Dyslexia and other Specific Learning Disabilities

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Introduction

Dyslexia and other specific learning disabilities are still not universally recognized as conditions that cause difficulties in children's learning. Indeed they have been often referred to as "hidden handicaps" because of the lack of awareness by teachers, physicians and parents. There is also the erroneous belief by many that these are rare and mild problems despite evidence to the contrary. Attempts to achieve a universally accepted definition for specific learning disabilities have been plagued by continuing and often bitter disagreements among the various professions who have legitimate interest in this field. These disciplines include neuroscience, neurology, clinical and neuropsychology, education professions including educational psychology, teaching and education administration, speech and language pathology and so on. This fragmentation arises from differences in focus by individual professions on the various aspects of specific learning disabilities, with each discipline often not being aware of practices and advances in other fields. Territorial interests add to the poor communication. Finally, differences in identification criteria for subjects often make sharing of research data across professions all but totally meaningless.

Definitions

General Definitions
"Specific Learning Disabilities" (sometimes referred to as "Specific Learning Difficulties" in the United Kingdom and "Learning Disabilities" in the United States) is a generic term which here refers to a group of learning disorders with respective cognitive specific deficits. Prevailing evidence based upon sound theories as well as replicable, valid prospective longitudinal studies, indicate that specific learning disabilities involve the following features.

1. A heterogenous group of disorders of constitutional origin,
2. Specific psychological process deficits causing impairment in corresponding domains of learning. Major forms include dyslexia, specific disability in oral language, specific disabilities in mathematics and non-verbal learning disabilities.
3. These disabilities may occur alone or co-occur in various combinations.
4. Specific learning disabilities often exist in spite of adequate intelligence, normal sensory and motor apparatus, and adequate educational opportunity; but could occur concomitantly with other handicapping conditions (sensory impairment, mental impairment, social and emotional disturbance) or extrinsic influences (cultural differences, insufficient or inappropriate instruction), although they are not the result of these conditions.
5. While problems such as attention deficit disorder are not specific learning disabilities in themselves, they may exist as comorbid conditions in an individual with specific learning disabilities.

Non-Validated Definitions
Non-validated general definitions are unfortunately still being used despite extensive research evidence which support the above understanding of specific learning disabilities. These include:
1. "Exclusionary Criteria": These define an individual with specific learning disabilities as one who demonstrates difficulties in learning despite "not being mentally retarded, not suffering from sensory handicaps, not being emotionally or socially deprived" etc. Such a definition is not helpful in delineating what the nature of the disorder is. It results in a group of extremely varied conditions, and cannot contribute to specific intervention prescription nor towards prognostication.

2. "IQ-Achievement Discrepancy Criteria": Increasing evidence points to the lack of validity of the IQ-discrepancy as an identifier of specific learning deficits. A specific disability such as dyslexia, for example, could only be identified through detection of the corresponding specific process deficit.

3. "Operational Definitions": These may define an individual with specific learning disabilities as one who performs in specified domains below a certain percentile standard, or who demonstrates a certain grade level lag in those areas. They are often used in education policy for resource gate keeping, and bear limited relation to theoretical considerations.

**Definition of Dyslexia**

1. Dyslexia is one of the most prevalent types of specific learning disabilities. It is a developmental language based disorder which affects an individual's ability to acquire skills for individual word reading (i.e. word recognition). Problems with automatic retrieval of words are also present, hence the difficulty with dictation and spelling.

2. Dyslexia is a constitutional disorder, hence it is lifelong and often occurs in families. It is not an all-or-nothing phenomenon but occurs in degrees similar to other biological disorders, so manifestation occurs in a continuum.

3. Prognosis depends on the severity of the disorder, the specific pattern of other strengths and weaknesses within the individual, and the availability and appropriateness of intervention.

4. Difficulties with receptive and expressive oral language often co-exist.

5. Difficulties with writing (i.e. handwriting), a visuomotor impairment, is not a feature of dyslexia itself although they could co-exist in an individual.

6. Literature quotes an average of 10-20% of children being affected with specific reading difficulties, with around 5% being severely affected. This would mean that 2 children per class of 40 students may be significantly affected!

**Contributory Etiological Bases for Dyslexia**

1. Dyslexia is believed to be due to a central nervous system dysfunction leading to a core deficit in reading because of a failure to rapidly, accurately and automatically recognize and recall individual written words. Such individual-word recognition difficulties are in turn obvious obstacles to understanding what is being communicated in a sentence, paragraph or passage.

