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Case Study

Targeted Remediation in Dyscalculia: A Case Study of Cognitive and Educational Intervention in an Indian Adolescent

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ABSTRACT

This case study explores the academic, cognitive, and emotional traits of Ms. S, a 13-year-old Female Student diagnosed with Dyscalculia, a Specific Learning Disorder. Ms. S showed age-appropriate reading and writing skills as well as characteristic intellectual functioning, however she persistently challenged with Mathematical Ideas, quantitative reasoning and numerical operations. A domain Specific learning deficits was identified using the Malin's Intelligence Scale for Indian Children (MISC) and a culturally acceptable Specific Learning Disorder Diagnostic Battery. A comprehensive intervention combining multisensory instruction, cognitive training, academic accommodations, and emotional support was implemented. Over a 12 week- period, significant improvement was observed in Ms. S's conceptual clarity, academic preparation, and self-confidence. This case underscores the importance of early diagnosis, culturally appropriate assessments, and holistic, individualized intervention approaches in addressing Specific Learning Disorders in school-age children, particularly within the Indian educational framework.

Keywords: *Dyscalculia, remediation, cognitive intervention, specific learning disorder*

Dyslexia is a specific learning disorder characterized by serious challenges in acquiring mathematical skills that have long remained unsung despite its significant impact on academic achievement and psychological well-being. The Diagnostic and Statistical Manual of Mental Health Disorders indicates that Dyscalculia is refereed to as specific learning disorder affecting mathematical skills. It is characterized as persistent difficulties with mathematical comprehension, facts, acquisition, and computations that cannot be attributed by cerebral boundaries, inadequate learning or sensory impairments. About 3%- 4% of people have the condition (Shalev, Manor, & Gross-Tsur, 2005), yet prevalence numbers vary greatly depending on demographic surveys and diagnostic standards.

In educational studies, students with dyscalculia are often labelled as "poor in math" without recognition of the underlying cognitive impairment, leading to delayed or inappropriate intervention. (Mazzocco,2007).

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As cognitive neuroscience has improved, additionally had an idea underlying dyscalculia. The "core deficit hypothesis" put forward by Butterworth 1999 proposes that dyscalculia arises from a basic malfunction in an essential number module that represents quantitative scale.

This part of the brain is vital for the neural representation of mathematical quantities and is believed to be situated in the intraparietal sulcus (IPS) (Dehaene, 2001; Price et al 2013). In terms of limiting learning achievement, the condition can lead to diminished academic self-efficacy, high levels of frustration, and anxiety related to education, particularly when it goes undiagnosed (Ashcraft & Krause, 2007).

There are persistent challenges with recognizing and assisting students who have dyscalculia. It usually occurs during a period of mental turmoil or persistent academic failure. Female students are more likely to experience this interruption since they may absorb their difficulties with school or use retention techniques to make their struggles less apparent to educators and mental health professionals (Devine et al., 2013). In addition, parents and teachers' ignorance leads to the erroneous assumption that mathematical problems are driven by lack of enthusiasm or a general academic deficit.

Proper Diagnose and care are important since untreated dyscalculia has long term effects on academic performance emotional health, and employment. Effective tactics include collaboration between educators, parents, and therapists; explicit number sense training; cognitive- behavioral approach to anxiety; and individualized instruction utilizing multifaceted techniques (Wilson et al., 2015).

The resurgence of a distinction between "primary" and "secondary" developmental dyscalculia is another outcome of recent advancements in our understanding of DD. The former type of DD seems to be associated with impaired development of brain mechanisms for processing numerical magnitude information, while the latter refers to mathematical deficits resulting from external influences such as domain-general cognitive deficits, behavioural attention issues, low socioeconomic level, inadequate instructions. Future research that combines this distinction with longitudinal empirical studies holds great promise for expanding our understanding of the disorder and creating successful educational interventions.

METHODOLOGY

Aim

To examine how effectively an intensive program and psychoeducational evaluation can address the academic, cognitive, and emotional difficulties of a 13-year-old girl with Dyscalculia.

