

# Online Education Adaptability for South African Learners with Dyscalculia and Dyslexia using Digital Learning Methods

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## Abstract

While the United Nations Sustainable Development Goal 4 defines equal and inclusive education, countries in the Global South, including South Africa, have a long way to go to achieve this goal. South Africa has a unique political and historical narrative, and three decades after apartheid, there remain stark differences in education. This research focuses on learners with learning disabilities, such as dyscalculia and dyslexia. The introduction of digital technologies within higher education institutions excludes these learners, as the adaptability of digital learning techniques has not been considered for specific learning disabilities. The challenges are now heightened. Although primary studies have been conducted in the past, no definitive solutions have been established for the seamless integration of these learners into mainstream education. Hence, a different research approach was undertaken. An expansive review of existing scholarship was conducted using online academic resources and search platforms such as Google Scholar, Scopus, and EBSCOhost. The purpose was to engage with global literature responding to South African-specific issues. A discussion and comparison of available resources and tools were outlined and structured according to the inclusion and exclusion criteria. The study was underpinned by the universal design for learning theory. Global research indicated the availability of online tools that were too expensive for South African education and incompatible with the lack of technological skills and infrastructure. Popular and effective tools, including augmented reality and gamification-type applications, have seen positive results

but are currently impractical for South African usage. The literature provided adequate information to develop an introductory clinical sociology intervention and embark on a process of awareness and support for educators and affected learners.

**Keywords:** Digital tools, dyscalculia, dyslexia, education, South Africa

## 1. Introduction

Although South Africa is a developing country, education must be a strategic priority to improve its socio-economic landscape. Quality education can improve socio-economic conditions and contribute to the economy (Andrews et al. 2021). Education under the apartheid regime in South Africa was racially divided but also split learners according to (dis)ability, with a well-resourced, unique education system for white learners with disabilities (Walton & Rusznyak 2014).

The emphasis on an inclusive education system connected to human rights and dignity principles and respecting equal rights to high-quality education without discrimination led to a transformation of education policies after 1994 (Andrews et al. 2021; Stofile et al. 2018). The Department of Education's White Paper 6 (2001) addressed the economic case for inclusive education by stating that the system for students with disabilities—which accounted for 20% of all students with disabilities in special education settings in 1994—was inefficient and costly. Expanding educational opportunities for students with a range of educational requirements was the goal of the Department of Education (2001). This includes structural and environmental barriers to learning in a mainstream educational system that is democratic and specifies that education for students with disabilities should be more affordable and accessible to learners who were previously marginalized. Therefore, developing adequately trained teachers as the primary resource for learner diversity and inclusion in mainstream classrooms is vital.

Additionally, educational policymakers should implement strategies for both school-based and district-based support systems, ensuring the availability of the necessary resources in school. (Department of Education 2001). Strategies were implemented at the system level to ensure the gradual implementation of inclusive

education. These strategies included creating support teams based in both the school and the district and focusing on training teachers to the necessary level to effectively accommodate the diverse range of learners in mainstream classrooms.

The post-apartheid African National Congress (ANC) government's early policymakers developed several higher education policies aimed at "putting in place appropriate redress strategies for the past inequities of the apartheid era" (Vincent & Chiwandire 2019, p. 2) and at the radical transformation of South Africa's higher education environment (Badat 2010, p. 2). Transformation, thus, became a shorthand term to encapsulate a variety of initiatives aimed at "removing barriers and providing access to higher education for Black learners, disadvantaged groups, and women" (Belyakov et al. 2009, p. 1). It is important to note that the remnants of the apartheid basic schooling infrastructure continue to exist. During the apartheid era, schools preserved for white children were provided with higher funding compared to Black schools. In 1982, an average of R1,211 was allocated per white child, while R146 was allocated for each Black child (Boddy-Evans 2020). This shows the division and inequality between Black and white schools, which proves that white schools were given more support as compared to Black schools. Therefore, this discrimination has created and maintained the current quintile school system.

