Chapter 22
Low Cost Solutions for Learning Disabilities

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Abstract Learning difficulties are encountered in the school settings across the globe. Economic recession in the Western world and absence of quality education for the majority of children in the developing world forces us to re-examine our educational practices across cultures. Yet the nature of these problems, their causes and ways to intervene are entirely different in the developed and the developing nations. Much of the literature on the management of learning difficulties is anchored to western research. These are mostly inapplicable in the Asian/African context. Since the 1980s the author and her team in Bangalore have developed tools of assessment and strategies of intervention packages for specific learning disabilities based on western as well as indigenous strategies that are modified to suit the Indian context in terms of language, schooling and culture. But these are meant for children from schools with adequate infrastructure. The Asian reality at the grass roots level reveals that the majority of the schools suffer from paucity of teachers and infrastructure. Most intervention strategies developed in the West target specific deficits with specific intervention strategies based on certain theoretical constructs. The author examines some of the intervention strategies developed in India and highlights the results. The author also proposes to demonstrate effective models of empowering children to learn through play and providing effective low cost intervention for learning difficulties caused by poor school practices. These models are based on holistic and eclectic approaches with outcome evaluation of the intervention with a pre- and post-design. This is especially a model that can be replicated across the world especially in the developing counties and in countries hit by recession in the recent times.

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Abbreviations

LD	Learning disability
SLD	Specific learning disability
MBD	Minimal brain dysfunction
NIMHANS SLD BATTERY	NIMHANS index learning disability
NIMHANS	National Institute of Mental Health and Neuro Sciences
CPM	Coloured progressive matrices test
SFB	Seguin form board
PASS	Planning, attention, arousal, simultaneous and successive
COGENT	Cognitive enhancement training
Malin's WISC	Wechsler's intelligence scale for children

22.1 Definitions

The term Learning Disabilities emerged from a need to identify and serve students who continually fail in school yet are not intellectually disabled. The concept of learning disabilities has undergone distinct phases of development in its history. The study of learning disabilities began in the early 1940s. The term they used for these children was "brain-injured" children. They established several criteria to classify these children. They were: perceptual disorders, perseveration, conceptual or thinking disorders, behavioural disorders, soft neurological signs, a history of neurological impairment with no history of mental retardation.

In 1960s a shift in terminology occurred with the introduction of the term "Minimal Brain Dysfunction (MBD)". The term brought in the concept of minor brain injury and linked to with learning problems. The National Advisory Committee on handicapped children USA in 1968 submitted the first definition. Since then a number of definitions have been proposed but none of them are totally acceptable. The latest definition proposed by DSM 5 (2013) is as follows: Specific learning disorders are diagnosed when the individual's achievement on individually administered, standardized 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.

Torgensen (1991) opined that the standard definition of LD has four major problems.

i. The definitions do not indicate that LDs are a heterogeneous group.
ii. The definition fails to recognize that the condition persists into adulthood.
iii. It does not specify that there is inherent problem in the way information is processed regardless of the cause.
iv. The definition does not recognize that individuals with other disabilities or environmental limitations may concurrently have learning disability.

22.2 Characteristics of Learning Disabilities

1. Discrepancy factor—A discrepancy exists between a child's ability and academic performance across one or all skill areas.
2. Academic learning difficulty—Academic problems exist in the area of reading, writing, spelling and mathematics.
3. Perceptual disorder—Perceptual problems include inability to recognize, discriminate and interpret sensation. It can be in the area of auditory channel or/and visual channel.
4. Metacognitive deficits—Metacognitive abilities involve the ability to use self-regulatory mechanisms such as planning moves, evaluating effectiveness of ongoing activities, checking the outcome and remediation of the errors.
5. Memory problems—Most students complain of poor memory. Students with learning disabilities fail to use strategies that nondisabled students readily use.
6. Phonological deficits—students with reading, spelling difficulties often have poor phonological skills.
7. Motor disorders—Children with this problem are clumsy, unable to skip or hop. Some exhibit fine motor difficulties such as in cutting with scissors.
8. Attention problems and hyperactivity—Many researchers have documented that many learning-disabled children have short attention span, distractibility and impulsivity. Some are restless and hyperactive.
9. Social emotional problems—The prevalence rate of psychological disturbance is high among learning-disabled children compared to the normal population. Continuous failures in academics results in poor self-concept and self-esteem.