Research Design

A qualitative, exploring solitary case design is applied in this studies. To provide thorough, framed and multifaceted view of Ms. S cognitive, intellectual, emotional and behavioural profile, a case study method was picked. For low- incidence, high impact, conditions like dyscalculia, where special encounters provide useful insights into diagnosis and treatment methods, this design is especially ideal.

To ensure validity and depth of understanding the study is cross-sectional design and uses a variety of data gathering sources, such as developmental history reports, clinician interviews, standardized test, and qualitative observations.

Tools & Instruments

1. **Malins Intelligence Scale for Indian Children (MISIC)**

The MISIC (Malin, 1969) and Indian adaptation of the Wechsler Intelligence Scale for Children (WISC) was used to assess the child cognitive functioning. It includes verbal and performance subtest to evaluate various cognitive domains such as comprehension, arithmetic reasoning, vocabulary, digit span, block design, and object assembly. The test is normed for Indian children and provides an estimate of overall intellectual functioning (IQ), as well as individual cognitive strengths and weaknesses.

2. **Specific Learning Disability (SLD) Battery**

The SLD assessment battery consisted of standardized academic achievement tests tailored to assess reading, writing, spelling, and arithmetic skills in alignment with age-appropriate curriculum standards. This included: Mathematical ability tests evaluating basic operations (addition, subtraction, multiplication, division), number concepts, place value, and word problem-solving.

3. **Reading and writing assessments to rule out other SLDs.**

Curriculum-Based Assessment (CBA) to compare academic performance with class-level expectations.The battery was used to confirm deficits in mathematical processing and to rule out co- occurring academic impairments in literacy.

4. **Clinical Interview and Developmental History**

Semi-structured interviews were conducted with the child, parents, and teachers to gather detailed developmental, academic, emotional, and social history. This helped contextualize test results within environmental and behavioural patterns.

5. **Observation and informal Assessment**

To examine attention span, math-related anxiety, avoidance behaviours, and coping mechanisms during mathematical activities, behavioural assessments and classroom observations were carried out.

CASE PRESENTATION

Ms. S is a 13-year-old female student studying in Grade 8 at a mainstream CBSE school who was referred for psychological evaluation due to consistent academic underachievement, specifically in mathematics, accompanied by growing anxiety and behavioural withdrawal during math-related activities. Born at full term with no complications and having achieved developmental milestones on time, Ms. S's early childhood was medically and developmentally unremarkable. She demonstrated age-appropriate language and social skills and was described as a cheerful and expressive child with strong creative interests. Her academic difficulties were first noticed in the second grade, where she struggled with basic number concepts, counting, and place value. Over time, these challenges escalated to include confusion between mathematical operations, poor retention of multiplication tables, and reliance on fingers for even simple arithmetic. Despite consistent attendance, private tutoring, and regular parental support, her mathematical performance remained significantly below her grade level. These difficulties began to affect

her self-confidence, and teachers reported that she frequently avoided participating in math-related activities, exhibited test-related anxiety, and showed signs of academic helplessness. A detailed semi-structured interview with her parents and teachers revealed no familial or environmental risk factors such as intellectual disability, neglect, or emotional trauma. Ms. S demonstrated strengths in language-based subjects and creative activities, showing clear academic potential in other areas. A Mental Status Examination revealed that she was well-groomed, cooperative, and age-appropriate in behaviour. Her effect was mildly anxious but congruent, and her thought process was logical and coherent. She displayed insight into her learning struggles, describing herself as "bad at math" despite "trying very hard." There were no indications of perceptual disturbances or severe emotional dysregulation. Cognitively, she was oriented, with intact memory and attention, although mild distractibility was observed during numeracy tasks.

A standardized cognitive assessment using Malin's Intelligence Scale for Indian Children (MISIC) revealed a full-scale IQ within the average range, ruling out intellectual disability. Verbal subtests such as Comprehension and Vocabulary were above average, while subtests requiring numerical reasoning, such as Arithmetic and Coding, were significantly lower. These results highlighted weaknesses in working memory and processing speed related specifically to numerical operations. Subsequently, Ms. S was administered the Specific Learning Disorder Diagnostic Battery based on Indian norms. Her reading and writing skills were found to be adequate for her age, effectively ruling out dyslexia or dysgraphia. However, her performance in mathematical tasks was significantly below expectations, with difficulties observed in basic arithmetic, number sequencing, understanding of quantities, and problem-solving. Performance was found to be 1.5 to 2 standard deviations below grade level, fulfilling the DSM-5 diagnostic criteria for Specific Learning Disorder with impairment in mathematics (Dyscalculia).

