# A MEASURE TO IDENTIFY LEARNING DIFFICULTY IN CHILDREN (4-5 YEARS)



## SUMMARY

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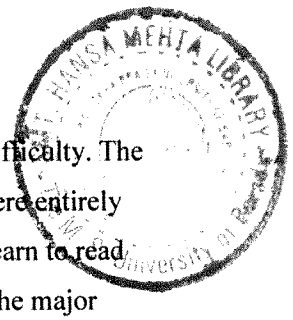


# EXECUTIVE SUMMARY

In 1896, Dr. Pringle Morgon describes a 14 year old boy with reading difficulty. The boy's teacher says- "He would be the smartest lad in the school if instruction were entirely oral." This is true even hundred years down the history of time! The ability to learn to read and write is a very important stepping stone in making one literate. Literacy is the major benchmark in today's world of cut throat competition. It opens doors to various options that a person can choose in life. To be successful in life, one needs to go through the grind of standard education in which the earliest and the basic step is reading and reproducing that reading skill in the written form which is writing skill and doing mathematical problems in a written form. Any deficit in reading (dyslexia), writing (dysgraphia) and mathematics (dyscalculia) leaves a big gaping hole in ones ability to complete years of formal education. So many apparently bright appearing children fare poorly in the formal assessment at school or are unable to clear their examinations year after year. Unfortunately, awareness of the difficulty being faced by the child is noticed quite belatedly when he/she is not able to cope up with the studies in higher standards. By definition, therefore, dyslexics are not identified until they have tried and failed to learn to read in school. Early knowledge of alphabet and alphabetical principals are the key to later reading (Adams 2001). By that time, it is difficult to determine whether observed differences between reading-disabled children and their classmates reflect direct causes, or merely consequences, of reading failure (Scarborough 1990). Initial difficulties in lower classes are overlooked both by the parents as well as the teachers and are attributed to other causes like disinterest in studies, malingering, hyperactivity etc. Even at a very early age, children with language disorders manifest hard-to-manage behaviors and evidence of emotional distress (Sundheim 2004). With the parents, medical fraternity and educational department becoming more aware of the magnitude of the problem; methods to identify and intervene were developed. Unfortunately, most of the children get identified in the latter years of primary school or some even later. Most of the children receive improper or no intervention at all or they themselves device methods to overcome their difficulty but deficits remain. Learning disabilities are lifelong conditions, which affect learning in individuals with normal or above normal intelligence. These disorders affect learning processes, but not necessarily the capacity to learn. They also affect an individual's mental health. Learning difficulties lead to poor self esteem, stress, social and behavioral problems. In this modern age most of our communication and work is done through reading and writing. Academic success is a prerequisite to economic and social

success and puts these individuals at a disadvantage from the very beginning of formal education. Various names or labels have been given to such conditions like reading blindness, word blindness, dyslexia, minimal brain dysfunction, specific learning disability etc. To put it formally : "Dyslexia is a specific learning disability that is neurobiological in origin. It is characterized by difficulties with accurate and/or fluent word recognition and by poor spelling and decoding abilities. These difficulties typically result from a deficit in the phonological component of language that is often unexpected in relation to other cognitive abilities and the provision of effective classroom instruction" (Lyon, Shaywitz & Shaywitz, 2003).

## Theories and models of language development

There are many theories and facets of language development. Various theories have been proposed regarding child language acquisition. They can be broadly divided into

1) Factors contributed by nature –

Chomsky's Universal Grammer Theory - According to him the brain in humans has neural circuits which have linguistic information right from the time of birth. The heard speech acts as a trigger towards a child's natural predisposition to learn language and his brain is able to interpret the heard speech according to the structures the brain contains. This is known as the Language Acquisition Device (LAD) ( Catts 1989, Slobin,1977)..

2) Factors contributed by nurture-

i) Cognitive Theories -

a) Jean Piaget's - He placed importance on language acquisition in context of a child's mental or cognitive development. He theorized that social interaction was the key to overcome the instability of the symbols (Becker and Varelas 2001).

b) Vygovtsky's Views - One of his major contributions was regarding the relationship thought and language development. Connections between speech and cognition and mental concepts were established by him.

ii) Behaviorist Theories –

a) Skinner Verbal Behavior- According to him children learn language while imitating adults and their correct utterances get reinforced when they get rewarded for the same. Their correct utterances are reinforced when they get what they want or are praised.

## Normal reading development

Once children enter school, they go to a stage called phonetic cue reading from the pre reading. They begin to read phonetically from the letter representation. They begin to associate the letter to the sound.

## Reading comprehension

As decoding and word recognition skills improve, other factors like vocabulary, oral comprehension and working memory into play which helps them in understanding the textual meaning (Snowling, 2000).

