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Exploring the Prevalence and Awareness of Dyscalculia Among Grade 10 Learners: A Case Study

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Abstract

Research Objectives and Problem(s): This study explores the prevalence and awareness of dyscalculia—a learning disability that impairs individuals' ability to comprehend and engage with mathematical concepts—among Grade 10 learners in two secondary schools in Soshanguve, South Africa. The research aims to determine the prevalence of dyscalculia in this population and assess the level of awareness among Grade 10 mathematics teachers regarding the identification and support of dyscalculic learners.

Research Methods: Research design incorporates both quantitative and qualitative methodologies, including standardized tests, focus group interviews, and questionnaires.

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Structure of the Article: The study is framed by the Integrated Cognitive-Socio-Inclusive Model, which combines elements from cognitive neuropsychology, socio-cultural theory, and inclusive education to provide a comprehensive understanding of dyscalculia.
Research findings and their Impact on the Development of Educational Sciences: The findings reveal a concerning prevalence of below-average mathematical skills among Grade 10 learners and highlight the need for targeted interventions. They also underscore the importance of raising teacher awareness to better identify and support learners with dyscalculia.
Conclusions and/or Recommendations: This study contributes valuable insights into dyscalculia in the South African educational context. It advocates for data-informed policy decisions and enhanced teacher training to create a more inclusive learning environment.

Keywords: dyscalculia; intervention; prevalence; awareness; Grade 10 learners, teachers, mathematics

Introduction

Dyscalculia, commonly referred to as "number blindness," is a learning disability that significantly hinders individuals' ability to comprehend and engage with mathematical concepts and operations (Onyishi & Sefotho, 2021). It is estimated to affect between 2% and 10% of the global population, with a prevalence comparable to that of dyslexia (Butterworth et al., 2011; Bastos et al., 2016; Wangdi, 2021). Learners with dyscalculia face specific challenges in acquiring fundamental arithmetic skills, such as recalling multiplication tables and performing calculation procedures (Kunwar, 2021). Their difficulties also extend to tasks involving number comparison, counting, and mastering processes like carrying over during calculations. Notably, dyscalculia is considered a specific learning difficulty confined to mathematics (Butterworth et al., 2011; Espina et al., 2023).

The implications of dyscalculia on academic performance and future opportunities are profound, as mathematical proficiency is essential for

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educational attainment and employment prospects, which directly impact socio-economic status (Pule, 2020). Recognizing the prevalence and impact of dyscalculia is crucial for designing effective support and intervention strategies. Teachers play a vital role in identifying and supporting learners with learning disabilities. However, dyscalculia often goes unnoticed by educators, which can lead to academic struggles, diminished self-esteem, and long-term negative consequences for affected students (McCarroll, 2021). The lack of awareness among teachers further complicates the implementation of effective teaching strategies tailored to the needs of dyscalculic learners.

Additionally, the prevalence and awareness of dyscalculia among Grade 10 mathematics learners in South Africa remain poorly documented. The Department of Basic Education reports that 28.9% of Grade 6 learners fail to achieve a passing mark in mathematics (DBE, 2014), highlighting the urgent need to investigate dyscalculia's prevalence and teacher awareness to enhance learners' mathematical performance. International research suggests that dyscalculia affects 3% to 7% of school-age children (Price & Ansari, 2013; Ashraf & Najam, 2020; Monei & Pedro, 2017). However, limited empirical evidence focuses specifically on the South African context, particularly among Grade 10 learners. Therefore, understanding the prevalence of dyscalculia and teacher awareness is essential for developing targeted interventions. This study seeks to explore the prevalence and awareness of dyscalculia in this specific educational context. The primary objective of this study is to:

a) Determine the prevalence of dyscalculia among Grade 10 learners in two Soshanguve secondary schools.
b) Assess the level of awareness among Grade 10 mathematics teachers in identifying and supporting dyscalculic learners.

This study aimed to address the following key research questions:

c) To what extent is dyscalculia prevalent among Grade 10 learners in the selected schools?

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d) What is the level of awareness among Grade 10 mathematics teachers regarding dyscalculia?

To achieve these objectives, the study employed a participatory action research (PAR) design, examining dyscalculia in two distinct school settings through standardized dyscalculia tests, focus group interviews, and questionnaires. This approach allowed for an in-depth analysis of the condition within each case context and facilitated comparisons of findings across different educational environments. The methodology involved the collection of both quantitative and qualitative data to assess the prevalence of dyscalculia and the level of awareness among learners and teachers alike.

Theoretical Framework

This study utilized the Integrated Cognitive-Socio-Inclusive Model, which merges elements of the Cognitive Neuropsychological Model, Vygotsky's Socio-Cultural Theory, and the Inclusive Education Framework to provide a comprehensive understanding of dyscalculia. The cognitive component addresses specific deficits such as numerical processing, working memory, and visual-spatial skills, all of which are essential for arithmetic and mathematical comprehension (Butterworth et al., 2011; Middleton et al., 2019). By identifying these cognitive difficulties, educators can create targeted diagnostic tools and interventions for learners with dyscalculia.