Following diagnosis, a structured and individualized intervention plan was implemented. Psychoeducation sessions were provided to Ms S, and her parents seek out myths about leaning difficulties and resist stigma. She was enrolled in a remedial education program focusing on multisensory instruction, employing visual, auditory, tactile, and kinaesthetic modalities to teach number concepts and operations. Tools such as base-ten blocks, abacus, and color-coded worksheets were integrated to enhance her concrete understanding of math. Simultaneously, cognitive training exercises targeting working memory and sequential processing were conducted using both paper-pencil tasks and digital programs. School-based accommodations were recommended, including extra time for math exams, permission to use a calculator for complex calculations, and exemption from time-bound math drills. Additionally, emotional support through individual counselling was offered to build self-esteem and teach coping strategies for academic stress, including relaxation techniques and positive reinforcement strategies. Over a span of 12 weeks, Ms. S demonstrated improved conceptual clarity, reduced anxiety, and enhanced engagement with mathematics. While mastery in all areas of mathematics was not immediately achieved, the intervention facilitated measurable academic and emotional growth. This case illustrates the importance of early identification, culturally sensitive diagnostic tools like MISIC and the SLD Battery, and a holistic remediation approach to support children with dyscalculia.

Menal Status Examination: - During the assessment, Ms. S presented as a neatly dressed adolescent with age-appropriate grooming and hygiene. She appeared her stated age and maintained appropriate eye contact throughout the session. Her posture was relaxed, and her

motor activity was within normal limits, with no evidence of psychomotor agitation or retardation. She was cooperative, attentive, and established rapport easily with the examiner. Ms. S's speech was spontaneous, coherent, and goal-directed, with normal rate, rhythm, and tone. Her mood, as described by her, was "nervous but okay," and her effect was mildly anxious but appropriate to the content of the discussion and context. There were no signs of lability, irritability, or flattening of affect.

Her thought process was logical, linear, and goal-directed, with no signs of tangentiality, circumstantiality, or derailment. Thought content did not reveal any delusional ideas, obsessions, or preoccupations. Ms. S expressed concerns about academic failure, particularly in mathematics, and her statements reflected low academic self-esteem and anticipatory anxiety around tests. No suicidal ideation or intent was reported. There were no perceptual disturbances, including hallucinations or illusions. She was completely conscious of place, time and people. Attention and concentration were generally intact but showed slight variability during tasks requiring numerical computation. Immediate and recent memory functions were adequate, and remote memory was intact. Her abstract thinking was appropriate for age, demonstrated through proverb interpretation and similarity tasks. Adequate Insight into her challenges she faced was given; she acknowledged to having challenges with mathematics and claimed that she desires to do better with guidance and support. Her judgment was assessed as intact in hypothetical and real-life scenarios. Overall, the MSE indicated no significant psychopathology, though mild anxiety and academic stress were evident, particularly linked to her struggles with mathematics.

RESULT TABLE

Assessment Tools	Subtest/ Domain	Score	Interpretation
Malin's Intelligence Scale for Children (MISIC)	Verbal IQ	102	Average
	Performance IQ	91	Low Average
	Full Scale IQ	96	Average
	Arithmetic (Performance Subtest)	Below Average	Difficulty with numeric reasoning
	Coding	Below Average	Slow Verbal Reasoning
	Comprehension	Above Average	Strong Verbal Reasoning
	Vocabulary	Above Average	Rich Vocabulary and Expression
SLD Diagnostic Battery	Reading Accuracy	Age Appropriate	No Impairment
	Writing Skills	Age Appropriate	No impairment
	Number Concepts	Below Grade Level (1.5 SD below mean)	Difficulty understanding quantity and operations
	Mathematical Skills	Below Grade Level (2 SD below mean)	Significant impairment – Dyscalculia
	Word Problems	Below Grade Level	Poor applied math and reasoning
	Visual- Motor Integration	Borderline	

DISCUSSION AND CONCLUSION

The case of Ms. S, a 13-year-old girl diagnosed with Specific Learning Disorder with impairment in mathematics (Dyscalculia), highlights several critical issues surrounding the identification, diagnosis, and remediation of learning disabilities in the Indian context.