## Major components of oral language

*Phonology*: Phonological sensitivity is a micro level language skill compared with syntactic and semantic processes. This skill development is crucial to the acquisition of word decoding skills. Early manifestations of phonological awareness include the recognition of rhyming words. For phonological awareness one needs to hear the spoken stimulus, comprehend and express a response to the spoken stimulus. For all this one needs to have a basic cognitive processing ability (McBride-Chang, 1995). Phonological awareness can be tested by identifying initial phoneme recognition and production, identification-, phonemic segmentation and integration.

**Table No 1**

| Type of Task | Description | Example |
|---|---|---|
| Syllables (4 Yr) | Blending syllables into words. This skill begins to emerge about the age of 4. | /pup/ /pet/ - puppet<br>seven - /sev/ /en/ |
| Onset & Rhymes (4-5yr) | Blending the initial consonant (onset) and the vowel and following consonant sounds (rime). Around the age of 4 to 5, this skill becomes evident. | /m/ /op/ - mop<br>stripe - /str/ /ipe/ |
| Phonemes (4-5yr) | Blending, segmenting, and manipulating individual sounds in words. | /t/ /r/ /o/ /t/ - trot<br>stick - /s/ /t/ /i/ /k/<br>sound substitutions : change the /h/ in hat to /b/ - bat |

## Morphology

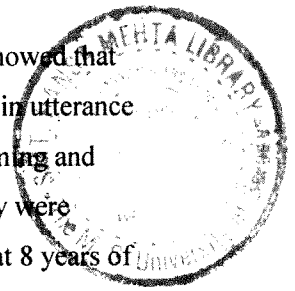
In a study done by Casalis et al 2004 they found out that children who had developmental dyslexia were poorer in morphemic segmentation tasks. They produced more derived words in production task. This suggests that phonological impairment prevent segmentation of affixes but allow development of productive morphological knowledge. Dyslexic children display a particular profile in their oral morphological abilities. Their morphological skills develop, at least in part, independently of their phonological skills. Consequently, they may have built compensatory strategies to bypass the impediments caused by their poor phonological skills. This point of view is supported by the results of Elbro and Arnbak (1996) in training disabled readers in morphological analysis. They found that the slight benefits from morphological training were gained independently of phonological abilities

## Vocabulary

It is predictive of a later reading comprehension. Children with language impairments demonstrate a broad range of semantic difficulties, including problems with new word acquisition, storage and organization of known words, and lexical access/ retrieval. Unfortunately, assessments of children's semantic skills are often limited to measures of receptive and expressive vocabulary size. As a result, the semantic deficits of these children may not receive the attention they need (Brackenbury & Pye ,2005).

## Phonological awareness and its role in children at familial risk of learning disability

Studies done by Puolakanaho et al indicate that familial risk for dyslexia is reliably reflected in emerging phonological awareness already at an early age and it can be assessed independently of other language skills. The difference between the at-risk and control group at 3.5-year in phonological awareness remained significant. When the children are learning to read i.e the reading acquisition phase they become aware of the phonological element of speech while learning the alphabetical code and this leads to a growing aplhabetical skills.(Morais, 1991; Vellutino, Scanlon, & Chen, 1995; Wagner, Torgesen, & Rashotte, 1994). Both reading and phonological skills are known to be strongly genetically transmitted



(DeFries et al, 1991, Pennington, 1995). Pioneering work done by Scarborough showed that children with familial risk had difficulties in pronounciation accuracy, deficiency in utterance length and syntactic complexity at 2.5 years. They showed difficulty in object naming and receptive vocabulary at 3 years of age. Such deficiency became evident when they were assessed at 5 years of age. These very children were labelled as reading disabled at 8 years of age (Scarborough -1989, 1990, 1991). Studies done by Byrne, et al. (1997) found that at risk children at 4 years 7 months had difficulty in initial phoneme identification but not in rhyme awareness. On assessment at 6 years of age Elbro, et al (1998) demonstrated phoneme identification, letter naming, and distinctness of phonological representations were predictors when assessment of dyslexia was done at 6 years of age.

## Factors affecting learning disability

*Structural factors* In 1892, Dejerine discovered that reading difficulties resulted due to damage to left angular gyrus. A Scottish eye surgeon published a report about word blindness in 1895. In 1925, an American Neurologist Dr. Samuel T Orton, proposed the theory of specific learning difficulty. He also proposed the term 'strephosymbolia' which means "twisted symbols". According to him if one side of the brain had to dominate and become specialized in order to be able to learn. If this did not happen it led to confusion and learning difficulties and thus twisted symbols. This was later dropped and replaced by the term dyslexia.