The socio-cultural aspect emphasizes the significance of social interactions and cultural contexts in learning, particularly the need for teacher awareness and preparedness (Middleton et al., 2019; Daneshfar & Moharami, 2018). Research demonstrates that informed teachers who use scaffolding techniques can enhance the mathematical skills and performance of dyscalculic students (Akinade, 2022). The inclusive education component advocates for integrating learners with disabilities into mainstream classrooms to promote equity and access (Regmi, 2019).

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The Department of Basic Education's 2010 Guidelines for Inclusive Teaching and Learning reinforce this by emphasizing the importance of identifying and supporting learners who face barriers, such as dyscalculia (Dube, 2020; Hayes & Bulat, 2017). Strategies like differentiated instruction and assistive technologies can further enhance the educational experiences of these students (Onyishi & Sefotho, 2021).

The Integrated Cognitive-Socio-Inclusive Model was selected as the most suitable theoretical framework for this study, offering a holistic approach to understanding and addressing dyscalculia from multiple perspectives. This integrated framework aligns with the study's objectives to examine the prevalence and awareness of dyscalculia among Grade 10 learners and teachers, thereby laying a robust foundation for developing effective teaching strategies and educational policies.

Literature Review on Dyscalculia

This study highlights the significant cognitive deficits experienced by individuals with dyscalculia, particularly in numerical processing. Research by Butterworth et al. (2011), Aunio & Fritz (2019), Allen (2020), and Maricle & Vidovic (2022) reveals that dyscalculic learners often struggle with working memory, which hinders their ability to manipulate numerical data, and is essential for multi-step arithmetic and problem-solving tasks. Additionally, deficits in visuo-spatial skills impede their capacity to organize and comprehend numerical data, limiting their ability to recognize number patterns and perform mental calculations.

Research by Van Hoof et al. (2017) emphasizes that children with dyscalculia typically exhibit poor intuitive understanding of numbers and their relationships, linked to deficits in the intra-parietal sulcus, a brain region crucial for numerical cognition (De Smedt et al., 2019). Prabavathy & Sivaranjani (2020) note that dyscalculia significantly hampers learners' ability to perform basic arithmetic operations, such as addition, subtraction, multiplication, and division. Studies by Molise & Luneta (2024) and Kunwar (2021) indicate that individuals with dyscalculia face difficulties

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in both conceptual understanding and procedural execution, particularly in operations that demand a strong grasp of numerical relationships. Chinn & Ashcroft (2017) and subsequent research underscore that subtraction and division pose unique challenges due to the cognitive load required for sequential and methodical operations, often resulting in slower task completion and increased procedural errors.

The educational implications of dyscalculia are profound, affecting academic performance and self-esteem. Onyishi & Sefotho (2021) argue that traditional teaching methods fail to meet the needs of dyscalculic students, who require tailored educational strategies and early diagnosis. Effective interventions, as suggested by Delgado et al. (2019), include enhancing number sense and foundational arithmetic skills through manipulatives, visual aids, and engaging computer-based tools. Increasing societal awareness is also crucial. As Chinn (2020) points out, limited public understanding of dyscalculia can lead to delayed diagnosis and inadequate support. Advocacy groups and educational institutions, highlighted by Hussain & Soares (2022), play a vital role in raising awareness and integrating dyscalculia-focused support into educational policies. This study emphasizes the importance of early identification, targeted interventions, and increased societal awareness to better support individuals affected by dyscalculia.

Methodology

Research Design

This study adopted PAR (Participatory Action Research) as its research design, a collaborative and iterative approach that actively involves participants in the research process. PAR is defined by its focus on action and reflection, with the aim of both understanding and addressing issues within a specific context through the active engagement of those directly affected by the problem being studied (Shamrova & Cummings, 2017). In this case, PAR was chosen for its suitability in tackling the challenges of dyscalculia among Grade 10 learners in two distinct educational settings, referred to as School A and School B.

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The participatory nature of PAR allows for the involvement of learners and teachers in the research process, ensuring that the insights and solutions developed are grounded in the lived experiences and practical realities of those involved (Chevalier, 2019). This approach not only enhances the relevance and applicability of the findings but also empowers participants by providing them with a voice in the research, fostering a sense of ownership and commitment to implementing the outcomes. The study began with the administration of standardized tests to students in both schools as shown in **Figure 1**, which serve as a quantitative assessment tool to measure the extent and nature of dyscalculia among the participants (see **Figure 1, Step A** and **Step B**).

This initial step was crucial for establishing a baseline understanding of the learners' difficulties and provided empirical data that informed the overall analysis. The quantitative data gathered during this phase laid the groundwork for subsequent research phases, ensuring that the findings were based on objective, measurable outcomes. Building on the quantitative analysis, the research design incorporated a qualitative dimension through focus group interviews (see **Figure 1**, **Step D**). A representative sample of three learners identified as dyscalculic through the quantitative analysis participated in in-depth discussions to explore their experiences with dyscalculia, revealing the emotional, psychological, and educational impacts of their condition (Nyumba et al., 2018). This qualitative approach enriched the study, offering a nuanced understanding of how dyscalculia affects learners daily.

