit is a problem of important relevance not only to schools but also to institutions of higher learning. Thus, every year many learners who attain the set university entry score cannot pursue their coveted careers, and others are unable to secure placement as arithmetic is still a vital necessity to pursue many courses.

The Kenya Universities and Colleges Central Placement Service (KUCCPS) usually decides on the learners who will attend higher education institutes and receive government funding. It affirms that mandatory units, including English, Kiswahili and mathematics, will be utilised as a gauge of excellence whereby the average score is the only admission necessity. The effects of this are that a learner can attain a C+ in KCSE, which is a minimal necessity for higher institutions admission but is unable to acquire their coveted program. This has led KUCCPS to avail another option for learners to enable them to change their professional choices for those who were unable to acquire their coveted programs Ndori, (2022).

More than fifty per cent of individuals that did the Kenya Certificate of Secondary Education examinations in 2022 scored D and E in arithmetic. Learners who are choosing degree and diploma programs are undergoing a tough time following their desires with regard to the realities of their achievements. For example, a learner who attained an average mark of B+ but a D+ in mathematics cannot apply for any health sciences or a bachelor of education program. Kenyan professional and regulatory agencies have placed thorough regulations for those willing to join the various programs whereby mathematics is one of the vital subjects that is considered. The numbers of dyscalculic learners entering higher learning institutions are few because of the admission qualifications required so as to transition from high school education to colleges and universities. Our Kenyan schools have a role in ensuring good grades for students to transition to higher education with an understanding that it will have an effect on their career choice (Karau, 2023).

AETIOLOGY OF DYSCALCULIA

According to Plessis (2022) and Mazzocco & Thompson (2021), there are various causes of

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dyscalculia, like genetics, whereby it can be passed on in families. Whereby among identical twins, there is a 58 % chance both can get dyscalculia and a 39% chance of occurrence in fraternal twins; thus, there exists a connection between dyscalculic parents and siblings. Cognitive deficits are also a cause of dyscalculia whereby studies have shown that without the vital foundational math abilities of visual memory, visual-spatial memory and working memory, attention and logical abilities can predispose to dyscalculia. Deficits in math abilities like basic arithmetical analysis can predispose one to dyscalculia since there are usually various skills that a learner must understand, including multiplication, division, addition, fractions, reading and subtraction. Learners with dyscalculia are usually prone to getting mathematics anxiety which is a negative backlash related to unfavourable feelings. They tend to feel tense, mental confusion, helpless and gloomy when they are called upon to work on arithmetic or math questions (Kunwar, 2021).

According to Plessis (2022), another cause of dyscalculia is brain differences, whereby studies that have been carried out indicated that defects in the right parietal lobe contribute to dyscalculia. Scientists using transcranial magnetic stimulation (TMS) to induce neuronal activity disruption specifically to the right intraparietal sulcus led to non-dyscalculic participants developing temporary developmental dyscalculia. According to Willburger & Schwenk (2022), environmental factors like predisposing the child in the uterus to alcohol can lead to dyscalculia. According to Shavel (2004), being preterm or having low birth weight may predispose one to dyscalculia.

Sharma (2020) stated that ecological aspects like minimal participation, poor teaching methods, absence of practice, substandard syllabus, and poor level of understanding of the topic, among others, lead to problems in understanding arithmetic. According to Courtade, Test, & Cook (2015), others have arithmetic learning problems including lagging in understanding numerals and confusion of place values of numerals.

Characteristics of Individuals with Dyscalculia

According to Kaufmann and Aster (2012); Yoong & Ahmad (2021), dyscalculia has various challenges related to mathematics, and hence its features differ with regard to each individual. It is recognisable before the child begins schooling, which is when they are acquiring mathematical educational abilities and proceed all the way to adulthood. Features of dyscalculia in children who have not started school include difficulty understanding computation, challenges in understanding arithmetic, difficulty to categorise and quantify, challenges recognising images related to numerals, wrong figures, reverse numbering, writing inaccuracies, pronunciation inaccuracies and challenges categorising objects.

According to Kaufmann and Aster (2012); Price & Ansari (2022); Kunwar (2021), features of primary school-aged children with dyscalculia include challenges understanding mathematical figures and words, challenges understanding and recalling steps followed in solving simple questions, challenges analysing mathematical questions and also have general challenges telling time and have poor orientation. Some features of dyscalculia in secondary-going learners including difficulty incorporating mathematics in daily activities, challenges quantifying variables, and difficulty comprehending graphs or arithmetic representations. It is vital to say that not all individuals with difficulties doing arithmetic equations have dyscalculia, and it is important to recognise the frequency of symptoms. Dyscalculia is not always associated with arithmetic equations individuals may have challenges with day-to-day activities or usual games.