*Phonological processing factors* Isabella Liberman did a lot of work to show that deficits in the phonological processing underlie most of the learning difficulties. It is generally accepted that children with developmental dyslexia present deficits in phonological processing— difficulty in awareness of the sound structure of words (Shaywitz, 1998). Phonological awareness at 3.5 years was predicted by early language skills (e.g., verbal comprehension, vocabulary, and inflectional skills) assessed between 14 and 26 months of age. The group difference in phonological awareness remained significant even when both early language and concurrently assessed language skills were controlled for. This study supports the importance of assessing emerging phonological awareness skills in association with risk for dyslexia (Puolakanaho et al, 2004). Also naming speed deficit and phonological deficit are now increasingly being evidenced as being specific to children with specific learning difficulties (Swan & Goswami, 1997; Wolf & Obregon, 1992).

*Auditory processing skills* In addition to the phonological impairment, dyslexic subjects show deficits in the processing of rapidly changing auditory information, implying that the phonological impairment might result from this more fundamental deficit. Dyslexics show poor performance on a number of auditory tasks, frequency discrimination and temporal order judgment (Tallal, 1980; Nagarajan et al, 1999 Ramus et al. 2003,). The difficulty in differentiating phonemic contrasts like /ba/ versus /da/ is due incorrect representation of short sounds and fast transitions. There is also evidence that dyslexics may have poorer categorical perception of certain contrasts

*Chemical alteration in brain* In 1998, the work published in the lancet by Australian researcher Dr. Caroline Rae showed altered ratio of certain chemicals in two areas of the brain which suggested that differences exist in the development of the brain in dyslexics and non-dyslexics (Rae,C., Lee, M.A., Dixon, R.M., Blamire, A.M., Thompson, C.H., Styles, P., Talcott, J., Richardson, A.J., Sein, J.F.,1998).

*Genetic factors* A joint venture involving researchers from United States, Norway and Belgium and was led by Dr. Torrii Fagerheim carried out in 30 family members, 11 were found to be having dyslexia and on having their gene analyzed; it was found that one short sequence in their genetic material was causing the problem which was published in the British journal of medical genetics.

*Visual Spatial Abilities* It has been proposed by some researchers that there is association dyslexia and visual –spatial talent (Geshwind and Galaburda, 1985). Some evidence has been shown that dyslexia is overrepresented in these fields of spatial (engineering, architecture and art) and in other vocations that require a high visual spatial orientation (Tobias, 2004) which could be due to relative strength in visual spatial versus verbal areas.

## Later problems

Caulfield and colleagues identified a significantly increased rate of shyness or fearfulness in new situations in these children. Such children also find problems with bedtime (going to sleep, sleeping through the night, or remaining in own bed through the night—potentially anxiety-related issues (Caulfield 1989). Children with reading difficulties face a

lot of emotional problems. The level of social acceptance, peer rejection and problems in making friends were repeatedly considered to be a secondary impact of reading difficulties and this was predictive of the negative experience of social isolation and loneliness (Asher, 1990, Parker, 1993). Language impairment at age 5 years is associated with an increased risk of psychiatric disorder at age 19 years (Beitchman 2001).

## Need for early identification of learning disability

There may be confusion regarding the age at which children should be labeled as having dyslexia but there is overwhelming research which supports that early identification and intervention benefits children as early as two years of age (Steele, 2004). The most important advantage of early identification and intervention is that it provides a foundation for later learning and thus, can help in later academic success (Peltzman, 1992; Soyfer, 1998).

## Emerging research questions

On the backdrop of review of literature and critical understanding of existing theories, the need is felt to develop a tool for early identification of reading disability. Although the need has been identified by earlier research (Olofsson and Niedersoe, 1999) and addressed in various ways in different parts of the world. The purpose behind the development of a tool at an early age is to catch them young and as early as possible to start the remediation process and give them a jumpstart in reading and writing. The objective is to minimize their deficit when they grow older and prevent long term complications at school, home and social environment. The age group of 4-5 years was considered as the precursors of learning disability are easily identifiable. The exposure to English language too is present as the children are already in school for a period of 1-2 years. Training and instructions given at this age can significantly reduce the co existing morbidities like social and behavioral difficulties.

## HYPOTHESIS OF THE STUDY

Based on the literature review and the objectives of our study, the following hypotheses have been conjectured.

a) There will be significant difference in the test scores of normal children and children identified as having learning difficulties in

i) In phonemic decoding skills

ii) In auditory processing skill

iii) In visual-spatial motor skill

b) There will be significant correlation between the test scores on the developed test and the existing test (NIMHANS- SLD) to measure learning difficulty which is administered after six months.

c) There will be significant correlation between the test scores on the developed test and the ratings of the teacher.

d) There will be no significant difference in the test scores of the newly developed test and the NIMHANS-SLD test when tested on children identified as at risk of learning difficulty.

e) There will be significant difference in the test scores, in different dimensions of the newly constructed test in children identified with and without risk of learning difficulty.