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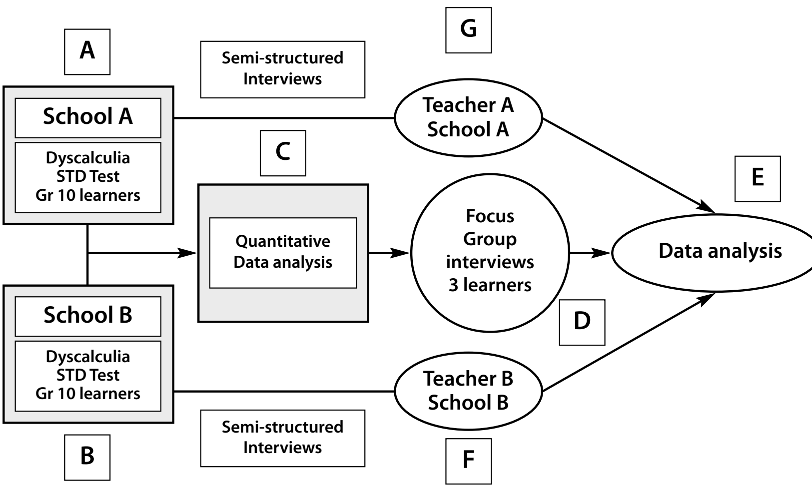
Figure 1: Research Design of the Study



Additionally, semi-structured interviews with teachers from both schools (see **Figure 1**, **Steps F** and **G**) captured educators' perspectives on dyscalculia, including their observations, challenges, and strategies for supporting affected students. Incorporating teachers' insights was a critical component of the Participatory Action Research (PAR) approach, recognizing the importance of teacher agency in the research process (Kushniruk & Nøhr, 2016). The study's design, incorporating both quantitative and qualitative methods, aimed to provide a comprehensive analysis of dyscalculia while generating actionable insights to inform teaching practices. The cyclical nature of PAR was evident in the structure: beginning with data collection and analysis, moving to reflection and interpretation through focus groups and interviews, and ultimately influencing future classroom actions (Morales, 2016). This dynamic feedback loop emphasized a commitment to continuous improvement and adaptation. Qualitative data were collected through semi-structured interviews with teachers and focus group discussions with learners. These interviews explored learners' difficulties with arithmetic operations—specifically division, multiplication, addition, and subtraction—and the resulting impact on their academic performance and self-esteem (Adeoye-Olatunde

& Olenik, 2021). Focus group discussions gathered collective perspectives, discussing common challenges, successful strategies, and potential improvements for supporting students with dyscalculia.

Thematic analysis, following the procedures outlined by Castleberry & Nolen (2018), identified and categorized emergent themes related to cognitive deficits and educational interventions. Content analysis further extracted key points and recurrent topics, providing depth to the findings.

Participants and Sampling

The study employed purposive sampling to recruit seventy (70) Grade 10 mathematics learners and two (2) mathematics teachers from the two selected schools, ensuring a diverse range of participant backgrounds and experiences. Purposive sampling, a method in which participants are selected based on specific criteria relevant to the research, was used in this study to focus on individuals directly impacted by dyscalculia. The primary criteria for selection included participants' willingness to participate and their informed consent.

The sample size of seventy learners was determined with a dual focus on achieving qualitative data saturation and ensuring sufficient statistical power for quantitative analysis. From a quantitative perspective, a sample of this size allowed for meaningful statistical analysis, enabling the detection of significant patterns, trends, and relationships within the data. The quantitative data collected through standardized tests were subjected to descriptive statistics to summarize learners' performance and inferential statistics to explore correlations between dyscalculia and other variables, such as academic achievement.

This robust quantitative approach, combined with the strategic selection of a school known for its lower performance in Grade 10 mathematics, enabled the research to produce findings that are both statistically valid and highly relevant to similar educational contexts where learners struggle with mathematics due to learning difficulties.

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Data Collection

Dyscalculia Standardized Test: Administered to all Grade 10 mathematics learners, this test featured both multiple-choice and open-ended questions. It was conducted under controlled exam conditions to ensure data accuracy. Quantitative analysis involved recording learners' scores within a 60-minute timeframe (Shalev et al., 1998).

Focus Group Interviews: Teachers and learners participated in interviews to explore their knowledge of and perceptions about dyscalculia. The interview questions encompassed both closed and open-ended formats, with sessions lasting approximately 30 minutes. Audio recordings were transcribed verbatim for subsequent thematic analysis.

Data Analysis

Statistical analysis of dyscalculia standardized test scores employed descriptive statistics, focusing on the percentage of learners scoring below 30% to determine the prevalence of dyscalculia. Content analysis was applied to the focus group interviews, while thematic analysis of interview transcripts facilitated the identification and categorization of emergent themes (Miles et al., 2014).

Ethical Considerations

Participants were assured of the confidentiality of their information, with an emphasis on voluntary participation and the right to withdraw from the study at any time. The research adhered strictly to ethical guidelines for studies involving human subjects (American Psychological Association, 2017).

Results

The Dyscalculia Standardized Test revealed a significant prevalence of below-average mathematical abilities among Grade 10 learners in two Soshanguve schools. Key areas of difficulty included language ability, where many students struggled with mathematical word problems,

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as shown in **Table 1**, which illustrates the distribution of scores in this domain. Visual-spatial ability was another area of concern, with learners facing challenges in understanding geometric shapes and spatial relationships. Additionally, deficits in cognitive abilities, such as working memory and processing speed affected problem-solving skills, while weak numeracy skills and confusion over mathematical operational signs (e.g., addition, subtraction) were widespread. Students scoring below the 30th percentile were identified as potentially dyscalculic.