This section reveals that the features are varied in nature. Obviously there would be multiple causes leading to the varied symptoms of SLD.

22.3 Attributed Causes of Learning Disabilities

There is no single cause to explain the origin of learning disabilities. Nor are any of them proven empirically. A variety of factors have been linked with its occurrence. However. coexistence does not mean it is the cause

1. Genetic—It is found that learning disabilities run in families.
2. Language—Poor phonological processing is seen in children with reading and spelling disabilities.
3. Biochemical—Possible chemical imbalance that lead to inefficient or faulty brain functioning.
4. Biological—Head trauma that causes brain Injuries, foetal distress during birth and so on.
5. Unfavourable uterine environment—Drugs, smoking, alcohol that adversely affect development of the foetal brain in the uterus.
6. Environmental deprivation—A lack of stimulation at critical times of development that prevents optimal brain function.

These are some of the common correlates. There are also other factors, such as the problem of laterality, size of the left hemisphere and the size of the neurons in the left hemisphere.

22.4 Biological Approaches to Learning Disabilities

1. The inferred pathologies in the following systems (Hallahan et al. 1985) are described. These are: Perceptual Systems, perceptual motor functioning, neurological Organization and oculo motor functioning.

Causes are attributed to: genetic, head injury, chemical deficits, allergens and toxic substances.

Yet there is no firm evidence for any of these are really the causes and are merely speculations and applicable only in small number of cases.

2. **Neuropsychological Approaches**

   Initially began with the speculation of brain damaged, when not found, led to use of another term, 'minimal brain damage'. When there was no evidence of brain damage, minimal brain dysfunction was hypothesized. These are of two types: acquired and developmental.

Taylor (1988) described the processes as: somato sensory/motor skills, language and auditory processing, visuo-spatial/constructional skills, memory and learning skills, attention and psychomotor efficiency and abstract reasoning and problem-solving skills.

3. **Psycholinguistic Approaches**

   Mann and Liberman (1984) proposed LD as deficiency in a variety of language functions namely, in reading, writing and spelling.
4. **Psycho-Educational Approaches** (Kaufmann 1985) consist of: Insensitivity to student as an individual, too high or too low expectations, uncertain classroom

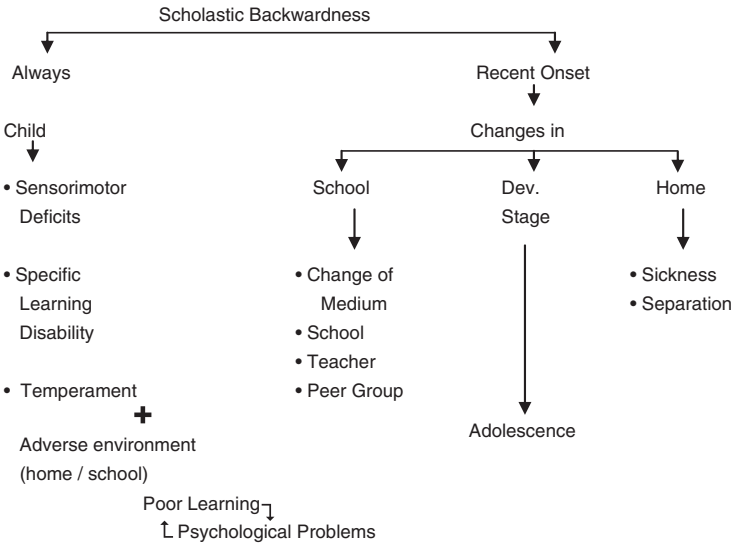

Fig. 22.1 Scholastic backwardness

situation, uninteresting instructional tasks, reinforcement of undesirable behaviour, undesirable models and teacher centred rather than child-centred methods.

It may be seen from the above that the causes of SLD are multifactorial, while the theories focus on specific areas or systems. These are like the proverbial blunders of the story of the blind men and the elephant.