Types of Dyscalculia

According to Kosc (1974); Kunwar & Raj (2012); Kunwar (2021); Kaufmann & Von Aster (2021),

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there are several varieties of dyscalculia including vocal dyscalculia that are defined by trouble mentioning and learning arithmetic concepts shown verbally. These individuals can read or write numerals but have challenges knowing them when provided verbally. Practognostic dyscalculia is defined as having challenges when deciphering a theoretical mathematical concept into a valid concept. These individuals know arithmetic concepts but have challenges listing, comparing and analysing arithmetic equations. Lexical dyscalculia is associated with challenges in reading and comprehending arithmetic figures and numerals, and mathematical expressions. These individuals can comprehend the concepts when vocalised but have challenges writing and comprehending.

According to Kosc (1974); Wilson (2021); Butterworth (2021), individuals with graphical dyscalculia have challenges writing arithmetic symbols whereby they can comprehend arithmetic concepts, but they are unable to read, write or utilise the corresponding right figures. Individuals with Ideognostical dyscalculia have trouble performing intellectual operations without using numerals to answer arithmetic problems and comprehending arithmetic concepts. They also have difficulties recalling arithmetic concepts after mastering them. Individuals with operational dyscalculia have trouble completing written or vocalised arithmetic calculations. They can comprehend the numerals and the relationships between them but will have challenges manipulating numerals and arithmetic figures in the computation procedure.

EVALUATION OF LEARNERS WITH DYSCALCULIA

According to Adhikari (2014); Michealson (2007), there are three well-documented ways of evaluating dyscalculia. The learner's chronological age is one of the strategies used to determine if one has dyscalculia. It is done by giving a formal assessment test to determine if the individual has adequate arithmetic abilities with regard to their age. Tutors can diagnose dyscalculia if either one of the following situations is noted, including if there is a deviation between the cognitive capacity of the individual and the outcomes of the examination and if there is a notable discrepancy, mostly if there is about a two-year grade difference between an individual's grade and their mathematics ability. Since both of the described situations tend to generalise the assessment of dyscalculia, some learners may be inaccurately diagnosed as being dyscalculic and yet may have other learning impairments.

According to Adhikari (2014), the second way of determining if someone has dyscalculia is the direct observation of dyscalculic mannerisms, including undeveloped methods for dealing with challenges, calculation mistakes due to a poorly functioning memory duration, inaccuracies in long-term remembrance of mathematics concepts, diminished rate of understanding fundamental arithmetic abilities, not able to know the computation of adding and multiplying, increased rates of careless mistakes and challenges with visual and structural operations. This assessment method may misdiagnose non-dyscalculic individuals as dyscalculic.

According to Adhikari (2014); Butterworth (2003), the dyscalculic evaluator created by Butterworth in 2003 is the third method utilised to determine if an individual has dyscalculia, but it is not affected by other contributing factors that lead to an incompetent performance in numeracy. This method was created to determine an individual's level of innate arithmetic understanding by the use of simple examinations that utilise the calculation of dots and the comparison of numerals. It is a software design for evaluating the natural expertise of individuals aged 6 and 14, as people have a scientific tendency to acquire a basic level of comprehending numbering concepts and fundamental arithmetic abilities innately with no formal learning. This program tests three different areas and, depending on how fast and accurately an individual responds on average in sections like dot

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numeration, number correlation and mathematical performance that is age-related to determine if one has dyscalculia. Hence an individual with dyscalculia will have a poor score in dot numeration and numeral correlation and an average score in the mathematics performance exam, while a non-dyscalculic individual with poor mathematic abilities will have a higher score in the dot numeration and numerical correlation exams with poor score in the mathematic performance exam. A dyscalculic evaluator is a great tool that can be used to recognise dyscalculia in children, but some institutions may not be in a position to apply it as it is expensive, among other social factors.

According to Gifford (2005), diagnosing wholesome cases of dyscalculia is difficult as there are many areas of a child's developmental stages that may infringe on their awareness of numeracy. They assert that using more than one method for the assessment might actually increase the reliability of the diagnosis.