2. Substantial evidence is available to support the role of deficient phonological (speech sound) processing as the major cause of this disability.

3. Simultaneous efficient processing of the sound of a word, efficient analysis of its appearance (orthographic analysis), and access to its meaning are necessary to allow skilled word recognition and fluent reading. This language based ability is deficient in individuals with dyslexia.

**Biological Bases**

Genetic, neuroanatomical, neurophysiological and neuobiological features have been identified in dyslexic individuals.
1. **Genetic Findings**
   Large longitudinal twin studies have shown that constitution factors of genetic origin are involved in dyslexia. Both major gene form and polygenic modes of transmission are supported. In some families genetic markers on chromosome 15 have been detected, and chromosome 6 is possibly implicated in other families.

2. **Neuroanatomical Features**
   The left planum temporale on the superior temporal lobe of the brain is believed to be responsible for language processing in the majority of people. In dyslexic individuals, ectopia and heterotopias within the left perisylvian cortical area were detected, and the usual asymmetry between the left and right brains were absent. The relationship between planum temporale morphology, language and psycholinguistic function is significant in understanding the etiology of dyslexia.

3. **Neurophysiological Features**
   Studies in brain electrical activity mapping recordings distinguished between dyslexic and non-dyslexic individuals, with aberrant physiology found in cortical areas usually involved in speech and reading in dyslexic individuals. Positron emission tomography (PET) scanning showed functional alterations in dyslexia adults during the act of reading, and Xenon-133 photon emission computed tomography (SPECT) indicated decreased regional cerebral flow (rCBF) in left prefrontal and perisylvian regions in children with developmental language learning disabilities.

4. **Neurobiological Features**
   Most recently, fMRI studies of the neurobiology of reading in dyslexic and non-dyslexic children and adults have suggested a tentative neural architecture for word reading involving a) the extrastriate cortex within the occipital lobe in identification of letters, b) the inferior frontal gyrus in phonological processing, and c) the middle and superior temporal gyri in accessing meaning. Gender difference in brain representation for phonological processing have provided explanation why women are less likely than men to suffer significant impairments in their language skills after a stroke and tend more often to compensate for dyslexia, despite an equal gender incidence of the condition. The identification of unique brain activation patterns in individuals promises more precise diagnosis of dyslexia and may allow access to the effects of interventions.

**Other Types of Specific Learning Disabilities**

1. **Specific Learning Disability in Spoken Language**
   Specific language impairment occur in individuals who exhibit linguistic deficits which outwardly appear subtle. These deficits affect different aspects of linguistic performance, including phonology (speech sounds), semantics (meaning), grammar and so on, presenting as expressive language and comprehension disorders which affect academic achievement and social communication.

2. **Specific Learning Disability in Mathematics**
   Impairment in ability to learn mathematics may result from a variety of deficits: linear thinking and rapid recall of learned facts such as those required in mechanical arithmetic; linguistic analysis of problems in mathematical reasoning; visual-spatial abilities for comprehension of many mathematical concepts, and problem solving skills for complex mathematical tasks.

3. **Non-Verbal Learning Disabilities**
   a. **Motor Planning and Coordination Disorders**
      Individuals with motor planning and coordination problems have difficulties in gross and fine motor execution, in postural control and balance, in graphomotor
skills (i.e. controlling pencil and paper during writing), and are commonly described as "clumsy".

b. Visual Spatial Organization and Perceptual Disorders
These individuals have difficulty in understanding spatial relations, left/right concepts, and in perceptual organization of nonverbal output (including for drawing and handwriting).

Secondary Problems

Dyslexia and other specific learning disabilities bring with them many secondary problems. With good intellectual potential, these individuals' discrepantly low attainment in one or more scholastic areas cause perplexity and misunderstanding. The following are some common sequelae.

1. Increasing amounts of time are spent on homework with progressive restriction of extra-curricular and social activities and its ensuing problems.
2. Deterioration of relationship between child and parents (typically the mother, who supervises homework), and frequent increase in strife between parents on how school demands and failures should be dealt with.
3. Teachers often complain that the affected child who appears normally intelligent is being lazy or oppositional, and the child may be stigmatized as such by the school and classmates.
4. These children's self esteem gradually becomes eroded, secondary emotional and behavioural problems arise, and many may drop out of school - either literally or in spirit - and later end up as problematic young people and unemployed adults.