To contextualize, South Africa has quintile 1-3 schools, which are the poorest and, therefore, are granted the most government funding. These are non-fee-paying public schools, quintile 4 are fee-paying public schools, and quintile 5 are private schools (CAPS 123 2023; Ogonnaya & Awuah 2019). The percentage of learners attending quintile 1-3 schools was 67.2% in 2018 (Government Communication and Information Systems 2018). This directly impacts a learner's academic achievement because the majority of students in South Africa attend schools with inadequate or insufficient infrastructure, mainly quintile 1-3 schools. These include classrooms that are in poor condition, overcrowding, lack of electricity, and pit toilets that endanger the health and safety of students. They also include schools without libraries or study facilities.

According to Jumareng et al. (2022) and Supratiwi et al. (2021), the issue of discrepancies in learning outcomes between students with and without learning disabilities has been heightened by the use of online instruction in schools and higher education institutions. The significance of having sufficient digital learning resources and being flexible was evident. This experience demonstrated that many South African students lack access to the resources needed to receive an education that will enable them to contribute to the country's economic growth (DBSA n.d.). When people enter the job market without the necessary skills to promote economic growth, this has an adverse impact on the economy. It further disadvantages students and increases the socio-economic divide (Seedat-Khan & Ramnund-Mansingh 2022). In light of this narrative, the researchers recognize several challenges learners face in South Africa. These challenges are heightened for learners with learning disabilities. As this is a broad area of research, this paper will focus on dyscalculia and dyslexia as learning disabilities among learners attempting to adapt to complex education environments.

## 2. Framing Learning Disabilities

The Framework of Action on Special Needs Education (UNESCO 1994) states that inclusive education upholds the equal acceptance, provision, and support of all learners' needs while embracing each child's right to an education. Moreover, there is a global commitment to the promotion of inclusive, equitable, and high-quality education for everybody (UNICEF 2017). Consequently, educational systems in industrialized nations are dedicated to providing varied and productive learning opportunities through customized settings that meet each student's needs (Mutanga 2017; Winter & O'Raw 2010).

The American Psychiatric Association (2013) defines neurodevelopmental disorders as disorders that persist throughout life and cause challenges in acquiring academic skills like writing, reading, and math reasoning, even in individuals with ordinary or above-average cognitive capacities. Fortes et al. (2016) define specific learning disorder (SLD) as a failure to meet approved grade-level standards: "The diagnosis of SLD is made through a clinical

review of the individual's developmental, medical, educational, and family history, test scores and teacher observations, and response to academic interventions" (Fortes et al. 2016, p. 196). The disorders are presumed to result from a central nervous system dysfunction and may occur across the individual's life span (National Joint Committee on Learning Disabilities 1990). Porter et al. (2021) discuss that learning disabilities are initially defined as functional difficulties based on evidence of unexpected underachievement relative to the typical academic achievement in a school or learning environment.

Sustainable Development Goal (SDG) 4 promotes inclusive education, which has increased awareness and has legislation supporting learners with disabilities. These initiatives have increased the number of learners with disabilities in higher education (Lipka et al. 2019). Various programs and services currently support learners with learning disabilities in higher education institutions. However, inclusive education is implemented in different ways across different contexts. It varies with national policies and priorities, influenced by social, cultural, historical, and political issues (UNESCO 2021). Despite much research on inclusive education, putting it into practice remains problematic for the educational environment (Gavish 2017), particularly in higher education (Moriña 2017). Thus, simply providing students with disabilities access to schools is insufficient to guarantee their inclusion; they also need to receive the right kind of support (Gibson 2015).

The 1996 Green Paper proposed implementing "funding mechanisms that will embody the principles of affordability, sustainability and shared costs, as well as those of equity, redress, development, democratisation, effectiveness and efficiency" (Department of Education 1996, p. 6). The Education White Paper 3 called for the establishment of a new funding mechanism to achieve the principles of equity and redress through the elimination of all forms of discrimination, including on the grounds of disability, through empowerment measures, "including financial support to bring about equal opportunity for individuals and institutions" (Department of Education 1997, pp. 7-8). Through their institutional plans and strategies, the National Plan for Higher Education calls

on higher education institutions to increase access for people with special education needs. These policies have been applauded as “the best in the world of learning disabilities, meeting internationally acclaimed standards” (Mapesela & Hay 2005, p. 112). Although the policies have been positively recognized, adequate evaluation in response to their impact is not available.