Despite having average intellectual functioning and strengths in verbal and creative domains, Ms. S faced persistent and specific difficulties in mathematics that significantly impacted her academic self-esteem, classroom participation, and emotional well-being. The delay in formal diagnosis until adolescence reflects the common pattern of under-identification or misattribution of SLD in school systems, where persistent academic struggles are often mistaken for lack of effort, behavioural issues, or poor teaching.

The assessments used in this case — the Malin's Intelligence Scale for Indian Children (MISIC) and the Specific Learning Disorder Diagnostic Battery — proved effective in differentiating between global cognitive deficits and domain-specific learning difficulties. MISIC helped establish that Ms. S's intellectual functioning fell within the average range, thereby ruling out intellectual disability. Notably, her performance in verbal subtests was stronger than in performance-based, numeracy-related tasks, aligning with her reported academic profile. The SLD Battery further confirmed significant deficits in arithmetic computation, conceptual understanding, and applied math skills (e.g., word problems), consistent with diagnostic criteria for Dyscalculia as outlined in the DSM-5.

The intervention plan focused on a holistic, multimodal approach, incorporating both academic remediation and emotional support. Multisensory instruction — integrating visual, auditory, tactile, and kinesthetic learning — played a key role in addressing foundational numerical understanding. These strategies are especially important for children with Dyscalculia, who often struggle with abstract representations of quantity and benefit from concrete, experiential learning tools such as base-ten blocks, manipulatives, and color-coded visuals. Cognitive exercises aimed at enhancing working memory and sequential processing — both commonly weak areas in Dyscalculia — were incorporated to support underlying cognitive functions related to mathematical learning.

Importantly, the case also demonstrates the psychological toll of undiagnosed learning disabilities. Ms. S exhibited mild anxiety, avoidance behaviors, and reduced academic self-confidence, which were directly addressed through supportive counseling. Building emotional resilience, self-advocacy, and motivation became an essential part of the intervention. School accommodations, such as extra time, calculator use, and math-specific exemptions from rigid time-bound tests, further helped to level the playing field, allowing Ms. S to demonstrate her true learning potential.

This case underscores the value of early identification, culturally appropriate assessments, and individualized, evidence-based interventions in managing Specific Learning Disorders. It also illustrates the importance of a multidisciplinary approach involving educators, clinical psychologists, special educators, and family members. The positive outcomes observed in Ms. S — including improved engagement, reduced math-related anxiety, and better conceptual clarity — support the growing body of research advocating for multisensory and cognitive strategies in the treatment of Dyscalculia. In conclusion, this case affirms that with the right support system, even children facing specific learning difficulties can overcome barriers and thrive both academically and emotionally.

Key Learnings

- Early Identification is Crucial: Ms. S's case underscores the importance of early screening for Specific Learning Disorders. Delayed diagnosis can result in emotional distress, academic underachievement, and poor self-esteem.
- Domain-Specific Deficits Must Be Differentiated: Standardized assessments such as the MISIC and SLD Diagnostic Battery are vital in distinguishing between general cognitive impairments and specific learning difficulties like Dyscalculia.
- Multisensory and Individualized Instruction is Effective: A tailored intervention using multisensory teaching methods significantly improved Ms. S's mathematical understanding and engagement, validating the efficacy of concrete, experiential learning techniques for Dyscalculia.
- Emotional Support Enhances Academic Interventions: Addressing emotional components like anxiety, self-doubt, and learned helplessness through counselling helped improve Ms. S's overall functioning and school experience.
- Parental and School Collaboration is Key: Successful intervention depended on coordinated efforts among parents, school staff, and clinical professionals, emphasizing the role of systemic support in managing learning disabilities.

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Conflict of Interest

The author(s) declared no conflict of interest.

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