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Sensory Integration Therapy in Learning Disabled School Going Children of Age Group 8-11 Years

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ABSTRACT

Introduction: Learning Disorders are diagnosed when the individual's achievement on individually administered, standardised tests in reading, mathematics, or written expression is substantially below that expected for age, schooling, and level of intelligence. Learning Disorders (LD) are complex diseases that affect about 2-10% of the school-age population. Various assessment tools are used to identify learning disability like learning disability evaluation scale (LDES), Children nonverbal learning disabilities scale, learning disability diagnostic inventory (LDDI).

Methodology: A total of 480 forms were distributed in the schools of Dehradun, out of which 162 forms were collected, and based on inclusion and exclusion criteria, 8 subjects were identified to have learning disability. LDDI scale was used to assess learning disability, consisting of six sections (listening, speaking, reading, writing, mathematics and reasoning).

Results: Prevalence was calculated using the point prevalence formula, and the prevalence of learning disability in Dehradun was 4.9%. Data was analyzed using SPSS software 15.0. Paired T test was used and the result showed a significant difference between the total score pre and post reading.

Conclusion: The study concluded that sensory integration positively impacted learning disability, helping to improve the behaviour of learning disabled subjects.

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Introduction

Learning disability are neurobiological disorders that are not diagnosed before school age, affecting the subject throughout their life. Genetic and acquired factors may occur alone or in combination in determining learning disability [1]. The definition of learning reflects four concepts. Firstly, Learning is a process of acquiring the capability for skilled action; then, secondly, Learning results from experience or practice. Thirdly, Learning cannot be measured directly; instead, it is inferred from behaviour, and finally, the fourth stage, Learning produces relatively permanent changes in behaviour (Schmidt, 1988). Learning Disorders are diagnosed when the individual's achievement on individually administered, standardised tests in reading, mathematics, or written expression is substantially below that expected for age, schooling, and level of intelligence. The learning problems significantly interfere with academic achievement or activities of daily living that require reading, mathematical, or writing skills. Various statistical approaches can be used to establish that a discrepancy is significant.

LDs are intrinsic to the individual, presumed to be due to central nervous system dysfunction, and are chronic, life-long conditions. Molecular genetic studies suggest that this disorder has a complex etiology, with multiple genetic and environmental risk factors contributing to each disorder's overall risk. Genetic and acquired factors may occur alone or in combination in determining LD. Several acquired factors have been also involved such as: childbirth dystocia's, neonatal asphyxia, neonatal icterus, cardiorespiratory arrest, status epilepticus, low birth weight and preterm birth, smoker mother during pregnancy, exposure to more than 2 general anesthesia within the fourth year of life, parental history of alcoholism or substance abuse and prenatal exposure to cocaine. School, family and social context are also interwoven with neurobiological factors and contribute to determining the multifactorial nature of LD [1].

"No other disabling condition affects so many people and yet has such a low public profile and low level of understanding as LD," WASHINGTON SUMMIT 1994 (Reid L, et. al,1994)

Learning Disorders (LD) are complex diseases that affect about 2-10% of the school-age population [1]

In India, very few focal studies have been conducted regarding the prevalence of SLD, and the results are variable. In a multicenter study on child psychiatric epidemiology (ICMR), the prevalence reported by NIMHANS (2001) is 7.2% and the prevalence of SRD reported by KGMC Lucknow (under the same multicenter study) is 0.52%. The prevalence of SLD in a study conducted at AIIMS in 1991 on school children was 4.87 per 1000; currently, it is estimated to be around 9%. The boys were more commonly affected than the girls, the ratio being 4:1 (boys to girls) [2]. The various tools used for assessment are LLDI, LDES, and sharp observation by the school teachers, along with awareness among parents and teachers, which can make the diagnosis easy.

The sensory integration theory was the life's work of Dr. A Jean Ayres (1920 to 1988) and continues to evolve and be modified by researchers and clinicians worldwide.
Sensory Integration is defined as:

- "...the neurological process that organises sensation from one's body and the environment and makes it possible to use the body effectively within the environment. The spatial and temporal aspects of inputs from different sensory modalities are interpreted, associated and unified. Sensory information is information processing. (Ayres 1989a, p 11).