### *Understanding Dyscalculia and Dyslexia*

As this study will focus on two learning disabilities, namely, dyscalculia and dyslexia, it is imperative to define the two concepts. Dyscalculia is a neurological condition that affects the ability to acquire arithmetical skills at the expected age (Landerl et al. 2021; Mahmud et al. 2020). A key indicator of dyscalculia is the inability to look at a small number of objects and say how many there are. Co-occurring specific learning problems may cause numeracy difficulties. Complications may arise from developmental or visual perceptual factors, meaning the child with this learning disability is not ready to learn at the expected pace (Emerson & Babbie 2015). Learners with dyscalculia may also grapple with social issues and adaptability due to the lack of life experience.

Proficiency in numerical abilities is a fundamental aspect of both professional and academic domains. Research conducted by Kucian and Von Aster (2015) confirms that a range of 3% to 6% of children with learning disabilities suffer from developmental dyscalculia. Dyscalculia is particularly noticeable among primary school learners, and their academic performance may be negatively impacted when they participate in the same instructional methods as their non-dyscalculic peers (Desoete et al. 2004; Kunwar 2021). The factors contributing to the failure of learners in mathematics courses are diverse. The inability of these learners can be attributed to the lack of suitable personalized education. The factors contributing to poor performance in mathematics encompass inadequate pedagogical practices, disregard for learners’ unique learning modalities, visual-spatial impairments, inattentiveness, verbal language deficiencies, motor skill deficits, cognitive limitations, and memory issues (Koc 2018).

According to the International Dyslexia Association (2002), dyslexia is a distinct learning disability of neurological origin. It primarily impacts acquiring and mastering language and literacy abilities (Maskati et al. 2021). Dyslexia is distinguished from other learning disabilities by challenges in phonological processing, rapid naming, working memory, processing speed, and the automatic acquisition of proficiencies that may not be commensurate with an individual's other cognitive capacities and inadequate spelling and decoding proficiencies (Nicolson & Fawcett 2021). The challenges above commonly arise due to a deficiency in the phonological aspect of language, which is frequently unanticipated compared to other cognitive proficiencies and the implementation of efficient pedagogical methods. The potential aftermath of this issue may display difficulties in understanding written material and a diminished reading encounter, which could hinder the expansion of one's contextual understanding (International Dyslexia Association 2002).

The condition is often genetic and has enduring consequences throughout one's life. Dyslexia is a word-level reading difficulty and the most common learning disability (Nicolson & Fawcett 2021). It is grounded in reading development theory and accounts for neurobiological and environmental factors and the effects of intervention (Elliott & Grigorenko 2014). Central to dyslexia is "difficulty in learning to decode and to spell" (Snowling et al. 2020, p. 503).

Children with learning disabilities may suffer from more than one learning disability. According to the study by Moll et al. (2019), 40% of children with dyslexia have another disorder. Interestingly, since reading and mathematics entail "complex skills with multiple components", dyslexia and dyscalculia are often comorbid conditions (Moll et al. 2019, p. 289). According to Mahmud et al. (2020), limited studies investigate the exact cause of dyscalculia compared to research on dyslexia. They found that the ratio of academic investigations conducted on dyslexia to those carried out on dyscalculia is 14:1.

Both learning disorders are of neurobiological origin and constitute two reasons for failing to develop literacy or mathematical abilities. Prevalence rates for academic failure in these domains vary widely,

depending on definitional criteria. Subsequently, Landerl et al. (2009) stated that academic failure is likely the cause of poor performance in the low average or lower third of the population range, which can be attributed to several biological and environmental variables. Both dyscalculia and dyslexia are complicated neurodevelopmental disorders of biological origin. According to Reigosa-Crespo et al. (2012), the prevalence rates for dyslexia are between 4% to 9% and 3% to 7% for dyscalculia. Significantly, studies on prevalence that include multiple learning disorders show that dyslexia and dyscalculia often co-occur (Thapar et al. 2017).