Nature of SLD

The children with learning difficulties present with scholastic backwardness. These children need to be examined as given below, relying on the history of the disorder, the nature of onset and detailed assessment of the child, the family and the school (Figs. 22.1 and 22.2).

The above flow chart highlights that a detailed psychological assessment is essential in case of learning difficulties. These include;

i. The psychosocial contexts in which the problems occur such as poor home environment or ineffectual school system.
ii. The assessment of individual profile of assets and liabilities in learning in the child as this forms the basis on which the remedial work is initiated.
iii. Most of the remedial measures overlook the above two factors as the theoretical anchors of the practitioner does not permit recognition to the multifactorial nature of the problem and the heterogeneity of the group of the learning disabled.

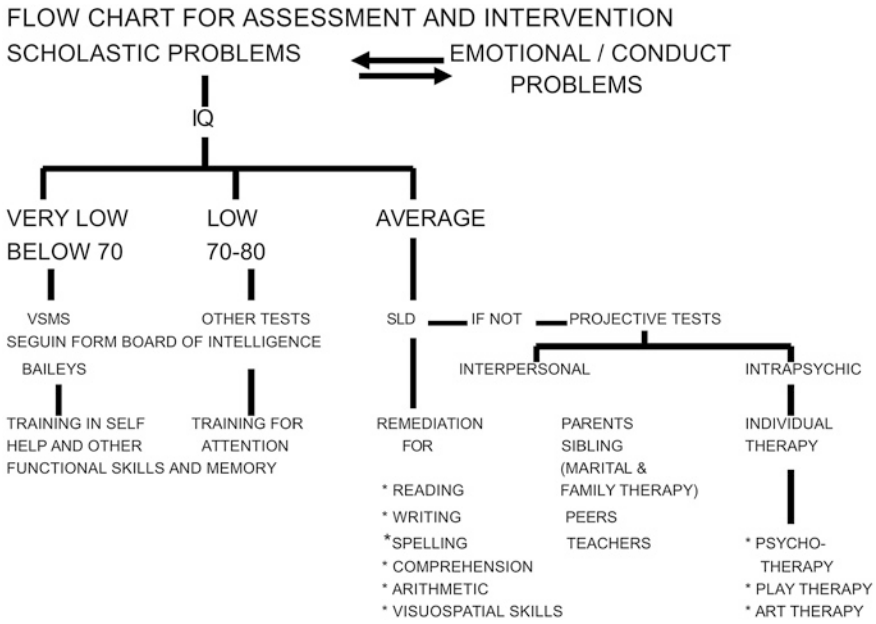

Fig. 22.2 Flow chart for assessment and intervention

22.5 Interventions for Learning Disabilities

1. Interventions or Remediation for SLD in the West

The initial training methods focused on multi-sensory stimulation, and subsequently, training focused on phonological awareness as some argue that phonological awareness is the core deficit seen in reading disorders. Some other researchers argue there are deficits in receiving and perceiving auditory inputs. Working memory and semantic memory deficits were implicated in math disorders.

Initial training methods focused on multi-sensory stimulation (Lindamomd-Bell method; Orton—Gillingham method). Subsequent training focused on phonological awareness. Researchers argue that phonological awareness is the core deficit seen in reading disorder (Shaywitz and Shaywitz 2005). Other researchers argue there are deficits in receiving and perceiving auditory input is impaired (Tallal 1998). Working memory and semantic memory deficits noted in math disorders (Greary 2000). Several studies have claimed functional changes within the network supporting phonological processing after training (Shaywitz and Shaywitz 2005). Training in processing and sequencing rapid auditory inputs associated with improved reading (Tallal 1998; Troier and Whitney 2003). And was found to improve cognitive functions across several age groups. Findings indicate

improved cognitive functions in addition to improved reading and spelling (Das et al. 2006; Hayward et al. 2007).