## Methodology for Development of the tool

## Identification of the existing tool

After identifying existing tools to check their utility in the Indian context, the adaptation or construction of the diagnostic tool was undertaken. Some of the tools looked at before construction of our tool in the Indian context:

- The Stanford-Binet Intelligence Scale Fourth Edition (SB: FE)
- Malin's Intelligence Scale for Indian Children, Indian adaptation of WISC [MISIC]
- Comprehensive test of non verbal intelligence (C-TONI-2) (Donald D. Hammill, Nils A. Pearson, and J. Lee Wiederholt) ( 1997).

- Comprehensive Test of Phonological Processing (CTOPP- Wagner, Torgensen & Rashotte, 1999)
- Test of Phonological Awareness Skills (Newcomer & Barenbaum,2003)
- Lindamood Auditory Conceptualization Test (LAC-3) (Lindamood & Lindamood,1979).
- NIMHANS Index of SLD TEST (NIMHANS -SLD) ( Kapur et al.1992)

## Item Development

After identification of the available tests, their utility in the Indian context was looked at and adaptation and construction of items was done. For the development of items the following tests were looked at considering the age of the children and their age appropriate developmental capacities. We under took the following dimensions in our test. Broadly they can be divided into:

Phonemic decoding skills (adapted from CTOPP, TOPAS, LAC-3)
Auditory processing skills (adapted from LAC-3, NIMHANS index of SLD)
Visual-spatial motor skills (adapted from NIMHANS index of SLD, MISIC, CTONI-2)
Attention (adapted from NIMHANS index SLD)

## Dimensions of the Newly developed Tool

Tool developed in this research study (Biswas and Kaul) after looking at quite a few tests as mentioned above, this test was formulated keeping in mind the Indian child and their age. Broadly the testing was done for

- Phonemic decoding skills -Phonemic awareness, rhyming words, blending, and rapid naming objects.
- Auditory processing skills -Auditory discrimination, Auditory memory,
- Visual-spatial motor skills -Visual discrimination test, Spatial orientation test, Visual organization, visuomotor skills, picture sequence, story sequence, literacy readiness.
- Attention- object cancellation test

These tests were further divided into smaller subtests so that a detailed testing in all these three fields could be done. Attention too was tested for supportive and secondary identification. Total number of tests was 29. Each test was assigned a given a time depending upon the difficulty levels.

## Selection of sample and pilot study

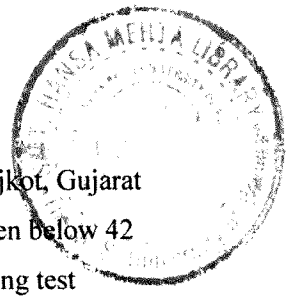
### 1) Pilot study, modification and final selection

A pilot study was undertaken on 10 children from the age group of three to five years of age. Five children were in the age group of 3 to 4 but not completed four years of age and five children were in the age group of 4 to 5 years of age. Children in the lower age group were unable to perform most on the tests of phonemic decoding skills (Phonemic awareness, rhyming words, blending), auditory processing skills (Auditory memory) and visual-spatial motor skills (Spatial orientation test, Visual organization, Visuomotor skills, Picture sequence, Story sequence). So they were dropped from the study and another group of five children in the age group of 4-5 years of age were selected and were tested. The age group of children was narrowed down to 4-5 years of age where most of the children were able to clear the tests successfully. The numbers of subtests were increased in blending, rhyming, spatial orientation, picture sequence and story sequence tests. Specific effort was made to ensure that the children had understood the test well and not responded correctly to the test by chance.

### 2) Teacher's rating scale

A semi structured 4 point rating scale based on certain selected parameters to identify learning difficulty was given to the school teachers to assess details regarding the difficulties the child was having in the regular school curricula and difficulties faced by the child in visual, auditory or phonetic areas. The purpose of this exercise was to validate our tool. We tried to measure the dimensions to get it rated. Some of the dimension could be rated by the teachers. This questionnaire was adapted from the NIMHANS teacher rating scale (Kapoor et al., 91). The teacher's questionnaire was then compared with the present developed tool and content validity of the developed tool was checked on the basis of the correlation.