### 3. Methodology

While accommodation occurs for physical disabilities, learning disabilities are often undiagnosed, with a lack of understanding of how to approach accommodation and support. This article provides a systematic review of literature focusing on two learning disabilities, including dyslexia and dyscalculia. Initially, a detailed investigation of the global literature on learning disabilities was conducted. The authors identified a gap in scholarship for specific learning disabilities. Due to the subject matter's sensitivity and the attached societal stigma, the authors chose this approach for data collection. Resources were accessed and obtained from library database services such as SCOPUS, EBSCOHost, and Google Scholar. These three databases were chosen because the researchers have access to a wide range of accredited journal articles, theses, conference papers, book chapters, and policy papers. SCOPUS is specifically sought for the advanced search options.

A comprehensive literature search was conducted from June 2022 to March 2023. The initial broad search criteria included academic articles from global sources. There appeared to be a dearth of literature in the past five years. Although a global understanding was needed, the purpose was to contextualize from a South African higher education perspective. Literature on this was specifically lacking. The authors refined the study scope based on this.

The literature defined the parameters of the study. Although sources within the past five years were considered for the intervention strategy, literature regarding dyslexia and dyscalculia from a higher



education perspective was lacking. This paper was designed to understand the implications and interventions for dyscalculia and dyslexia in South Africa and globally. While we can learn from international interventions, consideration was given to the legacy of education inequality left by apartheid and the infrastructure gaps in the country. Therefore, themes and keywords surrounding the key concepts were highlighted when considering the eligibility criteria. These included studies on dyscalculia and dyslexia and strategies to inform future interventions.

The selection procedure began with a screening of abstracts and titles. To ensure uniformity, a single researcher screened the abstracts and titles. Both researchers divided up the themes of the literature review and reviewed them separately. A lack of suitability, typically a country-specific disconnect inconsistent with the study at hand, led to the deselection of specific articles. Data extraction focused on a comprehensive literature framework and outcomes for accommodating learners with learning disabilities. Learning disabilities were researched before narrowing the search and discussion to dyscalculia and dyslexia. Both researchers independently extracted data addressing the criteria of these specific themes and how learning disabilities contribute to a clinical solution.

#### **4. Theoretical Underpinning**

Universal design for learning (UDL) is underpinned as the core theory for this study. Inclusivity in higher education means that the socially constructed ideas of normality fall away and that every learner attending higher education institutions has equal opportunities. The practice of this theory in higher education is widely accepted across studies in over 800 peer-reviewed scientific and academic publications (Cumming & Rose 2022). The misconception, however, is that UDL is targeted at disabled learners. UDL aims to reduce barriers in the instruction methods and environment. It creates a space of engagement. Using this theory, the curriculum is designed with multiple tools and assessments, as the learner must guide their learning (Bradshaw 2020). Since the basis of UDL is cognitive neuroscience, the curriculum design team and educators must

understand the full scope before designing the content or assessments. According to Cumming and Rose (2022), the three principles of UDL include engagement (the *why* of learning), representation (the *what* of learning), and action and expression (the *how* of learning). In theory, this perspective is robust for its purpose. However, limitations exist within a South African perspective, with the gaps in South African education resulting from political legacies. These include the socio-economic, educational, and technological divides.