2. Studies of SLD in the Indian Context

Prevalence, nature and assessment

While western studies report a prevalence of 10 %, prevalence in India is reported to be 5–12 % of school population with the prevalence being higher in rural areas (Srinath et al. 2005). Prevalence in India—being 5–12 % of school-going population is reported by others too (Thapa 2008; Bhola and Kapur 2000). Prevalence is higher in rural areas (Yadav and Agrawal 2008). Increased prevalence of reading disorder in classes 2–5, greater incidence of writing disorder in classes 6 and above has been reported (Tripathi and Kar 2008). Phonological awareness is neither evident nor crucial for development of reading skills in Indian languages (Prakash and Rekha 1992; Prakash et al. 1993; Prema and Karanth 2003). Language deficits appear to be higher than phonological awareness deficits in both younger (Sharma 2000) and older children (Shankaranarayana 2003).

While most workers in India in the area prefer to work with the western models, there has been reasonable amount of research based on Indian work on assessment and remediation. The NIMHANS Index Learning Disability is a battery of tests evolved out of empirical data (Uma et al. 2011). The NIMHANS battery consists of: Attention test (Single and double colour and number cancellation), Language tests (Reading, writing, spelling and comprehension), Arithmetic tests (Addition, subtraction, multiplication, division) (single and double digits and fractions), Visuo-motor skills (Bender Gestalt Test BGT) and Developmental Test of Visuo Motor Integration and Memory tests (Auditory and Visual).

In addition there is a pre-academic skill assessment section in level—I while level—II consists of the above tests. The validity of the NIMHANS index was examined and found to be adequate (Uma et al. 2011).

Neuropsychological Profile of Learning Disability in the Indian Population-Preliminary Results studied by Krishna et al. (2007) in a sample of 60 children in classes 3–7 from English medium schools—who presented with learning difficulties in Child and Adolescent Mental Health Unit at NIMHANS, Bangalore. They were assessed on NIMHANS SLD battery, Malin's WISC and NIMHANS Neuropsychological battery.

The four patterns of deficits found were: Reading, Spelling, Writing and Arithmetic, with subgroups with any of the two, three or four deficits. The neuropsychological deficits were of two types suggestive of diffuse cortical or fronto-temporal dysfunction. The results showed that the age and the kind of neuropsychological deficits influenced the type of disability. Age and the nature of neuropsychological aspects, suggests some biological underpinnings of learning disability.

3. Remedial Measures in India

While several studies have used remedial packages developed in the west and these are theoretically driven (Das 1999).

Training on sight words, phonics and language skills was associated with better reading (Rozario 2003). Training auditory visual channel, spelling rules, comprehension skills, oral expression and visuo-motor perceptual aspects improved language based SLD (Srikanth and Karanth 2003). Remedial measures for 7–11-year olds was better than remedial training as usual for word attach and word identification skills (Padegar and Saranath 2008).

Neuropsychological Remediation for Children with Specific Learning Disorder for Arithmetic

Sukumaran (2003) in his doctoral thesis focused on specific disorder of arithmetic. The study consisted of two phases. In phase I norms were developed for a test of arithmetic ability that was based on a neuropsychological model. The test was administered on a sample of 284 children studying in III to VI. Standard wise cut off scores were obtained to identify Specific Learning Disorder for Arithmetic. In the second phase a remedial program for the Specific Learning Disorder for Arithmetic was developed. The remedial program consisted of two components, i.e. neuropsychological remediation and content-based arithmetic skills training given sequentially. The sample consisted of 17 children studying in standards III to VI with a diagnosis of Specific Learning Disorder for Arithmetic as identified by the NIMHANS Index for SLD. There were 10 children in the treatment group and 7 children in the control group. The children in the treatment and control groups were comparable in severity of arithmetic disorder at the pre-remediation assessment. The treatment group received neuropsychological remediation while the control group received remedial sessions for improvement of handwriting skills. These were daily individual sessions, which ranged from 15 to 20 min. Arithmetic remediation was given in small groups of 2–3 children. Children from the treatment and control groups were regrouped based on the nature of arithmetic deficit as seen on the Test of Arithmetic Ability.

The post remediation assessment showed significant improvement in arithmetic skills in the treatment group but not in the control group. This indicates that a combination of neuropsychological remediation together with content-based arithmetic skills training is efficacious. The neuropsychological tasks of attention, verbal and visual memory could have contributed to the improvement of arithmetic skills in the treatment group. Improvement of attention may have led to an overall improvement of attention to details and relevant information needed for successful problem solving. Improvement of visual memory could have led to a decrease of visuo-spatial difficulties experienced by the children.