## Sample



Initially, 400 children from 5 English medium schools in and around Rajkot, Gujarat were considered for the study. Using the exclusion and the inclusion criteria given below 42 children were screened out who showed positive symptoms in one of the screening test described below. 358 children were retained for the final study. A screening Intelligence quotient test using Stanford Binet test was administered on 400 children out of whom 358 children passed the screening test and were selected for phase III. Attention deficit hyperactive disorder was screened using DSM-IV criteria. It is difficult to label preschoolers as having ADHD. Any child who was in the spectrum was not labeled as ADHD but was not included in the study. Any child having developmental delay in either motor or mental areas of development (falling outside the normal range of development) was excluded from the study. Children falling in autistic spectrum disorder using the DSM –IV criteria were not included in the study. Children identified as having cerebral palsy from birth history and medical histories and clinical assessment were excluded from the study.

## Table No 2

| Sample Distribution | | | | | |
|---|---|---|---|---|---|
| Age in mo | 48-50 | 51-53 | 54-56 | 57-59 | Total |
| MALE | 85 | 47 | 37 | 38 | 207 |
| | 41% | 23% | 18% | 18% | 58% |
| FEMALE | 59 | 36 | 30 | 26 | 151 |
| | 39% | 24% | 20% | 17% | 42% |
| Total | | | | | 358<br>100% |

Technically, it is possible to score a maximum of 174 if the child has difficulty in all areas of developed tool and minimum score of zero, if child makes no mistakes in any of the tests. The time period taken for the administration of the test was around 45 minutes to 1 hour depending on the individual time taken by each child

## Administering the NIMHANS Specific Learning Disability Index

After 6 months, children who completed 5 years of age were administered the NIMHANS specific learning disability index including those children who were identified as learning disabled by our newly developed tool. NIMHANS Index for specific learning disabilities ( Kapur, John, Rozario and Ommen 1991) This test was revised by Kapoor. et al in 1992 and has the following subtests-language test which comprises of reading writing and spelling test, arithmetic test which comprises of addition, subtraction, multiplication and division, simple and graded fractions, visual motor skills tested by bender and gestalt and test for visual motor integration,

Considering the fact that the researcher wants to establish the predictive validity of the developed test by correlating the earlier test performance with the test performance on NIMHANS test 6 months after the initial testing, only those parameters which were used in the newly developed tool were selected to be administered. The following tests were used for the children who had crossed five years of age after six months.

- Attention ~ simple color cancellation test
- Visual discrimination
- Visual memory
- Auditory discrimination
- Auditory memory
- Verbal expression
- Visual motor skills
- Writing skills

## Standardization of The Constructed Measure

The results were compared with the newly developed tool and the teachers rating scale to find the degree of correlation. Also, correlation was calculated with the new measure and the NIMHANS –SLD. Item analysis was done to look for appropriateness of the tests. Item difficulty was maintained in such a way so that 60% of the children were able to clear the items correctly.

## Reliability Analysis - Scale (Alpha)

**Table No 3**

| Sub Test | Items | | No of items | Mean | S.D | Alpha |
|---|---|---|---|---|---|---|
| Phonemic decoding skills | 1) phon awar | a) pat | 3 | 0.76 | 0.82 | 0.77 |
| | | b) lbst | | 0.92 | 0.98 | |
| | | c) lpmt | | 0.76 | 0.83 | |
| | 2) rhy & blndgWrds | a) rhy | 3 | 0.92 | 0.98 | 0.73 |
| | | b) b1t | | 1.18 | 0.94 | |
| | | c) b2t | | 0.93 | 0.80 | |
| | 3) rpd-nam obj | | 1 | 0.44 | 0.79 | |
| Auditory processing skills | 1) aud disc | | 2 | 2.16 | 1.74 | 0.74 |
| | 2) aud mem | | | 0.96 | 1.16 | |
| Visual spatial motor skills | 1) vis processing skills | a) vdt1t | 3 | 0.71 | 0.76 | 0.72 |
| | | b) vdt2t | | 0.82 | 0.78 | |
| | | c)vis mem | | 1.40 | 1.66 | |
| | 2)spat ort | a) sot1t | 3 | 0.81 | 0.72 | 0.73 |
| | | b) sot2t | | 0.83 | 1.05 | |
| | | c) sot3t | | 0.87 | 0.74 | |
| | 3)directionality | a) lar | 2 | 0.82 | 1.37 | 0.76 |
| | | b) tbt | | 0.85 | 0.99 | |
| | 3) vis org | a) prot | 4 | 0.92 | 1.00 | 0.77 |
| | | b) simt | | 0.46 | 0.63 | |
| | | c) clot | | 0.68 | 0.77 | |
| | | d) sat | | 1.37 | 1.47 | |
| | 4) vismotskil | a) vmst1t | 3 | 0.75 | 1.13 | 0.79 |
| | | b) vmst2t | | 1.10 | 1.17 | |
| | | c) vmst3t | | 1.05 | 1.53 | |
| | 5) pic & sto seq | a) pst | 2 | 0.90 | 0.96 | 0.73 |
| | | b) sst | | 0.68 | 0.76 | |
| | 6)lit red | | | 0.39 | 0.59 | |
| Attention | 1)obj cancl test | | 1 | 0.99 | 1.56 | |
| Speech and language | 1) recept langu | | 2 | 0.39 | 0.68 | 0.65 |
| | 2) express lang | | | 1.51 | 1.61 | |