The distribution of scores in the domain of language ability revealed that 10.8% of learners demonstrated high proficiency (90–100), indicating strong skills in retrieving number facts and using mathematical signs in word problems. Additionally, 31.1% exhibited proficiency (76–89), reflecting a solid grasp of mathematical language. A further 21.6% showed moderate proficiency (60–75), while 8.1% fell below proficiency (46–59), suggesting a need for additional support. Approximately 13.5% exhibited limited proficiency (30–45), likely struggling with complex problems, and 9.4% displayed low proficiency (20–29), highlighting the need for targeted interventions. Finally, 5.4% showed minimal proficiency (0–19), requiring intensive support.

Table 1: Prevalence of Dyscalculia in Language Ability.

s/m	Percentage score	No. of learners	Scored %	Learner %
1	90–100	8	100	10.8
2	76–89	23	85.7	31.1
3	60–75	16	71.4	21.6
4	46–59	6	57.1	8.1
5	30–45	10	42.9	13.5
6	20–29	7	28.6	9.4
7	0–19	4	14.3	5.4
Total		74	400	100

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Table 2 outlines learners' scores in visual-spatial ability, where students were tested on their understanding of geometric shapes, such as squares, parallelograms, and triangles.

Table 2: Prevalence of Dyscalculia in Visual-Spatial Ability

s/m	Percentage score	No. of learners	Scored %	Learner %
1	90–100	53	100	71.6
2	80–89	2	83.3	2.7
3	60–79	0	66.7	0
4	40–59	3	50	4.1
5	30–39	6	33.3	8.1
6	0–29	10	16.7	13.5
Total		74		100

The assessment of visual-spatial ability revealed that a substantial majority of learners (71.6%) demonstrated high proficiency, scoring between 90–100, which reflects a strong understanding of geometric shapes and spatial relationships. A smaller subset (2.7%) scored between 80–89, indicating good but slightly lower competence in visual-spatial concepts. Notably, no learners scored between 60 and 79, indicating a gap in moderate proficiency.

A modest 4.1% of learners scored between 40 and 59, signifying moderate competence, while 8.1% fell within the limited proficiency range of 30 to 39. These students may struggle with accurately identifying and differentiating between geometric shapes. Lastly, 13.5% scored between 0 and 29, indicating low proficiency and significant challenges with visual-spatial concepts.

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Table 3: Prevalence of Dyscalculia In Cognition Ability

s/m	Percentage score	No. of learners	Scored %	Learner %
1	90–100	8	100	10.8
2	80–89	12	83.3	16.2
3	60–79	18	66.7	24.3
4	40–59	15	50	20.3
5	30–39	8	33.3	10.8
6	0–29	13	16.7	17.6
Total		74		100

The analysis of cognitive ability related to numerosity, as illustrated in Table 3, reveals that 10.8% of Grade 10 learners achieved the highest proficiency (90–100), indicating a strong understanding of numerical principles. A further 16.2% scored between 80 and 89, reflecting a solid grasp of cognitive concepts associated with numerosity. A significant portion of learners (24.3%) fell within the moderate proficiency range (60–79), while 20.3% scored between 40 and 59, indicating lower moderate proficiency and challenges with more complex numerical tasks. Additionally, 10.8% of learners exhibited limited proficiency (30–39), and 17.6% scored between 0 and 29, highlighting substantial difficulties with basic numerical concepts.

Table 4: Prevalence of Dyscalculia in Numeracy

s/m	Percentage score	No. of learners	Scored %	Learner %
1	81–100	15	100	20.1
2	61–80	9	80	12.7
3	41–60	19	60	25.6
4	31–40	16	40	21.5
5	21–30	0	0	0
6	0–20	15	20	20.1
Total		74		100

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The test results, as depicted in Table 4, reveal that learners struggled with accurately identifying numerical sequences. For instance, many incorrectly answered "20000" instead of "19998" when asked what comes before "19999." Similarly, responses to the question "What comes after 39999?" indicated significant challenges, particularly among learners with dyscalculia.

The distribution of scores in **Table 4** shows that 20.1% of learners achieved high proficiency (81–100), demonstrating a solid understanding of numeracy concepts. A smaller group (12.7%) scored between 61 and 80, indicating proficiency but with room for improvement. A larger proportion (25.6%) fell within the moderate range (41–60), reflecting a basic understanding but challenges with complex sequences. Notably, no learners scored between 21 and 30, while 20.1% scored between 0 and 20, highlighting difficulties in identifying numerical sequences associated with dyscalculia. Further insights are provided in **Table 5**, which illustrates the challenges faced by dyscalculic learners in performing mathematical operations. Only 2.7% of dyscalculic learners achieved high proficiency (90–100), while a substantial portion (22.9%) scored between 40 and 59, reflecting significant difficulties in performing mathematical operations.