Additionally, according to Armstrong (2018), individuals' abilities and interests vary, prompting diversity in their learning strategies. Therefore, the Theory of Multiple Intelligences (TMI) by Howard Gardner contributed to a reassessment of the definition of intelligence, which interprets it in terms of genetic or environmental elements (Cerruti, 2013). Subsequently, Cerruti (2013) adds that TMI has directly affected the teaching and learning processes by emphasizing creative and productive problem-solving and encouraging teachers to comprehend their learners' capacities by choosing techniques that suit them and stimulate their interests. Individuals possess one or more patterns of the following intelligence, according to TMI: Verbal-Linguistic Intelligence, Logical-Mathematical Intelligence, Visual-Spatial Intelligence, Kinesthetic Intelligence, Musical Intelligence, Intrapersonal Intelligence, Social Intelligence, Natural Intelligence, Existence Intelligence (Ambusaidi 2009; Gouws 2007; Mahmoud & Almaharmah 2014).

TMI is one of the most influential cognitive theories that transformed the teaching and learning process by recognizing individual learner characteristics (Saban 2011). It is a contemporary method of teaching and learning because it offers teachers an active vision of teaching practices and behavioral techniques that may account for individual differences among learners. TMI contributes to developing intellectual and creative skills per its comprehensive educational vision and role in educating learners to meet the needs of the twenty-first century (Al-Zoubi & Al-Adawi 2019). In saying this, Gardner's work is also critiqued significantly. When he defines eight areas of intelligence, critics confirm that they can be condensed into personal traits, talents, and abilities (Klein 1997; Cary 2004; White

2005). Although the theory was widely used in learning environments, Gardner was clear that it was not designed for application in education (Cerruti 2013). While intelligences exist, they do not explain how a child processes information (Gardner 2006).

Despite Gardner's explanation for the theory not to be used in education, Al-Sulaiti (2012) discovered that teachers and learners are interested in TMI because it fulfils learners' needs and tendencies and helps them build learning disabilities into thinking and problem-solving techniques. Learners with learning disabilities may have difficulties in reading, writing, and mathematics (Al-Zoubi & Rahman 2017). Hence, these issues vary in nature, degree, and severity among learners with learning disabilities. The estimated prevalence of learning disabilities is 5.36 % (Al-Zoubi & Al-Qahtani 2015; Lerner & Johns 2012). After reading impairments, mathematical disabilities constitute the largest category of learning disabilities.

Accordingly, 26% of children with learning disabilities have mathematics difficulties, and 50% of individualized education programs (IEPs) in the United States emphasize mathematics skills training (Lerner & Johns 2012). IEPs target children who require additional school support (Mosbiran et al. 2021). Hence, teachers spend one-third of their time teaching mathematics skills to learners with learning disabilities. Learners with learning disabilities have mental capacities above the 85th percentile on the normal distribution of intelligence, but their academic accomplishments are low (McCoach et al. 2004).

Al-Zoubi and Al-Adawi (2019) established that TMI has evolved into a current approach to investigating learning and instruction for each learner, in addition to its contribution to curriculum development and improving learner assessment techniques. Consequently, TMI has transformed educational processes, altered teachers' conceptions of their learners, and highlighted the most effective ways to interact with them based on their talents and intelligence patterns (Batdi 2017). Al-Zyoud and Nemrawi (2015) highlighted how students with mathematical learning difficulties may perform basic arithmetic operations more effectively using a teaching approach based on TMI. Hakem and Bekri (2018) demonstrated the efficacy of TMI

in educational programs for learning disabilities in enhancing the basic arithmetic operations of children with mathematical learning disabilities.

## 5. Dyscalculia and Dyslexia – A Way Forward

Global sources were considered for intervention programs since there is limited to no research within the South African context. Currently, various programs and services aim to support learners with learning disabilities. Higher education institutions provide a variety of formats and support types in recognition of this demand. According to DuPaul et al. (2017), these interventions help students with learning difficulties overcome their academic obstacles and may offer continuing support. Two categories can be used to categorize support modalities. The first is centered on assisting students in achieving greater functional abilities (e.g., enhancing academic skills via tutoring, remedial courses, and workshops on compensating measures). The second seeks to alter the learning environment (e.g., by introducing human assistance or technical aids) so that these students can achieve despite their limitations (Rath & Royer 2002).