Ayres summarises the theory as:
Sensation from the body, especially during purposeful activity, provides how a neuronal model or percept of the body is established. An accurate body scheme is necessary for practising tasks to give a sense of directionality and to relate the body to space. At the same time, conceiving, planning, and executing adaptive action are significant means by which sensation is made meaningful and translated into body perception. Praxis is a uniquely human aptitude that underlies the conceptualisation, planning and execution of skilled adaptive interaction within the physical world, and it is fundamental to purposeful activity. Praxis and perception are both end products of sensory integration.... Somatosensory, vestibular and visual input to sensory integration and praxis are essential to the organism's environmental interaction (Ayres 1989b, pp. 11- 12).

Over time, sensory integration theory and its evaluation and intervention technology have undergone numerous revisions. Ayres anticipated the need for the theory to evolve, indicating that [3]:

..... In many instances, sensory integration theory falls short of its goals. Still, a useful purpose will have been served if a new focus on the problem of learning disorders stimulates further search for an even more effective and comprehensive theory that will yield procedures that may enhance CNS integration and consequently ameliorate associated learning and behaviour problems. Truth like infinity is to be forever approached but never reached.

Methodology
The school-going children of Dehradun between the age group of 8-11 years were approached. Permission was obtained from the principals of different schools in Dehradun. Then, the consent form was signed by the students' parents. The forms were distributed. A total of 480 forms were distributed, of which 162 were filled out and returned. The LDDI scale was used for the assessment of learning disability. The LDDI scale considers the six sections of listening, speaking, reading, writing, mathematics, and reasoning. Based on inclusion and exclusion criteria, out of 162 subjects, 8 had a learning disability.

The 8 subjects were given sensory integration treatment that included joint compression, swings, a Swiss ball, soft and loud music, clay and peg boards for improving hand coordination and strength of hand muscles. Through the abovementioned objects, subjects were made to perform various activities. Vestibular, tactile, and proprioceptive input was given, and the LDDI scale was again used as an outcome measure.

Result
A total of 480 subjects were included in the study. The subjects were evaluated on LDDI for the following six sections (listening, speaking, reading, writing, mathematics, and reasoning). The forms thus obtained were evaluated, the raw score for each section was converted to percentiles and stanines using conversion tables as given in the LDDI manual, the stanines thus obtained for each of the subjects were compared with standard stanine values for learning disability (at least one score above six and at least one score below six) and accordingly the learning disabled children were screened out from the total of 480 which came out to be 8.
The standard formula to find out the prevalence was then applied.

Point Prevalence
The formula gives the Point prevalence.

$$\frac{\text{Number of all current cases (Old and new) of a Specified disease existing at a given point in time}}{\text{The estimated population at the same point in time}} * 100$$

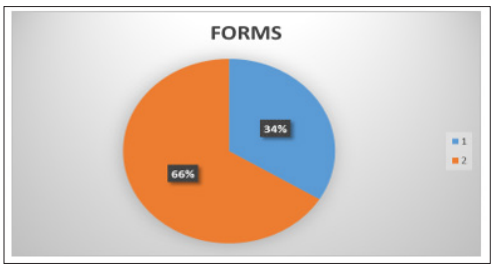
Number of learning disabled screened out = 8

Estimated population = 162

Therefore, the prevalence of learning disability in school-going children in Dehradun.

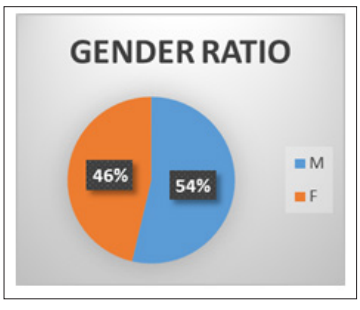
$$8 * 100 = 162$$

Pie Chart 1: Show Percentage of Forms Received and Not Received

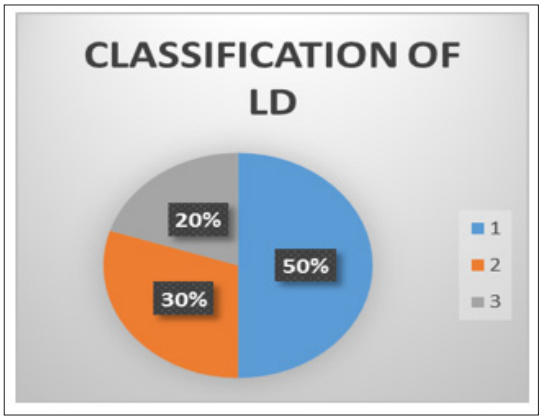


1= forms received
2= forms not received

Pie Chart 2: Depicts the Ratio of Male and Female



Pie Chart 3: Shows Types of Learning Disability in Subjects



Where 1 = DYSCALCULIA
2 = DYSLEXIA
3= DYSGRAPHIA

The data was analysed using SPSS software version 15.0. The score calculated was taken from the Stanine based on the LLDI manual. The mean and standard deviation of the individual and total scores were calculated for six sections (listening, speaking, reading, writing, mathematics and reasoning).