Table 5: Prevalence of Dyscalculia in Division, Multiplication, Addition And Subtraction

s/m	Percentage score	No. of learners	Scored %	Learner %
1	90–100	2	100	2.7
2	80–89	11	81.3	14.8
3	70–79	16	75.0	21.6
4	60–69	16	63.0	21.6
5	40–59	17	50.0	22.9
6	30–39	8	37.5	10.8
7	10–29	3	18.25	4.2
8	0–9	1	6.3	1.4
Total		74		100

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The impact of dyscalculia on learners' overall academic performance and behavior in the classroom has been previously explored by Butterworth et al. (2011) and Roulstone et al. (2024). According to their findings, dyscalculic learners exhibit typical reading abilities, engage actively in various subjects, and display appropriate classroom behavior, provided there is no comorbidity with dyslexia or Attention Deficit Hyperactivity Disorder (ADHD). However, challenges emerge specifically during mathematics lessons, leading to heightened anxiety and discomfort. Rulyansah (2023) noted a tendency among dyscalculic learners to rely on their fingers for calculations rather than retrieving basic mathematical facts.

To shed light on these difficulties, the focus group interviews yielded qualitative insights into the attitudes and experiences of learners with mathematics. A consistent theme across participants was the perceived difficulty of the subject. Learners expressed frustration with the continuous introduction of new concepts, emphasizing the need for practice and assistance. While this qualitative aspect adds depth to the understanding of learners' experiences, the small sample size limits the generalizability of these findings.

Teachers' insights into dyscalculia, obtained through interviews, revealed a concerning lack of awareness and specific knowledge about the condition. Both teachers displayed limited familiarity with the term and struggled to pinpoint the causes and appropriate interventions. This highlights a critical gap in teacher training, signaling the need for targeted professional development programs to enhance teachers' awareness and competence in addressing dyscalculia.

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Table 6: Learner Interview Question and Response

INTERVIEW QUESTIONS	LEARNER A RESPONSE	LEARNER B RESPONSE	LEARNER C RESPONSE
What is your personal experience in mathematics since the previous grade?	I find mathematics to be a difficult subject, but I think with practice and some help at home, I can do better, especially if I get extra assistance. Mathematics is a tough subject because we don't understand some things and most of us failed the subject last term; however, some topics are simple. Sometimes mathematics is a tricky subject; sometimes you miss steps, and sometimes you just remember, and it gives you a headache and stress.	Math feels difficult because each and every day we learn a new thing and when we learn, we learn it in different ways. One day, they explain something and tomorrow they continue without fully explaining the steps. Things feel disjointed, but I think math can be simpler when we practice regularly, when we practice at home and at school, helping each other and communicating.	Math is difficult becauseit has so many sections like trigonometry, geometry. Some of them are confusing when they are taught and when you try to learn it from the book, it's not explained the same way the teacher does. The teacher explains it the way he understands it but not in a way that makes sense to us all.
What do you like or dislike about mathematics?	I don't like mathematics because it's too challenging and overwhelming. Some of the sums are too long, and when you think you are done you realize that there's still more to do, so that is what makes it boring for me.	I don't like math at all because it's too challenging, and every time there's something new, it's like—how are we supposed to focus on this? It's just too much.	What makes me hate math it is one thing: I used to like it because when you're solving something, you feel like you're doing it right, but then you see you got zero. Have you noticed that? It's like the mind is a sponge—it soaks up information, but with math, it's different. Math is just a hard subject. When they teach us, they must think about us and how we learn. By the time you've had math class, after school, and you get home, your brain is so tired, you can't do anything else.
How does mathematics affect other Grade 10 subjects?	Math affects other learning areas because it needs more focus and time. By the end of the lesson, you don't understand it, and you end up thinking that every subject is difficult.	Math affects other subjects because it needs your full focus and concentration, so you end up not understanding other subjects.	Math affects other learning areas because it needs so much time and focus that you end up spending all your time at home trying to figure it out. You need to stay at home doing math problems Then, when you try to study another subject, you realize it might actually be easier.

The findings from learners reveal a widespread perception of mathematics as a challenging subject, significantly impacting their attitudes and academic experiences. Many learners reported difficulties in understanding mathematical concepts, highlighting the need for targeted support and

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effective teaching strategies. Key challenges included frequent introductions of complex topics, inconsistencies between teaching methods and textbooks, and distracting behaviors from teachers, such as excessive joking. Learners' dislike for mathematics is rooted in its perceived difficulty, lengthy problem-solving processes, and a disconnect between effort and outcomes.

This negative view extended to other subjects, leading some learners to believe that all subjects were equally challenging. Concentration issues during mathematics lessons were also apparent, with learners citing distractions and uneven teacher attention as contributing factors. These findings underscore the urgent need for improved teaching strategies and enhanced teacher awareness to better support learners with dyscalculia (Butterworth et al., 2011; Roulstone et al., 2024).

Table 7: Teachers Interview Question and Response.