Rababah & Alghazo (2016) investigated the effectiveness of implementing a diagnostic assessment strategy of instruction in helping students with dyscalculia improve their mathematical abilities. Two treatment groups and one control group were randomly selected and given instruction in mathematics for a period of two months. The findings revealed that students who were in the treatment groups and received diagnostic assessment-based instruction showed more improvement than students in the control group, which suggested that the diagnostic assessment strategy was effective in significantly improving dyscalculic students' mathematical abilities.

Role of Mathematics

According to Abd Algani (2019); Lubienski (2021); Greenes & Cavanagh (2022), arithmetic is vital in various sectors of daily life. For instance, communal progress has helped in the revolutionisation of the framework of the community in terms of means of transport, modes of communication and developments both scientifically and technically. Arithmetic has also helped in the advancement of cognitive abilities as when one is able to deal with an arithmetic problem, their brain is activated and in the process of solving it their mental capabilities are developed in this manner. This leads to boosting one's will, self-esteem and persistence. Arithmetic also helps in professional advancement as it is a vital unit that tends to determine the given career one can pursue in institutions of higher learning. Since the value of learning is to aid learners to earn a living and become independent. Arithmetic understanding also plays a part in aiding a learner's ethical development as it helps in building their identity and nature. Arithmetic knowledge also seems to play a part in the advancement of meditation strengths. Figuring an arithmetic question is satisfying, in particular, if one is able to get an accurate response to the problem at hand. Hence each learner is able to be self-sufficient.

Abd Algani (2019); Boaler (2020); Turgut (2020); Niss (2022) states that arithmetic may assist a learner in understanding how it contributes to the development of civilisation by promoting the consecration of individuals' existence and visual arts. Arithmetic has also played a part in the advancement of the learning system as it helps in shaping young individuals' goals. It helps these individuals to be able to decide whom they want to be and define their socioeconomic role, as arithmetic knowledge is needed in several careers like agriculture and banking, among others. Arithmetic has also been assisting in the scientific and technical advancement of architecture since it is vital in the construction of roads, buildings, aeroplanes, vehicles, and dams, among others. Arithmetic methods have been incorporated in the education of medicine and physics, among others; thus, arithmeticians are vital in high-level institution math learning.

Arithmetic has been utilised in scientific and technological progress. Arithmetic has also boosted

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the advancement of medicine and agriculture, whereby it has been used in the construction of equipment used in diagnosis and management, including sensing technology. In agriculture, it has helped in ensuring there is improvement in food security by boosting the creation of drought-resistant foods via technological According to Tella (2017), mathematics study is recognised worldwide as the most important subject in most fields of human ventures. Its practicality in science, technology, commerce, economics, education and even humanities is almost at par with the importance of education as a whole; it is also key in the understanding of other subjects such as chemistry, biology, and physics. This indicates that in order to operate adequately in the community and in this technical time, one has to have an accurate arithmetic understanding.

According to Aremu and Taiwo (2014); Nfon (2019); Park (2015); Mokotjo (2017), mathematics is vital to the prosperity of any state. Arithmetic is an important basis in the scope of science and contributes to science-based and technical development. Understanding mathematics is a vital ability that may alter future lifetime education and employment chances. Mokotjo (2017) and Mavesere (2014) emphasised the vitality of arithmetic in the community whereby mathematics may directly affect an individual's socioeconomic class, self-confidence and character of a person and are a basis for self-sufficient life and career prospects.

Components of Learning Mathematics

According to Kunwar (2021); Lobato (2020); Weber (2021), mathematics is a vital unit that involves numerals, proportions, probability, and algorithms. In order to understand mathematics, one needs three chronologically ordered elements that can assist in changing arithmetic approaches, theories, and comprehension. These elements include the language which is utilised in order for one to understand arithmetic, as it helps in passing information in terms of the arithmetic jargon, notations, theories, and methods. Language assists learners in transferring from concrete arithmetic abilities whose basis are tangible objects to figurative arithmetic based on numbers. The conceptual element plays a role in assisting individuals in understanding arithmetic by providing the correct definitions with the intention of increasing literacy in arithmetic, not just educating them to get answers. Conceptual education helps learners to apply their understanding to other areas and contexts efficiently. The procedural element plays a role in the understanding of arithmetic as it is based on the application of methods correctly, effectively, and easily in various issues and contexts and also being able to know which methods can be applied in a given situation. The procedural element can be utilised efficiently when the conceptual element is competent.