Interventions and accommodations are the general terms used to describe these two methods. Education institutions typically provide specific exam settings, such as extended time granted for exams and the ability to take breaks, to meet the needs of students with learning disabilities (Heiman 2007; Rath & Royer 2002). A widely used approach is a peer tutoring program in which learners without learning disabilities help learners with learning disabilities achieve academic success (Vogel et al. 2007). In this scenario, weekly one-on-one tutoring sessions are held for students with learning impairments. The lessons cover social and emotional aspects that affect academic performance in addition to learning tactics, organisational techniques, and writing and reading strategies (Ryan 2007). The tutors and the students reported a high success rate and deemed the tutoring relationship and experience valuable (Kowalsky & Fresko 2002). Including students with learning disabilities in effective modules that are intended for the entire first-year student body is another approach to help them build learning skills (Reed

et al. 2009). Over the past ten years, there has been an increased focus on interventions and accommodations for students with learning disabilities attending higher education institutions in Israel. According to WHO, the percentage of undergraduate students with learning difficulties in the post-secondary education population is 5.6%. (Lipka et al. 2019).

With instructional accommodations, a student's access to learning is altered. According to Lipka et al. (2019), learners with disabilities receive support in applying for and being granted various accommodations. Examples of these accommodations include reading aloud to them during presentations, allowing them to use electronic dictionaries for response, and providing quiet, distraction-free environments for testing. Modifications to the curriculum, such as learning different topics or writing shorter papers for assignments, may be given to the learners. The study by Lipka et al. (2019) examines the adapted course, an academic support model for higher education learners designed for learners with learning disabilities and/or Attention Deficit Hyperactivity Disorder (ADHD). This course is available for a number of subjects, particularly language structure, which presents particular difficulties for these students. Fewer students in each session and various learning styles define these distinctive courses. The course content satisfies general parallel standards (Lipka et al. 2019).

### *Digital Applications for Learners with Dyscalculia*

Several digital technologies are available to support individuals with dyscalculia. The primary purpose is to allow them to be independent and self-sufficient learners. There are several digital approaches, including Computer Assisted Instruction (CAI), which “may embed suitable visual fusion technologies (e.g. Augmented Reality (AR) and gamification) to engage, motivate, and encourage dyscalculia learners with specific mathematics disabilities” (Miundy et al. 2019, p.93). These CAI technologies include different tools and applications such as Six Sifteo cubes, Adaptive e-learning, MathemAntics, and Calculating Aid Tools. The purpose of these tools is to teach students the names of numbers, counting, and numerical comparison. They

were created with entertaining software that included audible feedback, speed deadlines, and multiple difficulty levels based on the student's progress. Students can improve their basic mathematical skills, such as counting, number knowledge, number names, simple addition, and subtraction, using e-learning.

### *Emerging Technologies for ICT-based Education for Dyscalculia*

The calculating aid tool, KitKanit, has proved positive in motivating and improving the performance of learners with dyscalculia (Ferraz et al. 2017; Poobrasert & Gestubtim 2013). Gamification is a process of using online games to learn concepts. Learners find it fun and engaging, positively impacting success (Miundy et al. 2019). Consistent with this are the studies by Vanjari et al. (2020) and Singal and Bakre (2021), who indicated greater confidence and understanding of mathematical concepts from children with dyscalculia who use gamification processes.

### *Using Virtual Reality in Teaching Learners with Dyslexia*

The inability to initiate and maintain conversations is also a problem for persons with dyslexia. Current research holds that virtual reality avatars have been instrumental in supporting learners with dyslexia (Dymora & Niemiec 2019; Gualano et al. 2023; Jamaludin et al. 2018; Pellas & Christopoulos 2022; Perea et al. 2014). It is similar to the gamification approach discussed above. While Maskati et al. (2021) indicate that several virtual reality applications incorporate the concept of avatars, the employment of an avatar would assist in establishing a comfortable setting for the user since avatars are typically employed in games to personalize and entice the player. Avatars can also be applied in educational applications where the avatar would be a teacher or mentor, establishing a rapport with the user and retaining their interest. All of these technologies have the potential to aid in the creation of solutions to numerous issues and have been utilized in various contexts (Gualano et al. 2023; Maskati et al. 2021).