a) *Item Analysis* - In order to check the item appropriateness and discriminability we started with a pilot testing. Items which were found to be difficult, ambiguous or with low discriminant value were dropped. Because this test has a specific purpose of identifying children with learning disability, item difficulty level was maintained in such a way that at least 60% of the children can respond to the item correctly. Based on the developmental theory of language acquisition the parameters selected in such a way that children of four years and above are expected to respond correctly to the administered test.

b) *Reliability* - To look for consistency in measurement across items within a test we used internal consistency method-Cronbach alpha. Test retest reliability was not considered to be suitable as these developmental skills are age dependent. Therefore, only internal consistency reliability measures were used.

**CORRELATION OF RESEARCHER'S TEST AND TEACHER'S RATING SCALE**

**Table no 4**

| Sr No | Teacher's Rating Test | Researcher's Test | Pearson Coefficient α |
|---|---|---|---|
| 1 | Te vms | vmst1t | 0.69(**) |
| 2 | Te vms | vms2t | 0.56(**) |
| 3 | Te vms | vms3t | 0.44(**) |
| 4 | Te audbe | Adt | 0.56(**) |
| 5 | Te auddis | Adt | 0.61(**) |
| 6 | Te audmem | Amt | 0.52(**) |
| 7 | te verexp | Vet | 0.63(**) |
| 8 | te atten | Object cancel test | 0.98(**) |

** Correlation is significant at the 0.01 level (2-tailed).

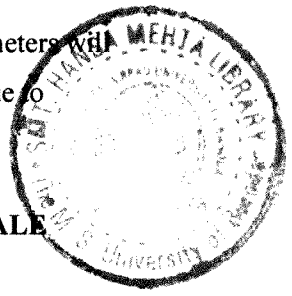
c) *Validity* -We found out validity by cross validating the performance score on the developed test with the teacher's rating questionnaire and NIMHANS test.

i) Content validity -By validating with the teacher's rating scale; the developed test has been validated for the content validity. It was not possible to get children rated by the teacher on all the subtests developed by us. In a classroom situation the variables possible to be rated by the teacher have been taken into consideration. An evaluation was made of the linear relationship between the above tests or observations of the teacher and the researcher' s test by using Pearson's correlation coefficient which indicates a statistically significant linear relationship between them. This implies that the developed test were content valid.

ii) Predictive Validity -We tried to find out the predictive validity by using NIMHANS specific learning disability index after 6 months of initial test administration. The developed test used most of the parameters being used in the NIMHANS specific learning disability index except the ones which are not applicable for the lower age group. The parameters used were simpler in formats and tests compatible with the age group (4-5 years) on whom the test was administered

The parameters present in the researcher's test were more in number than NIMHANS (specific learning disability index). As the age of the children was less, they needed to be tested on a larger number of criteria to identify them as having learning difficulty. Also, maturation process is the process within the participants as a function of the passage of time

(not specific to particular events) example growing older etc. Some of the parameters will improve with time in all children whether or not they have learning difficulty due to developmental constraints (Lerner, 1998)



**CORRELATION OF RESEARCHER'S TEST AND NIMHANS SLD- SCALE**

**Table No 5**

| Researcher's Test | Nimhans - SLD Test | Pearson's Coefficient - Our Test |
|---|---|---|
| Attention-<br>object cancellation test | Attention-<br>color cancellation test | 0.76** |
| Visual discrimination | Visual discrimination | |
| Vdt1t | | 0.39** |
| Vdt2t | | 0.42** |
| Spatial orientation* | | |
| Sot1t | | |
| Sot2t | | |
| Sot3t | | |
| Left & Right recognition* | | |
| Top & Bottom recognition* | | |
| Visual organization* | | |
| Prot | | |
| Simt | | |
| Clot | | |
| Sat | | |
| Visual motor skills | Visual motor skills | |
| Vmst1t | VIS MOT SKI | 0.48** |
| Vmst1t | WRIT SKILS | 0.23** |
| Vmst2t | VIS MOT SKI | 0.36** |
| Vmst2t | WRIT SKILS | 0.42** |
| Vmst3t | NUMBERS | 0.30** |
| Visual memory | VIS MEM | 0.44** |
| Auditory discrimination | AUD DIS | 0.47** |
| Auditory memory | AUD MEM | 0.44** |
| Receptive language* | | |
| Verbal language expression | VER EXP | 0.47** |
| Picture sequence* | | |
| Story Sequence* | | |
| Literacy readinesss* | WRITING SKILLS + | |
| Phonemic awareness* | | |
| Rhyming* | | |
| Blending* | | |
| B1t | | |
| B2t | | |
| Rapid naming object* | | |