Impact of Dyscalculia on Learning Mathematics

According to Kunwar (2021); Menon (2016); Dowker (2005), dyscalculia affects learners from the early days of schooling, whereby they are unable to understand arithmetic and also day to day living functions as they lack fundamental mathematical theories, including poor numerical understanding and analysation. Dyscalculia also affects individuals in several sectors of arithmetic including formation of a negative perception hence cannot perform tasks like defining distances, routes, depths, locations, big and small numerals, demoralisation and inability to understand arithmetic due to poor comprehension of arithmetic theories, regulations, formulae and accurate ordering, inability to focus for an extended duration on cognitively taxing activities, developing problems in day to day living because of poor numeral understanding among other arithmetic abilities, reduction of the self-sufficiency of a student in understanding arithmetic because of persistent issues associated to quantity, time, length, acceleration, computation, cognitive arithmetic and recalling numerals, development of

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low self-efficacy and hesitation to elaborating their opinions associated with cognitive mathematics and number computations and being sad and demoralised because of absence of basic arithmetic capabilities like recalling numeral facts, schedules, computing backwards among others.

According to Kunwar (2021), students with dyscalculia find it difficult to qualify in academic units that are associated with a quantitative intellect, like arithmetic, statistics, and science. Learners with dyscalculia have trouble comprehending arithmetic theories and utilise them in day-to-day life Learners with dyscalculia may become anxious, frustrated, and have low self-regard, which will affect their scholarly achievement.

According to a study by Drew (2016) on the ordeals faced by learners with dyscalculia in institutions of higher learning, he found out that it was vital to understand support providers in their role of dealing with arithmetic anxiety, classification of learners with dyscalculia in universities, various educating methods of learners with mathematics difficulty and literature difficulties, presence of four features of dyscalculics that have not been studied, comprehension of time, understanding the presence of numerals which are not whole and also non-essential numerals.

According to Kumar &Raja (2012), dyscalculia can be managed with relevant backing, advice, and interventions both at home and in learning institutions. Once learners with dyscalculia are recognised, caregivers and tutors should ask for assistance from certified specialists. Knowledge about dyscalculia can help caregivers offer the necessary strategies and appropriate surroundings and be enlightened that each learner understands at their own time and should not be overworked beyond their capability. Once tutors understand the problems of dyscalculic learners, they can come up with proper teaching methods, including new inventions, in order to accommodate their particular needs.

Interventions Measures for Learners with Dyscalculia

According to Nyaga (2012), there are a variety of education modes used for individuals with dyscalculia. The most common cause of arithmetic conditions that affect people with median or above-average cognitive abilities is due to inability to gain arithmetic basics at school. A variety of individuals with dyscalculia require to be educated in several ways, and each student needs a given duration of time in order to grasp the needed standards of arithmetic knowledge. Researchers are aware that even poor arithmetic performances can be ameliorated to an extent by utilising remunerator methods and well-structured regulations to improve their flaws. Students with dyscalculia require a well-structured education program so as to promote hands-on participation for all learners, as this leads arithmetic to become a positive education experience, as numerical procedures are theoretical and tiresome. Learners with dyscalculia comprehend education procedures by use of concrete objects that help the arithmetic issue-solving procedure clear, but these learners are also needed to comprehend similar theories, principles, and abilities from the regular syllabus. The use of various education strategies enables tutors to cater for different individual issues into consideration when arranging and teaching arithmetic classes, as individuals with dyscalculia find theoretical questions hard and hence cannot be able to comprehend and associate different arithmetic ideas with day-to-day circumstances.

According to Nyaga (2012), the utilisation of multiple sensorial education methods for individuals with dyscalculia assists them in recalling arithmetic theories by relating several senses. This assists the memory of individuals with dyscalculia to associate definitions of random words and figures easily. Any education strategy used for dyscalculic learners must be specific and related to purposeful education and in ensuring that the information given is sufficient for each

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individual's requirements, capabilities, and advancement. The visual audio kinesthetics tactile multisensorial educating strategy assists individuals with dyscalculia to recall and adopt key wordings utilised in an arithmetic sentence. In this education strategy, visual is associated with observing what the tutor does; audio is associated with the listening ability of the student, while kinaesthetically tactile is related to the ability to sense the side of the student. If students do not relate values with numbers, they may not understand place numbers, and if they do not comprehend multiplication, they will not recall associated facts. Multi sensorial educating strategy realises that using the conventional method that consists of the tutor elaborating and the learner listening is an ineffective method of educating students with dyscalculia since these students use only one sense which may cause poor comprehension of the theories; thus, they need to learn using multiple senses.