Avatars are an animated computer depiction of a user, such as a personal or graphical symbol, and typically a three-dimensional or two-dimensional shape. It can be expressed as assuming form or personality in the shape of a symbolic image in a virtual world, achieving the transition from the real world to the virtual world (Jamaludin et al. 2018; Perea et al. 2014). An avatar encourages learners to interact longer with educational software, considerably improving learning quality (Falloon 2010).

### *Comorbid Interventions*

Several studies reflect that individuals with dyscalculia are likely to have dyslexia and vice versa (Moll et al. 2019; Moreau et al. 2018). With the advent of the fourth industrial revolution, technological advances and assisted methodologies (as described in the above section: Computer Assisted Instruction, virtual reality, digital applications, and gamification) may reduce any challenges experienced by learners. Application quizzes and gamified technologies have already been used to assess learning disabilities and to improve learner performance (Al-Barhamtoshy & Motaweh 2017; Kularathna et al. 2014). Computerized gamification programs such as DyscalculiUM and Dyscalc are widely used globally but face language limitations for learners who are not English first language speakers (Beacham & Trott 2005). In addition, the gamified application needs a tablet for optimal benefit (Kariyawasam et al. 2019). Miundy et al. (2019) suggest that by enabling users to view and interact with virtual objects that are composites of the real world, augmented reality technology psychometric tools have been employed as a virtual reality rehabilitation technique for students with dyslexia and dyscalculia. This has helped the learners understand abstract concepts. Additionally, there are two ways that students with dyslexia and dyscalculia can interact with augmented reality objects: Tangible User Interaction (TUI), which uses magnetic pens or detection cards, and Natural User Interaction (NUI), which uses finger or eye detection (Miundy et al., 2019).

Although there is undeniable evidence of the success of these technological approaches, it comes with challenges. These will

be stark in a South African context. Firstly, hardware needs to be of the highest quality and specification. In the socio-economic environment, this becomes exceedingly difficult as priorities are necessities and food supplies. Additionally, South Africa lacks the technological infrastructure to allow these tools, especially in rural and underdeveloped areas; similar challenges were confirmed in Malaysia (Kariyawasam et al. 2019).

## 6. Clinical Intervention

In the literature and findings of the paper, some key challenges were identified. The researchers have chosen the most fundamental ones to address in a proposed intervention to support learners with dyscalculia and dyslexia. These are identified and discussed in Table 1. These include the identification of the learning disability (i.e., dyscalculia and dyslexia), a lack of understanding of the challenges faced by the learner with dyscalculia and dyslexia, the inability of the learners to cope with the academic workload, and the lack of access and use of digital support tools.

Due to social stigmas surrounding learning disabilities, many people are hesitant to be assessed and take on the burden of trying to conform to socially constructed norms. While assessment for learning disabilities, specifically dyscalculia and dyslexia, may be a long-drawn and costly process for higher education institutions, they can support learners who have declared a learning disability or who have been identified as being at possible risk and needing additional support. While significant studies need to be undertaken to plug in the research gaps, especially in countries in the Global South, the current intervention focuses broadly on improving success indicators for these learners. Therefore, drawing from the literature allowed for identifying risks and challenges for students with dyslexia and dyscalculia in a South African context.

The intervention creates a proposed plan that includes stakeholders and a proposed timeframe. Within intervention support systems, the most common is the learning strategies support provided individually or in groups. The literature reiterates that adapted courses are a way to provide accommodations for learners with learning disabilities,