INTERVIEW QUESTIONS	LEARNER A RESPONSE	LEARNER B RESPONSE
What are your experiences with learning-disabled learners?	I've never worked with disabled learners; however, I understand that being disabled physically does not always mean that a learner has a learning disability.	They need more attention since they require different teaching methods. They do not adapt easily and tend to forget everything that they've been taught.
What is your perception of the concept of mathematical disability/ dyscalculia?	Struggling to work with numbers is an exceptional case because in most situations you'll find learners who excel in all other subjects but struggle a lot with mathematics and making sense of how numbers operate. Most learners who have difficulties in mathematics cannot even understand a simple operation like addition.	I've never heard the term dyscalculia before; this is the first time I'm encountering it. I refer to learners that are struggling in mathematics as mathematically disabled learners. This difficulty in understanding math might be linked to their mental state, which could result from abuse or challenging experiences at home.
What assessments can be used for dyscalculic learners?	The assessments provided to learners are generally standard; there is no special activity tailored to a certain group of learners that we think might be having difficulties in math. However, we do offer intervention assessments after the diagnostic evaluation has been conducted.	You must apply Bloom's Taxonomy with more questions on the basics. Group Dyscalculic: to assess dyscalculic learners you must determine if the problem is with math or something else. Grouping dyscalculic learners with faster learners and assessing them through group discussions can also be helpful.
What teaching techniques can be implemented to assist learners with dyscalculia?	Techniques could only be implemented if teachers were aware of dyscalculia and understood the measures to take should they find themselves having a learner with that condition in a classroom.	Providing extra lessons, creating more opportunities for individualized attention for those learners, displaying more visual aids like charts around the classroom, and offering more examples and class activities.

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The responses from the teachers highlighted a significant lack of awareness and understanding of dyscalculia, which affected their ability to recognize and support learners facing mathematical difficulties. Teacher A viewed learning disabilities as challenges in comprehension, particularly in reading and writing, while Teacher B perceived them as an inability to learn, influenced by teaching methods and students' mental states. Teacher A had no direct experience with learning-disabled students diagnosed with learning disabilities, whereas Teacher B acknowledged the need for more tailored teaching methods (Butterworth et al., 2011; Roulstone et al., 2024).

Both teachers reported gaps in their training regarding dyscalculia, with Teacher A noting it was not addressed in their academic preparation and Teacher B emphasizing a focus on inclusive education without specific training on dyscalculia. Discussions revealed differing views on causes, with Teacher A attributing difficulties to early number introduction and Teacher B citing stress and domestic violence as contributing factors (Rulyansah, 2023). The lack of specific diagnostic tools for assessing dyscalculic learners was evident, as both teachers relied on general assessments. Teacher A highlighted the importance of raising awareness before implementing targeted strategies, while Teacher B suggested interventions such as extra lessons and visual aids. Both admitted to using general teaching methods, which limited their ability to support learners with specific mathematical challenges.

Discussion

The findings of this study align with existing literature on dyscalculia, particularly concerning language processing, visual-spatial skills, and working memory. The challenges identified in language abilities underscore the necessity for enhanced language support within mathematics instruction, as difficulties in interpreting mathematical terminology can significantly hinder problem-solving (Butterworth, Varma, & Laurillard, 2011). Similarly, struggles with visual-spatial skills point to the need for teaching strategies

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that incorporate visual aids and models, given that such difficulties are commonly associated with dyscalculia (Kaufmann et al., 2020). Cognitive challenges, especially those related to working memory, highlight the importance of early intervention, as deficits in this area can impede the retention and manipulation of numerical information (Butterworth et al., 2011). The widespread numeracy difficulties observed suggest a need to reinforce foundational arithmetic skills, as learners often exhibit poor number sense, a core characteristic of dyscalculia (Kaufmann et al., 2020). Furthermore, confusion with mathematical operational signs emphasizes the necessity for explicit instruction and regular practice in using these symbols, which is a common struggle for students with dyscalculia (Butterworth et al., 2011).

The distribution of proficiency levels revealed that 10.8% of learners possess high proficiency in numerical concepts, affirming an innate understanding of numerosity (Butterworth, 2008; Babu & Sasikumar, 2019). However, the moderate proficiency group (21.6%) and the below-proficiency group (8.1%) indicate the urgent need for interventions focused on enhancing language comprehension in mathematics. Dyscalculia often impairs the understanding of number facts and mathematical symbols (Kaufmann et al., 2020). Learners with limited (13.5%) or minimal proficiency (5.4%) are particularly at risk, necessitating focused support to address their struggles with mathematical language and problem-solving (Rosenberg-Lee et al., 2015; McGowan et al., 2023).

The observed challenges in numerical sequencing underscore the difficulties dyscalculic learners face in accurately processing sequences. High levels of anxiety during assessments may further impede performance; learners suspected of dyscalculia required significantly longer to complete tests compared to their peers, often taking 45 minutes versus the standard 30 minutes, reflecting issues with memory recall and lower self-esteem. Specific difficulties, such as number recognition, digit confusion, and mental arithmetic, correlate with variations in completion times and overall test performance (Hudson & English, 2016). Table 5 reinforces these observations, indicating that only 2.7% of dyscalculic learners achieved high proficiency, while 22.9% scored between 40–59, highlighting their challenges with mathematical operations.

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The impact of dyscalculia on learners' overall academic performance and behavior in the classroom has been previously explored by Butterworth et al. (2011) and Roulstone et al. (2024). These studies suggest that dyscalculic learners typically demonstrate standard reading abilities, engage actively in various subjects, and display appropriate classroom behavior, provided there is no comorbidity with dyslexia or ADHD. However, challenges manifest particularly during mathematics lessons, resulting in heightened anxiety and discomfort. Rulyansah (2023) noted that dyscalculic learners often rely on finger counting for calculations instead of retrieving basic mathematical facts. Qualitative insights from focus group interviews revealed consistent themes of frustration and the perceived difficulty of mathematics. Learners expressed a need for additional practice and assistance, particularly as new concepts were continuously introduced. While these qualitative aspects enrich our understanding of learners' experiences, the small sample size limits the generalizability of the results.