Table 4.1: Mean And Standard Deviation of Total Pre and Post Reading

Total score	MEAN±S.D.
Pre	37.50±.626
Post	37.62±.497

Graph 4.1: Shows the Mean Difference in Total Score

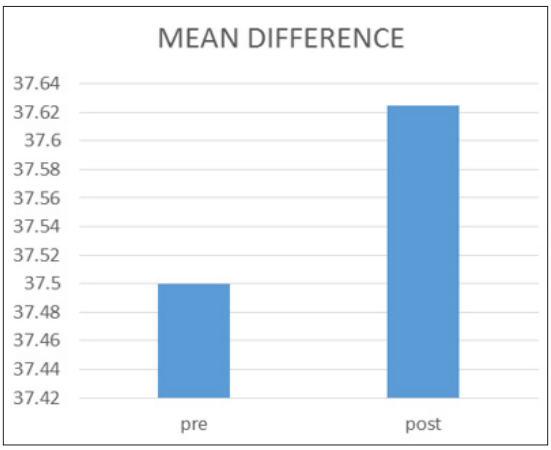
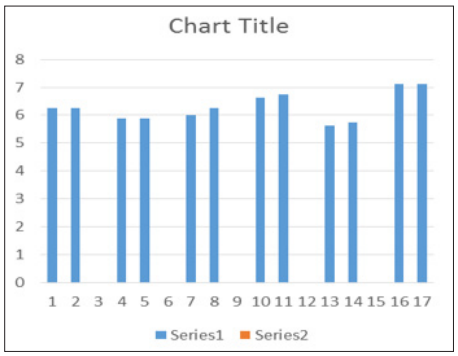


Table 4.2: Shows the Mean and Standard Deviation of Six Sections (Listening, Speaking, Reading, Writing, Maths and Reasoning)

COMPONENTS	MEAN±S.D.
LISTENING- PRE	6.25± 1.83
POST	6.25±1.83
SPEAKING- PRE	5.87±1.35
POST	5.87±1.35
READING- PRE	6.00±1.41
POST	6.25±1.16
WRITING- PRE	6.62±1.68
POST	6.75±1.48
MATHEMATICS- PRE	5.62±2.32
POST	5.75±2.25
REASONING- PRE	7.12±0.83
POST	7.12±0.83

Graph 2: Depicts the Mean Difference Between Six Sections of the LDDI Scale



1=LISTENING
2=SPEAKING
3=READING
4=WRITING
5=MATHEMATICS
6=REASONING

Table 4.2 Show the Test Results after Using the Paired T Test

Discussion

Learning disabilities constitute one of the major but ignored disabilities in India. Learning disabilities (Sold) is a generic term that refers to a heterogeneous group of neurobehavioral disorders manifested by significant unexpected, specific and persistent difficulties in the acquisition and use of efficient reading (dyslexia), writing (dysgraphia) or mathematical (dyscalculia) abilities despite conventional instruction, intact senses, normal intelligence, proper motivation and adequate socio-cultural opportunity (Sunil K, 2005). This study, therefore, was an attempt at screening the learning disabled Indian children out of children of the age group 8-11 years studying in school within Dehradun and to see the effect of sensory integration treatment on those learning disabled children. Few standardized scales for the screening of learning disability are available like learning disability evaluation scale (LDES), Children nonverbal learning disabilities scale, learning disability diagnostic inventory (LDDI). In this study, LDDI was used. The LDDI is devised to be used above 8 years of age up to 17 years of age, but in this study, the lowest limit of the age group was taken as an early identification provides better prospects for future assessment and intervention. Therefore, an age group of 8-11 years was chosen.

Viewing through the results out of the total included forms in the study, which were 162, the students who were screened to be learning disabled were 8 in number, constituting around 4.93 % which accounted for the same as Karanade S [2]. The prevalence of SLD in a study conducted at AIIMS in 1991 on school children was 4.87 per 1000; currently, it is estimated to be around 9%. The boys were more commonly affected than the girls, the ratio being 4:1 (boys to girls). (Manju Mehta8, 2011). Out of 8 subjects, 6 were males and 2 were females.