** Correlation is significant at the 0.01 level (2-tailed).

The tests with * in the researcher's test are the parameters which are extra number of tests tested in various parameters.

+ Tests were the tests which could not be tested by researcher in her test due to age constraint

The parameters present in the researcher's test were more in number than NIMHANS (specific learning disability index). As the age of the children was less, they needed to be tested on a larger number of criteria to identify them as having learning difficulty. Also, maturation process is the process within the participants as a function of the passage of time (not specific to particular events) example growing older etc. Some of the parameters will improve with time in all children whether or not they have learning difficulty due to developmental constraints (Lerner, 1998)

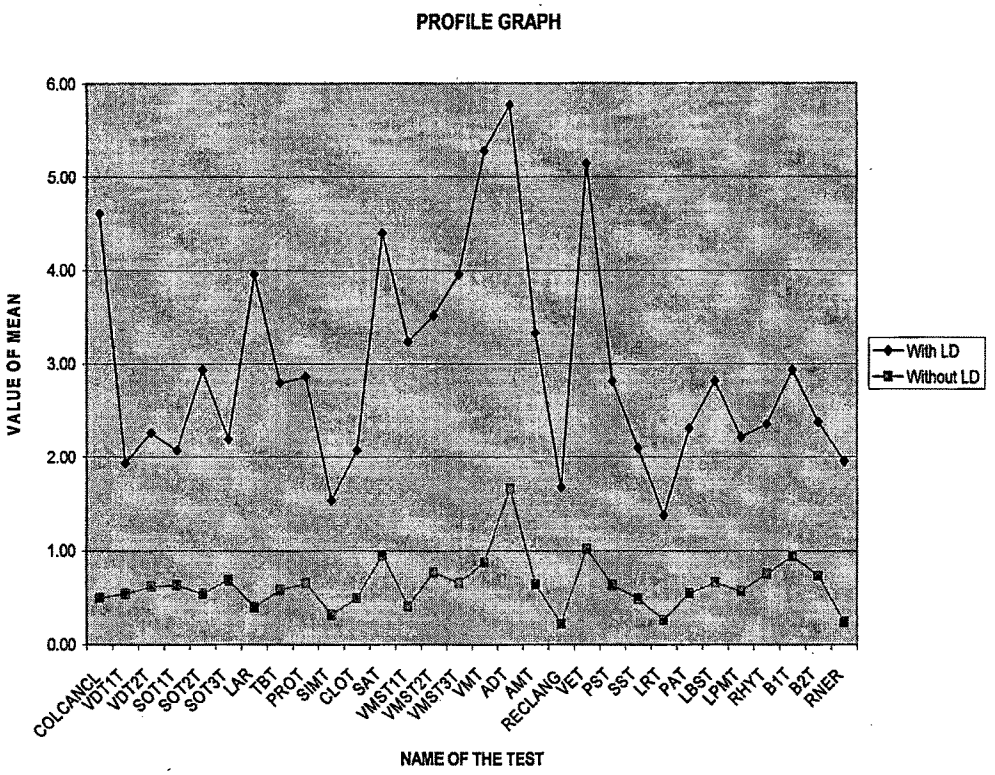
**COMPARISON OF MEANS OF CHILDREN WITH AND WITHOUT LEARNING DIFFICULTY IN THE RESEARCHER'S TEST**