Teacher insights into dyscalculia revealed a concerning lack of awareness and specific knowledge about the condition, emphasizing the critical gap in teacher training and the need for professional development programs aimed at enhancing teachers' awareness and competence in addressing dyscalculia. In the context of the study, the findings highlight a significant gap in teachers' understanding of dyscalculia, which impedes the effective identification and support of learners with mathematical difficulties (Butterworth et al., 2011; Roulstone et al., 2024). The differing perceptions of learning disabilities among teachers reveal the need for comprehensive training that clearly defines dyscalculia. Additionally, the absence of specific diagnostic tools and tailored teaching strategies restricts the educational opportunities available to dyscalculic learners. Therefore, addressing these gaps through targeted professional development and awareness programs is essential for fostering an inclusive learning environment that meets the diverse needs of all students, particularly those with dyscalculia.

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Conclusion

This study sheds light on the significant prevalence of dyscalculia among Grade 10 learners in Soshanguve schools. The findings highlight that difficulties in language processing, visual-spatial skills, cognitive function, and numeracy significantly impede learners' mathematical abilities, underscoring the pressing need for targeted interventions and tailored instructional strategies. A key takeaway is the limited proficiency observed among a considerable portion of learners, particularly in language comprehension and numerical sequencing, which points to an urgent requirement for enhanced language support in mathematics instruction. The alarming rates of below-average performance across various domains reflect the necessity for educators to prioritize foundational skills and adopt explicit teaching methods that cater to the unique learning needs of students with dyscalculia.

Moreover, the qualitative insights from learner interviews indicate a pervasive perception of mathematics as a challenging subject, compounded by inconsistent teaching methodologies and insufficient teacher awareness of dyscalculia. This lack of understanding among educators not only hampers their ability to identify dyscalculic learners but also obstructs the implementation of effective instructional strategies tailored to these students' needs. The study further emphasizes the importance of comprehensive teacher training programs that focus on dyscalculia, alongside the development of specific diagnostic tools to identify and support learners facing mathematical difficulties. Implementing targeted professional development initiatives will empower teachers to recognize and address the signs of dyscalculia effectively, thereby fostering a more inclusive learning environment.

Thus, addressing the educational gaps identified in this study is crucial for improving the academic experiences of learners with dyscalculia. By enhancing teacher awareness, developing tailored instructional strategies, and providing adequate support, educators can empower all learners, ensuring they have the skills necessary to achieve their full potential in mathematics and beyond. The journey toward inclusive education for

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students with dyscalculia is imperative, and the findings of this study serve as a foundational step toward fostering a more equitable and supportive educational landscape.

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References

Akinade, E. O. (2022). *Teachers' awareness and competence in the use of scaffolding as an instructional strategy for teaching students with dyslexia* (Master's thesis, Kwara State University, Nigeria).

Allen, K. (2020). *Understanding the contributions of working memory components over the primary school years to enable screening for future attainment in mathematics* (Doctoral dissertation, Durham University).

American Psychological Association. (2017). *Ethical principles of psychologists and code of conduct.*

Ashraf, F., & Najam, N. (2020). An epidemiological study of prevalence and comorbidity of non-clinical dyslexia, dysgraphia, and dyscalculia symptoms in public and private schools of Pakistan. *Pakistan Journal of Medical Sciences, 36*(7), 1659. https://doi.org/10.12669/pjms.36.7.2486

Aunio, P., & Fritz, A. (2019). Learning difficulties in mathematics. In A. Fritz (Ed.), *International handbook of mathematical learning difficulties* (p. 709). Springer.

Babu, A. G., & Sasikumar, N. (2019). Need for neurocognitive approach in teaching mathematics for children with dyscalculia. *International Journal of Basic and Applied Research, 9*(4), 194–200.

Butterworth, B., Varma, S., & Laurillard, D. (2011). Dyscalculia: From brain to education. *Science, 332*(6033), 1049–1053. https://doi.org/10.1126/science.1201536

Castleberry, A., & Nolen, A. (2018). Thematic analysis of qualitative research data: Is it as easy as it sounds? *Currents in Pharmacy Teaching and Learning, 10*(6), 807–815. https://doi.org/10.1016/j.cptl.2018.03.019

Chinn, S. (2018). *Maths learning difficulties, dyslexia and dyscalculia.* Jessica Kingsley Publishers.

Chinn, S., & Ashcroft, R. E. (2017). *Mathematics for dyslexics and dyscalculics: A teaching handbook* (4th ed.). John Wiley & Sons.

Creswell, J. W., & Creswell, J. D. (2017). *Research design: Qualitative, quantitative, and mixed methods approaches* (5th ed.). Sage Publications.