According to Jane (2014), the use of specialised educational resources like assistive technologies that include assistive and therapeutic equipment for learners with dyscalculia can help them manage the need to understand arithmetic in a traditional class setup. She states that documented lessons are transparent, and the student with a problem understanding mathematics will be able to understand since the videotaped classes and demonstration materials ensure that a link is able to be achieved between the numerical procedures and day-to-day life situations. According to Cook and Hussey (2002), assistive equipment like computer programs can help in setting up graphical user interfaces that change the hues and dimensions of desktops, and alternative icons, among others. Other equipment are monitor illuminators, monitor readers, and self-talking programs literature checkers, among others. According to Doyle (2010), the use of altered exams and evaluations is vital as a teaching strategy as there is usually a discrepancy among learners in terms of intellectual capabilities and comprehension of arithmetic theories. Hence a tutor should not assess a learner's ability to comprehend by basing it on if the student gives an accurate response but more on the intellectual level and the methods used by the learner to come up with a response. Thus, the tutor can also interrogate the learner on his understanding of how to solve the given question so as to be able to understand how he came up with an inaccurate response. According to Jane (2014), well-organised alterations of tests while incorporating scholarly strictness are vital so as to lay an even playing field among the various learners.

According to a study by the Open University of the United Kingdom (2005), it was found that if proper alterations to examinations were made, it would play a major role in supporting learners with dyscalculia. These alterations would include allocating about twenty-five per cent more time to do examinations and alterations of the surroundings. Also, the tutors should not be fined due to poor numerical processes unless they are being evaluated and form the foundation of the unit. The alterations to examinations need to incorporate well-articulated questions that do not use jargon expressions. The study suggested that caution should be taken when altering examinations, as excessive flexibility may end up being counterproductive.

According to Gardner (1983) and Jensen (1998), the use of specialised tasks and classroom tests as a teaching method is vital as there exists a link between a learner's performance and a tutor's capability to define a learner's capacity level and hence offer adequate tasks and class tests. Thus, more efficient education occurs when the task framework offered by the tutor is up to par with a learner's level of advancement. According to Byrnes (1996), when learners with dyscalculia meet tasks which are well organised at reasonable levels of difficulty, they can maintain their persistence to understand even if it is challenging.

According to Chinn (2020); Yeo & Butterworth (2004), students with dyscalculia perform well if they are taught at a slower rate by using appropriate educating materials since these students require

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more time to comprehend concepts, individualised explanations, and specific methods to deal with assessments. According to Savage & Hawkes (2000), students with dyscalculia have to be inspired to study, listen, vocalise, visualise, and touch examples in particular tasks using the multi-sensorial method.

According to Henderson, 2012, learners with dyscalculia need adequate intervention strategies whereby they need to be evaluated on a given issue, then intervention can be done for dyscalculia, and then the outcomes of the intervening method can be assessed. According to the National Centre for Learning Disabilities (2007), there are some interventions that can be utilised to cater for the individualised requirements of learners with dyscalculia, for instance, using a fundamental four-functional calculator on exams, offering more time and a quiet surrounding, using of note writers, using a teacher and offering formulae sheets.

According to Kunwar (2021); Kumar & Raja (2012), there are various methods that can assist learners with dyscalculia like early recognition and intervention, whereby it is vital to discover dyscalculia in good time so as to be able to offer adequate assistance and adaptations like working with a facilitator or scholarly support system, utilising assistive technologies, and offering more time for tests. Offering teaching assistance like teaching them in small groups, offering individualised teaching, or peer advisory can help learners with dyscalculia to comprehend the concepts and also increase their esteem.

According to Kunwar (2021); Fletcher (2007), positive encouragement can assist learners with dyscalculia to feel inspired and involved in their education process. It is vital to make comprehension of a given arithmetic concept enjoyable as poor comprehension leads to anxiety hence incorporating games by use of concrete objects like dominoes, dice among others, will make comprehension of these concepts enjoyable and also help in familiarising one with the image of a dice and the dot designs of dominoes.