**Table No 5**

| Name of the tests | Mean of children without learn diff | Mean of children with learn diff |
|---|---|---|
| COLCANCL | 0.50 | 4.40 |
| VDT1T | 0.54 | 1.87 |
| VDT2T | 0.62 | 2.20 |
| SOT1T | 0.64 | 2.00 |
| SOT2T | 0.54 | 2.84 |
| SOT3T | 0.68 | 2.13 |
| LAR | 0.40 | 3.78 |
| TBT | 0.58 | 2.69 |
| PROT | 0.65 | 2.78 |
| SIMT | 0.32 | 1.47 |
| CLOT | 0.50 | 2.00 |
| SAT | 0.95 | 4.27 |
| VMST1T | 0.40 | 3.16 |
| VMST2T | 0.77 | 3.36 |
| VMST3T | 0.65 | 3.82 |
| VMT | 0.88 | 5.07 |
| ADT | 1.66 | 5.58 |
| AMT | 0.64 | 3.22 |
| RECLANG | 0.22 | 1.60 |
| VET | 1.02 | 4.98 |
| PST | 0.64 | 2.69 |
| SST | 0.49 | 2.04 |
| LRT | 0.26 | 1.31 |
| PAT | 0.55 | 2.22 |
| LBST | 0.66 | 2.71 |
| LPMT | 0.57 | 2.13 |
| RHYT | 0.75 | 2.27 |
| B1T | 0.94 | 2.84 |
| B2T | 0.73 | 2.29 |
| RNER | 0.24 | 1.87 |
| RNT | 37.85 | 50.83 |

## Difference between the profile of children with and without learning difficulty

There is significant difference in the test scores of normal children and children identified as having learning difficulties when tested by the new measure in phonemic decoding skills, auditory processing skill and visual-spatial motor skill. Children without learning difficulty have a limited range of mean in all the tests below 1 whereas children with learning difficulty had a greater degree of fluctuation in the range of mean in all the tests. Profile graph clearly differentiates children with and without learning difficulty. Children without learning difficulty have a mean score which is consistent within a limited way. Thus, there is a significant difference in the test scores of children with and without learning difficulty as hypothesized.



## Difference in the test scores of children with learning difficulty and children without learning difficulty

It is hypothesized that there would be significant difference in the test scores of normal children and children identified as having learning difficulties when tested by the new measure in phonemic decoding skills, auditory processing skill and visual-spatial motor skill Studies supporting our views "Phonological awareness at 3.5 years is predicted by early language skills (e.g., verbal comprehension, vocabulary, and inflectional skills) assessed between 14 and 26 months of age. The group difference in phonological awareness remained significant even when both early language and concurrently assessed language skills were controlled for. This study supports the importance of assessing emerging phonological awareness skills in association with risk for dyslexia (Puolakanaho et al, 2004)." Strong predictors of reading in kindergarten were phonological awareness and rapid naming skill (Snowling, 2000). Very young children with high visual spatial difficulties have been found to have language difficulties (Von Karolyi & Winner, 2004). Our findings support the hypothesis. All the above parameters of tool construction, hypothesis, methodology and analysis have been discussed in details in their respective chapters.

## Implications

Whole purpose of our study was to identify children as soon as they enter pre primary section. Most of these children are bright eager minds that are embarking on a journey of learning. There is this vast ocean of knowledge laid at their feet and the method by which this can be achieved is through reading and writing. So, it becomes imperative on our part to provide children with methods to overcome the hurdles that come in their way- may it be skills to read or write or the strategies to overcome them. Intervention strategies are possible if identification is possible. The earlier the children are identified, the better it is for them, the parents, the school and the society.

Children would have a longer time period to cover the reading and writing skills and their base which is acquisition of these skills becomes stronger. The areas that they are delayed in reading or writing like phonemic skills, visual spatial orientation or auditory processing skills can be identified and appropriate remediation can be taken. The strengths of the child can also be identified through this method and remediation techniques can take the strength in one area to teach proper strategies.

By this test we can ensure the literacy readiness of the preschoolers. Wrong attribution given to the children like lazy, uninterested, poorly motivated etc. when they are not ready can demotivate such children, amount to lower self esteem and hinder proper development of self concept. These act as building blocks for later personality development. Such children are branded or tagged with personality attributes.

The general development process gets affected. By using this test to identify children early, misjudging of personality attributes can be avoided. Also we can use this for development of a remediation model.

*Implication for the parents-* We can build awareness in parents regarding the possibility of identification of learning difficulty before the child starts primary school, the area where the child is lacking and would consciously be aware of the difficulty and would try to get help or rectify it as early as possible.

*Implication for the teachers-* Teachers will be made aware of the areas that they need to work on with the child. While assessing the child for literacy readiness for school, the teachers too would emphasize on these areas and would know the areas that the child needs help and support.

*Implication for the clinicians-* Children would not unnecessarily be labeled as lazy or inattentive or hyperactive. Clinicians would also take this into consideration before labeling the children as ADHD, hyperactive, personality trait, aversive attitude towards school.

## Conclusion

The research provides evidence that learning difficulty is identifiable in early preschool children using phonemic decoding skills, auditory processing skill and visual-spatial motor skill. Usage of this measure can create awareness amongst parents, teachers and clinicians and sensitize them for early and better remediation and rehabilitation of these children, prepare better learning readiness in them. Also, this can avoid associated problems in future growth and development of the child.