Daneshfar, S., & Moharami, M. (2018). Dynamic assessment in Vygotsky's sociocultural theory: Origins and main concepts. *Journal of Language Teaching and Research, 9*(3), 600–607. https://doi.org/10.17507/jltr.0903.21

Multidisciplinary Journal of School Education • Vol. 13, 2024/2 No. 26
Teacher and Technology
ISSN 2543-7585 e-ISSN 2543-8409

Delgado, M. A. C., Delgado, R. I. Z., Palma, R. P., & Moya, M. E. (2019). Dyscalculia and pedagogical intervention. *International Research Journal of Management, IT and Social Sciences, 6*(5), 95–100. https://doi.org/10.21744/irjmis.v6n5.726

Department of Basic Education. (2014). *Report on the Annual National Assessments of 2014.* https://www.education.gov.za/Portals/0/Documents/Reports/REPORT%20ON%20THE%20ANA%20OF%202014.pdf?ver=2014-12-04-104938-000

Dube, B. (2020). Rural online learning in the context of COVID-19 in South Africa: Evoking an inclusive education approach. *REMIE: Multidisciplinary Journal of Educational Research, 10*(2), 135–157. https://doi.org/10.17583/remie.2020.5607

Espina, E., Marbán, J. M., & Maroto, A. I. (2023). The affective domain in mathematics in children with dyscalculia: A systematic review. *Quadrante, 32*(2), 106–129. https://doi.org/10.48489/quadrante.2023.32.2.106

Hayes, A. M., & Bulat, J. (2017). *Disabilities inclusive education systems and policies guide for low- and middle-income countries.* RTI Press.

Hudson, L., & English, L. (2016). *Mathematics anxiety: Research, theory and practical applications.* Springer.

Hussain, K., & Soares, N. (2022). Dyscalculia. *International Journal of Child Health & Human Development, 15*(3).

Kaufmann, L., von Aster, M., Göbel, S. M., Marksteiner, J., & Klein, E. (2020). Developmental dyscalculia in adults. In L. A. Fritz & P. Aunio (Eds.), *International handbook of mathematical learning difficulties* (pp. 367–384). Springer.

Kunwar, R. (2021). Impacts of dyscalculia in learning mathematics: Some considerations for content delivery and support. In D. C. Singh (Ed.), *Learning disabilities: Neurobiology, assessment, clinical features and treatments* (pp. 125–134). IntechOpen.

Layes, S. (2022). Verbal and visual memory skills in children with dyslexia and dyscalculia. *Psychology & Neuroscience, 15*(3), 251–259. https://doi.org/10.1037/pne0000212

McCarroll, J. (2021). *Math anxiety across all majors 2.0* (Master's thesis, Saint Mary's College of California).

McGowan, V. A., & Rosenberg-Lee, M. (2023). The neurobiological basis of dyscalculia: Implications for intervention. *Neuroscience and Biobehavioral Reviews, 137,* 102619. https://doi.org/10.1016/j.neubiorev.2023.01.013

ISSN 2543-7585 e-ISSN 2543-8409

Middleton, L., Hall, H., & Raeside, R. (2019). Applications and applicability of social cognitive theory in information science research. *Journal of Librarianship and Information Science, 51*(4), 927–937. https://doi.org/10.1177/0961000617742459

Molise, D. C., & Luneta, K. (2024). An overview of the causes of dyscalculia and its impact on learners' arithmetic ability. *The Independent Journal of Teaching and Learning, 19*(1), 124–144.

Monei, T., & Pedro, A. (2017). A systematic review of interventions for children presenting with dyscalculia in primary schools. *Educational Psychology in Practice, 33*(3), 277–293. https://doi.org/10.1080/02667363.2017.1306601

Morales, M. P. E. (2016). Participatory action research (PAR) cum action research (AR) in teacher professional development: A literature review. *International Journal of Research in Education and Science, 2*(1), 156–165. https://doi.org/10.21890/ijres.45436

Nyumba, T. O., Wilson, K., Derrick, C. J., & Mukherjee, N. (2018). The use of focus group discussion methodology: Insights from two decades of application in conservation. *Methods in Ecology and Evolution, 9*(1), 20–32. https://doi.org/10.1111/2041-210X.12860

Onyishi, C., & Sefotho, M. (2021). Factors influencing STEM career interests in high school students with disabilities. *International Journal of Mechanical and Production Engineering Research and Development, 11*(4), 1–14.

Prabavathy, M., & Sivaranjani, R. (2020). Effects of virtual manipulative in enhancing basic arithmetic for students with developmental dyscalculia. *Journal of Emerging Technologies and Innovative Research, 7*(6), 19–26.

Pule, K. G. (2020). *School effectiveness and effective mathematics teaching: Towards a model of improved learner outcomes* (Doctoral dissertation, North-West University, South Africa).

Regmi, N. P. (2019). *Inclusive education in Nepal from theory to practice* (Doctoral dissertation).

Rosenthal, M. (2016). Qualitative research methods: Why, when, and how to conduct interviews and focus groups in pharmacy research. *Currents in Pharmacy Teaching and Learning, 8*(4), 509–516. https://doi.org/10.1016/j.cptl.2016.03.021

Roulstone, A., Morsanyi, K., & Bahnmueller, J. (2024). Performance on curriculum-based mathematics assessments in developmental dyscalculia: The effect of content domain and question format. *Psychological Research.*

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