Improvement of verbal memory could have improved encoding and rehearsal of verbal information. Thus improvement of neuropsychological components appears to contribute positively to improvement in arithmetic skills in children with Specific Learning Disorder for Arithmetic.

Comparing two Intervention Programmes for Reading Disorder (Sadasivan et al. 2009a, b). The sample consisted of two groups of 10 children with reading disorder in age range of 10–13 years. Group 1 received 20 sessions of phonological awareness intervention while group 2 received 20 sessions of neuropsychological intervention. Both groups were assessed before, immediately after and 3 months

after intervention, were comparable in the outcomes. Both groups assessed on reading subtest, phonological awareness measures and neuropsychological measures.

Much of the phonological work is only for children studying in English medium schools. This may not be applicable for phonetic languages as the Indian languages. In the Indian studies, apart from a few that merely replicate Western remediation strategies, the others are innovative and appropriate to the Indian school context.

Good practice guidelines for India have been brought out by John et al. (2013). These are characterized by the following features.

a. The assessments take into account of heterogeneity in the SLD population.
b. The remediation measures of SLD are more comprehensive and consequently more effective.
c. There is willingness to accommodate multiple theories while handling individual cases.
d. The relation of SLD to the inherent linguistic structures of the Indian languages have been explored.

To summarize, several Indian studies have replicated theoretically driven western tools and found them useful, but these are not understood very well by children whose medium of instruction is not English and inadequate school system.

22.6 Approaches to Learning Difficulties—Asian Reality and Challenges

Learning difficulties could be a function of developmental problems which would lend itself to the western methodologies. Or could be due to poor school systems that are rampant in many of the developing countries. The corollaries are as follows:

Specific Learning Disabilities in the individual child due to developmental problems despite average intelligence, normal schooling and absence of sensory motor deficits require **individual intervention**.

Learning difficulties due to deficient school system in most of the children requiring **universal intervention with child-centred play way method**.

With the former group the focus is on assessment and intervention package that is applicable for children with 'genuine' SLD, despite good educational support, there are large sections of those who come from socio-economically and educationally backward backgrounds who may appear to have skill deficits, similar to SLD. While the children with SLD require **individualized** intervention to target specific skill deficits the latter group needs **'universal'** intervention. The following report shows an experiential work with 2000 children in rural and tribal regions in Karnataka in one district (Kapur 2007) of a model of universal intervention.

1. **Interventions may be of two kinds: Specific and Universal**

In the specific interventions individually tailored programmes to remedy the skill deficit profile of the child with special focus on phonetic languages.

In the universal intervention, the aim is to modify the school system adopting child-centred Universal Intervention through PLAY WAY methods.

An example of Universal intervention

A study by Kapur (2007) was carried out in H.D. Kote in Karnataka in one of the 19 clusters of schools. This programme on integrated approach consisted of training of 21 Primary Health Care doctors, 65 Health workers and 96 Anganwadi workers on mental health and child development. One cluster of school of the 19 clusters was taken for the intervention study. This cluster had 15 rural schools with 1200 children from class 1–9, with 41 teachers. In addition 9 Ashram schools for 800 tribal and scheduled caste primary school children were also taken.

The programme aimed at promotion of Psychosocial Development. It was characterized by directly working with children, one hour a day over 24 sessions and the activities consisted of free art, craft, music, dance, drama and play. Evaluation was carried out before and after the intervention on tests of attention, intelligence, creativity, language, number skills and memory.

Results in the rural schools (N:1200)

Revealed that Performance there was significant improvement with reduced time on Seguin Form Board (SFB) test and significant improvement on simple attention and complex attention in colour cancellation tests in Children in Class 1 and 2.

There was improvement in performance of Children in Class 3–7, on simple and complex attention on number cancellation tests. Significant improvement was seen on intellectual function on Coloured Progressive Matrices Test (CPM) (Raven 1965) There was improved performance on Creativity test (Mehdi 1985), Vocabulary test (NIMHANS SLD Battery 2002) and Arithmetic test (NIMHANS SLD Battery 2002).