According to Kunwar (2021), learners with dyscalculia spend a longer duration at home than in learning institutions, and hence they have a stronger bond with their caregivers. Thus, they can play a part in being their support system. They can inspire their children by narrating their narratives of success in comprehending arithmetic. They can offer enough time to their children to enable them to play and have fun in activities they like. They can offer advice if the child is undergoing depression, anxiety or is demotivated, and they can also recognise the challenges the children are facing. They can also make an effort to know their children's passions. They can also assist their children with homework and in arranging for them their schedule so the children will have ample time for relaxing and school work.

According to Kunwar (2021), tutors can;

- Offer extra backing methods for the learners with dyscalculia in the classroom setup. They can help in dealing with the learner's anxiety since they are aware of the challenges these learners face in arithmetic.
- Offer enough supportive aids for educating arithmetic which can assist learners in overcoming challenging issues. They should concentrate on arithmetic games, puzzles and actions that can assist in eradicating notions that arithmetic is a hard unit and assist learners with dyscalculia to enjoy and be interested in understanding arithmetic.
- Help promote a positive attitude in the students by inspiring, praising and assisting them in advancing in the various activities in the class setup. Tutors should amend their lessons and utilise tangible life examples to make them simpler to comprehend and more recognisable.
- Utilise task analysis so as to assist learners with arithmetic difficulties by offering consistent

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additional help to these learners. Tutors can offer adequate time to practice in challenging areas in arithmetic.

Transition into Institutions of Higher Learning

According to Trott (2018) based on an investigation done on the progression of learners with dyscalculia to university level and employment areas showed that the number of learners with dyscalculia proceeding to university was minimal, while learners that qualified at GCSE arithmetic and later went to university progression was challenging. According to Trott (2015), a large number of learners are identified as having arithmetic difficulties while pursuing their higher education. There is therefore need to diagnose through standardised tests so as to be able to offer adequate interventions. Recognition of arithmetic difficulties is composed of interviews and a numeral-focused comprehension or operational arithmetic exam. The interviews should utilise a subjective method by creating an image of the learner's past and present level of performance. The arithmetic exam used should be based on the comprehension of theories and numerical connections. It should be adaptable to suit the individual learner's needs so as not to create unnecessary strain for those who had been exposed to stressors at earlier ages. According to Iansyst (2017), the dyscalculia screener can be utilised as a tool to diagnose learners with arithmetic difficulties. Once they have been diagnosed, a standardised test is administered. According to a study done by Trott & Chinn (2017), about twenty per cent of learners joining institutions of higher learning had no understanding of arithmetic content or the associated challenges in arithmetic based on their chosen program.

Evans &Ellen (2003), based on a review they did on several investigations on dyscalculia, indicated that learners with learning difficulties were fulfilled with the adaptations they had acquired in their college-associated mathematics units. According to a study done by Toppel (1996) on the impact of a labelling plus diagramming method and a labelling-only method on the arithmetic word challenge-solving mechanism of university learners with learning difficulties indicated that only six learners of the labelling plus diagrammatic cohort did not advance their skills of solving arithmetic associated word challenges but for those who were in the labelling only cohort just two out of the seven were able to advance their skills.

Transition into Employment

According to Tobias (1993), many individuals are hindered from occupational and individual job opportunities due to their anxiety or poor performance in arithmetic. According to Sheffield and Hunt (2007), arithmetic anxiety is an important component that must be considered during the progression to employment. Arithmetic anxiety is described as stressor associated reaction by some people when they encounter an arithmetic task. These reactions are mental, physical, and biological that result in anxiety, hopelessness, and worry. According to Beilock (2011), arithmetic anxiety affects the functioning of memory, which then contributes to the inability to perform arithmetic tasks. Arithmetic anxiety can be lifelong, which may lead people to stay away from arithmetic challenges rather than deal with them or ask for assistance.

CONCLUSION

Arithmetic is a vital subject in various aspects of day-to-day living, including in communal progress, progression to higher education and employment, revolutionisation of the framework of the community in terms of means of transport, modes of communicating and developments both scientifically and technically, among others. There is, therefore, a need for early diagnoses of dyscalculia for early intervention so as to bridge the gap and in the progression of individuals to their career prospects and employment opportunities. There is a need for the government to train teachers on how to handle learners with specific learning difficulties, such as dyscalculia and dyslexia,

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among others. Further studies should be conducted on the impact of dyscalculia in higher education in Kenya.

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