Non-validated Beliefs about Dyslexia and Specific Learning Disabilities

1. Misconception that dyslexia is a writing problem manifesting as mirror writing and reversals due to visual perceptual problems. Dyslexia is a language based disorder due to constitutional differences in the brain area which subserves language abilities.
2. Non-validated belief that Chinese characters, being "picture-like", is interpreted through visual-spatial processes, and that the right hemisphere of the brain is more involved in reading Chinese than alphabetic languages. Research evidence indicates that Chinese reading draws on linguistic skills in the same way does English, and that the above assumptions are to date not validated.
3. Misconception that individuals will "grow out of dyslexia. Being a constitutional difference dyslexia persists in an individual who may, however, compensate successfully in life. Dyslexics who are more severely affected or who are not given appropriate intervention may be permanently handicapped.
4. Misconceptions about the intellectual potential of dyslexic individuals. Being dyslexic neither implies that the individual is "retarded" nor that he must have special talents and superior intelligence.
5. Misconception that dyslexic individuals cannot read well because of eye problems such as impaired ocular movement or abnormal sensitivity to glare or certain colour frequencies. These problems may lead to inefficiency or strain during text reading, but do not cause a single word learning linguistic disorder as in dyslexia.

Non-Validated or Controversial Treatment Approaches

The following controversial therapies are either found not to have proven value, to be misapplied, or in some cases to be groundless in their claims towards treatment of dyslexia or other specific learning disabilities.
1. Optometric therapy for dyslexia, including vision training, prism or coloured lenses. Ocular movement disorders, light sensitivity etc. should be managed as such and not as causes of word recognition deficits.


3. Sensory integration therapy for dyslexia. Sensori-motor training may be appropriate for certain types of motor planning and coordination related learning disorders.

4. Medications for dyslexia. These include herbs, trace elements and psychotropic drugs, often with the claim that they target its basic pathophysiology. Medications which improve attention control are sometimes added in polypharmacy, and may cause change in behaviour which is reported as "improvement in the dyslexic condition".

5. Neurophysiological therapies for learning and emotional disorders. There is claim that such therapy may help to "reset" brain waves.

Management

The Paediatrician's Role

1. History taking should include perinatal and developmental information, in particular on language development, motor development and behaviour.

2. Family history of dyslexia and other specific learning disabilities should be specifically asked for.

3. Examinations include general and elemental neurological evaluation, together with hearing and visual function assessments.

4. Evaluation of learning difficulties by the neurodevelopmental paediatrician should include a detailed history of observations by parents and teachers on the child's learning, a careful review of the child's recent school work to search for clues on the nature of his problems, and an extended neurologic examination which taps sensori-motor and cognitive processes as well as behavioural features that affect learning.

5. The neurodevelopmental paediatrician should be able to prescribe the involvement of relevant multidisciplinary team members, and to understand the significance their findings. Members include the clinical psychologist (preferably one with experience in paediatric neuropsychology), speech and language pathologist, occupational and physical therapists, optometrist and medical social worker.

6. Explanation of findings and counselling should be provided by the paediatrician to the parents and when appropriate to the child.

7. The paediatrician should lead team coordination in providing relevant therapy or interim support for the child and parents.

8. He should ensure that arrangements for further management by educational professionals are effected, including by educational psychologists, teachers and if available, special educational needs teachers. Review sessions should be scheduled as appropriate.

9. Not least, the paediatrician should be ready to act as the child’s advocate.

Principles of Management

1. Management of dyslexia and other specific learning disabilities begins with accurate identification and characterization of the deficits and of other strengths and weaknesses of the child. Evaluation of the support which he may receive from parents and school are also essential.

2. Intervention for dyslexia and other specific learning disabilities should include:
   a. Direct teaching and remediation for the specific deficit(s).
   b. Accommodations in school so that the child may circumvent his handicap and continue to learn as other children: e.g. having examination questions given and
answered orally for a dyslexic child.

c. Allowances in tasks where he needs to overcome his disability: e.g. less
copying tasks for a child who has graphomotor output difficulties.

3. The above measures should be available in adequate amounts and throughout the
child's learning years. Short, one-off instructional courses to the child or parents will
not suffice. Interim reassessment of intervention efficacy should be carried out, and
modification of strategies made along the way as needed.

4. Finally, it is not the substance of the education which needs to be changed for these
children (unlike for example, educational targets for mentally retarded children which
need to be lowered), but the process through which these educational goals are
achieved which need to be specifically and professionally adapted.

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