Results in the tribal schools (N:800)

Significant Improvement of Tribal Children in Class 1 and 2 on Intelligence measured on Seguin Form Board (SFB), simple and complex attention on colour cancellation test (NIMHANS SLD Battery) along with Vocabulary, Creativity (Mehdi 1985), Number skills and Memory (Barnabas et al. 2011).

Significant Improvement occurred in Children in Class 3–7 on simple and complex attention on number cancellation tests, on Coloured Progressive Matrices test, Creativity test (Mehdi), Vocabulary test (NIMHANS SLD Battery), Arithmetic test (NIMHANS SLD Battery) and Memory test (Barnabas et al. 2011).

Improvement in Performance of Rural and Tribal Children using Play Way, child-centred methods an hour a day over 15–20 sessions in the regular class room setting, statistically significant improvement on quantitative assessment on psychological test on attention, intelligence, creativity, vocabulary arithmetic and memory. Additional improvement observed qualitatively on school performance, extracurricular activities, class room participation and enhanced interest in learning. This study is an unparalleled demonstration effectiveness of child-centred

play in promotion of psychosocial development as especially suited to developing nations that is universally applicable.

2. **Low Cost Universal Solutions for Asian Countries**

The assessment tools are not available in the developing nations, especially in the regional languages and English as taught in the local context. The following strategies can be employed to develop the material locally.

a. Assessment of language and Arithmetic skill deficit profiles using standard text books in the Asian languages from class 1–7
b. Performance gap of 2 years/2 grades and above indicates LD
c. Nature of language, arithmetic and visuo-spatial skill deficit profile is to be obtained

Remediation of Language may be carried out in the following steps:

First: Read an entire illustrated simple story aloud, showing the text and running a finger below the words and sentences
Second: Ask questions to check the comprehension at the end
Third: Ask them to enact the story
Fourth: Read again till they repeat by heart
Continue till they CAN READ independently

Remediation of Arithmetic
Chinese Abacus (from internet) and games that use numbers, ludo, snakes and ladders, chess, etc. Concrete objects such as sticks or beads can be used for basic counting starting from where the child understands the basic concepts—simple addition, subtraction, multiplication and division and then build on it.

22.7 Synopsis

Learning difficulties are frequently encountered in the school setting across the globe. It is essential to distinguish two kinds of learning difficulties.

First is those difficulties arising out of inadequate school systems resulting in learning problems in all the children and the second is those arising out of inherent specific learning difficulties of individual children where there has been adequate school inputs.

Consequently the remedial work needs to be carried out for all the children in the inadequate school system. In contrast, individual remediation is required for those who have individual profiles of specific deficits. Common strategies can be adopted for the children who are in the poor school system. But children with idiosyncratic deficit profiles in reading, writing and mathematics individually or in combination, require individually tailored remediation strategies. In addition, they may have difficult temperament, may in addition have psychological problems such as hyperactivity attention deficit disorder, conduct and emotion disorders.

In addition to remediation, supportive measures and counseling the child and the family and sometimes of even the concerned teacher may be needed. The specific learning disabled group is a very heterogeneous group requiring multiple strategies to solve the problem.

22.8 Conclusions

Specific packages based on specific theories may be of limited use to the child with SLD because of the overlapping deficits.

A holistic and eclectic packages based on individual child's skill deficits profiles are essential for good outcome.

Scholastic problems have multiple causes and hence simplistic solutions do not work. Multiple approaches tailored to each child's deficit profile needs to be adopted in a holistic manner. However, if there are failed school systems, the method of dealing with them need to be an universal intervention through child-centred play.

22.9 Implications

In the developing countries, the assessment and diagnosis of specific learning disability needs to be made on the background of similar profile being a function of poor schooling as well.

Assessments need to take into account of the cultural context in which the problem arises. The tools assessments are not culture free. Even Progressive Matrices in not culture free in rural India.

Specific learning disability is one group of multiple learning disorders that cannot be accommodated within a single theoretical frame work. The closest one can hypothesize is that it is a developmental disorder causing multiple deficits. However, the absence of a theory is no barrier for effective assessment and remediation.

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