TOTAL SCORE	STD ERROR	t VALUE	Sig (2-tailed)	P value
PRE AND POST	.350	-.357	.732	<0.05

When Ayres first presented the sensory integration (SI) theory, she grounded it in the neuroscience literature. Neuroplasticity was then and is today considered the heart of this theory. (Shelly J. Lane, 2010). Dendritic branching and an increased number of synapses reflect increased neuronal interactions and are a sign of structural neuronal modifications and increased complexity in neuronal interactions. Changes in dendritic branching in response to enriched environments were reported by Diamond et al (1972), Kempermann and Gage (1999), and Shelly J. Lane 2010). Enriched environmental conditions facilitate neural changes. Of interest is the finding that active exploration is a necessary component of the brain changes described, which also supports the central premise of SI: that active engagement of the child is needed to facilitate SI. Finally, it has also been observed that objects should be varied and that the period of exposure required was at least 1hour per day over a few weeks. (Shelly J. Lane, 2010). The SI theory assumption that a successful environmental interaction promotes processing and integration of sensory information was supported by Shelly J. Lane 2010 which suggested that deficits in one sensory modality results in alteration in how the brain processes information in other modalities and that a typical nervous system can flexibly rely on the sensory information available within the environment to complete the task.

The overall total score pre and post reading mean and standard deviation showed a difference, and in the same line, the components of the LDDI scale showed a difference. Addressing the mathematical component, the proposed etiological hypotheses to account for mathematical disabilities include poor motivation (Geary, 1993), deficits in verbal ability (Lansdown, 1978; Muth, 1984), and automatic deficits in basic arithmetic operations (Kirby and Becker, 1988). Sensory integration therapy is environment-enriched, specific to the individual's needs, and the changes may be individually driven. A playful environment that challenges the individual provides the individual with an opportunity to choose activities of their interest.

The improvement observed in the reading and writing component of the LDDI scale in the subjects was by Ayres's (1972 study, which found that in both the generalized sensory integration group and the auditory language problem group, children who received sensory integration treatment made greater academic gains in reading than the children who did not receive sensory integrative treatment [4]. (Moya Kinneley, 1993) Moreover, in contrast to Helen J. Polatajko 1991, who stated that neither approach (sensory integration and perceptual motor tasks) affects academic and motor performance and that observed changes should be attributed to normal growth and development. A study done by Paul L. Morgan et al, 2008, studied the interconnection between the reading problem and behavior modification and concluded that both are interlinked to each other. Another study done on sensory integration therapy and behavior modification by Michelle Zimmer et al, 2011, Sensory-based therapies are increasingly used by therapists in treatment of children with developmental and behavioral disorders.

The other components of LDDI scale as listening, speaking, and reasoning showed no significant difference on statistical analysis after sensory integration treatment but observed or behavior changes were seen as stated by the mother. Studies conducted by Ellen Yack (1989), Sadako Vargas et al (1998), and Helen J. Polatajko (1991 altogether stated that sensory integration alone has no effect on learning disability but can be given with other adjunct therapies, such as perceptual motor task, tuition, extra classes by the school or special education provided to these candidates. Aziz et al. concluded that Sensory integration-based learning model improves students' academic skills [5]. Teachers need training to implement the sensory integration model effectively [6]. Conclude that this paper serves as a call to action for occupational therapy professionals to increase the application of Ayres Sensory Integration (ASI) principles within school settings, addressing its historically limited use.

Maria et al. conclude that Sensory Integration Therapy (SIT) is increasingly recognised as a vital intervention for children, offering significant benefits across various developmental aspects [7]. Humpheries et al, concluded that sensory integration treatment had no effect on academic skills but that it improved motor performance as much as perceptual motor training and more than no treatment in his pilot study but on large scale study stated that sensory integration treatment however have a greater impact on sensory motor performance than either perceptual motor training or no treatment. Polatajko et al (1991) and Wilson et al (1992) interpreted their studies as showing that sensory integration treatment had the same effect on motor and academic variables as perceptual motor training or tutoring.

Future Scope of Study

- The study can be carried out in the adult population in terms of prevalence and treatment.
- Sensory integration treatment should be compared to other treatment approaches.
- Scale other than LDDI should be used.
- Should be done in a large sample size.
- The younger age group should be taken into consideration.

Limitation of Study

- Birth history was not taken into consideration.
- Genetic predisposition of learning disability is out of the scope of study.
- Long term environmental modification was not possible.

Conclusion

The study concluded that the sensory integration is effective in improving the behavior of individuals with learning disability thus accepting the alternate hypothesis [8-21].

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