**Table 1:** Clinical Sociology Intervention to Accommodate Learners with Dyscalculia and Dyslexia

<b>Risk/Key Challenges</b>	<b>Impediments in Context</b>	<b>Stakeholder</b>	<b>Timeframe</b>	<b>Clinical Intervention</b>
<p>Identification of learning disability</p>	<p>Lack of understanding of learning disabilities Cultural stereotypes don't accept the concepts of learning disabilities</p>	<p>Department of Education Department of Health Department of Social Development</p>	<p>Ongoing</p>	<p>Department of Health to facilitate awareness workshops with all stakeholders. Constant workshops regarding the removal of stigma from learning disabilities. Testing for educator-identified students.</p>
<p>Lack of understanding of specific challenges</p>	<p>Educators and academics are not equipped to identify dyscalculia or dyslexia to request professional assessment and provide additional support.</p>	<p>Department of Education Department of Health Department of Social Development</p>	<p>Annually</p>	<p>Awareness workshops should continue at schools and higher education institutions. Educators should be trained to identify signs. Testing should take place annually for new students.</p>

<b>Risk/Key Challenges</b>	<b>Impediments in Context</b>	<b>Stakeholder</b>	<b>Timeframe</b>	<b>Clinical Intervention</b>
<p>Inability to cope with academic workload for students with dyscalculia and dyslexia</p>	<p>Takes longer to work and understand certain concepts and modules.</p>	<p>Department of Basic Education (DOBE) Department of Higher Education (DOHE)</p>	<p>Ongoing Only works if students have been diagnosed with dyscalculia and dyslexia.</p>	<p>The DOBE and DOHE should develop separate curriculum policies to accommodate learners with dyscalculia and dyslexia. Support centers should be in basic education schools and higher education institutions for students with learning disabilities. Educators should put in place a concrete plan of action per student with dyslexia or dyscalculia. Plans must be individualized as each student's level of learning disability may be different. Students require individual attention, support, and time for understanding modules.</p>
<p>Access and use of digital tools</p>	<p>Learners and educators have challenges with technological literacy and poor technical infrastructure.</p>	<p>Educators Students Digital/IT service providers</p>	<p>Ongoing</p>	<p>Digital tools need to be accessible to support both students and educators.</p>

particularly in areas that learners tend to find challenging, such as academic writing and linguistic subjects (syntax, phonology). Whilst generic perspectives and traditional tools to support a broad category of learning disabilities exist, notable mention needs to be made of tools specifically for dyscalculia and dyslexia. This results from a lack of diagnosis, the stigma surrounding diagnosis, and the technological inability to utilize some global tools (Rath & Royer 2002).

## Conclusion

While accommodation occurs for physical disabilities, learning disabilities are often undiagnosed, with a lack of understanding of how to approach accommodation and support. This article provides a systematic desktop review of literature focusing on two learning disabilities, namely, dyslexia and dyscalculia. Initially, a detailed investigation of the global literature on learning disabilities was conducted. The authors identified a gap in scholarship for specific learning disabilities. The two learning disabilities identified in this paper were dyscalculia and dyslexia. This is due to the finding that while dyslexia and dyscalculia are globally recognized learning disabilities, there exist disparities in the support and integration of affected individuals within educational systems. Advanced initiatives and technologies in developed countries facilitate the identification and support of learners with these disabilities, enabling mainstream integration.

However, in South Africa and other developing nations, challenges such as lack of diagnosis, inadequately trained educators, and limited accessibility to support applications slow the inclusion of learners with dyslexia and dyscalculia in mainstream education. Consequently, these learners often face exclusion and societal perceptions of rejection. The introduction of digitized tools in higher education institutions exacerbates these exclusions. The paper presents a detailed discussion about dyscalculia and dyslexia, addressing some available mechanisms and tools to support both learners and educators. With the promotion of inclusive education by SDG 4, there has been increased awareness and legislation supporting learning disabilities. Various programs and services currently

support learners with learning disabilities in higher education institutions. However, despite a large body of research on inclusive education, its implementation is still challenging for the education environment, especially in higher education. As such, it is not enough for learners with disabilities to have access to education; they must have appropriate support to ensure their inclusion. The clinical and sociological interventions prescribed are recommended as a first-stage approach to foster inclusivity in mainstream education, paving the way for integrating students with dyslexia and dyscalculia into the higher education system.

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