

Research-Based Learning Disability Subtypes

Decades of research have identified a range of oral language and listening comprehension deficits and subtypes. Similarly, in the academic areas of reading, mathematics, and written expression there are empirical studies that define the subtypes of learning disabilities. With this science, we have the capacity to define the subtype of learning disability and better identify the instructional methods that will most benefit the student.

Subtypes of Reading Disorder

Unlike language development, reading does not develop naturally. Reading is a complex process that involves many cognitive functions, including general knowledge, reasoning ability, perceptual skills, and memory functions.

Deficits in **Basic Reading Skills** have been generally classified as of two types:

1. *Phonological Subtype* - Great difficulty using phonological route in reading, so visual route to lexicon used. There is little reliance on letter to letter sound conversion. Instead, an over-reliance on visual cues to determine meaning from print. Phonological awareness deficits.
2. *Surface Dyslexia (Rapid Automatic Naming Deficit)* - these children tend to over-rely on sound/symbol relationships as the process of reading never becomes automatic. Words are broken down to individual phonemes and read very slowly and laboriously, especially where phonemes and graphemes are not in a 1 to 1 correspondence. Difficulty with the rapid and automatic recognition of words in print

If a student has a prominent and specific weakness in *either* phonological or rapid print (naming-speed) processing, they are said to have a *single deficit* in word recognition. If they have a combination of phonological and naming-speed deficits, they are said to have a *double deficit* (Wolf & Bowers, 1999).

The relationship between specific reading disability subtypes and CHC correlates is described below:

1. *Dysphonetic Dyslexia or Phonological-deficit*: Readers have phonological processing difficulties without naming-speed problems; implicating a core problem in the phonological processing system of oral language.

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Broad CHC factors that may be related to this subtype of disability include: Auditory Processing, Long Term Retrieval. Narrow CHC factors may include: Phonetic Coding, and Memory Span.

2. ***Surface Dyslexia or Naming-speed-deficit:*** Readers have naming-speed problems with no significant deficits in phonological awareness or phonological decoding.
OR

Processing speed/orthographic processing deficit: Affecting speed and accuracy of printed word recognition (also called *naming speed problem* or *fluency problem*).

Broad CHC factors that may be related to this subtype of disability include:
Narrow CHC factors may include: Perceptual Ability, and Memory Span.

3. ***Mixed Dyslexia or Double-Deficit Hypothesis:*** In which phonological deficits and the processes underlying naming-speed deficits are depicted as two largely independent sources of reading dysfunction, resulting in three impaired reader subtypes. The double-deficit subtype represents the most impaired readers across all dimensions of reading, potentially because the co-occurrence of phonological and naming-speed deficits allows limited compensatory routes.

Broad CHC factors that may be related to this subtype of disability include: Auditory Processing, Long Term Retrieval, Processing Speed, and Short Term Memory. Narrow CHC factors may include: Phonetic Coding, and Memory Span Perceptual Ability, and Memory Span.

4. ***Comprehension deficit:*** Often coinciding with the first two types of problems, but specifically found in children with social-linguistic disabilities (e.g., autism spectrum), vocabulary weaknesses, generalized language learning disorders, and learning difficulties that affect abstract reasoning and logical thinking.

Broad CHC factors may be related to this subtype of disability include: Comprehension-Knowledge, Long Term Retrieval, Fluid Reasoning, and Short Term Memory. Narrow CHC factors may include: Working Memory, and Memory Span.

Researchers currently propose that there are three kinds of developmental reading disabilities that often overlap but that can be separate and distinct:

1. *Phonological deficit*, implicating a core problem in the phonological processing system of oral language.
2. *Processing speed/orthographic processing deficit*, affecting speed and accuracy of printed word recognition (also called *naming speed problem* or *fluency problem*).
3. *Comprehension deficit*, often coinciding with the first two types of problems, but specifically found in children with social-linguistic disabilities (e.g., autism spectrum), vocabulary weaknesses, generalized language learning disorders, and learning difficulties that affect abstract reasoning and logical thinking.

Subtypes of Mathematics Disorder

First, consider the facts about math disability. This is important data as there are a number of misconceptions about math disabilities. For example, some think that a child cannot have a disability in math and reading. The research shows that at least 17% of math disabilities co-exist with reading disabilities and 50% of the individuals with math disabilities have related spelling problems.

- 8% of children have a Math Disability
- Parents 10 times as likely to have Math Disability
- Math tests are not sensitive to subtypes or areas within subtypes
- 26% of Math Disabilities are related to ADHD
- 17% of Math Disabilities are co-morbid to Reading Disabilities
- 50% of Math Disabilities also related to Spelling Problems

The research has identified 3 key subtypes of math disability (confirmed in Geary and Hoard, [2005](#)):

1. *Procedural* (left hemisphere), in which children present a delay in acquiring simple arithmetic strategies, which may be a result of verbal working memory deficits, but also deficits in conceptual knowledge. This type of math disability is commonly identified as a Learning Disability in Math Problem Solving.

Acalculia has a neurological basis for the association of verbal retrieval with ability to manipulate numerical quantities.

Broad CHC factors that may be related to this type of math disability include: Long-Term Retrieval, Short Term Memory, Processing Speed, and Fluid Reasoning. Narrow CHC factors may include: Working Memory, Phonetic Coding, and Perceptual Speed.

2. ***Semantic memory*** (left hemisphere), in which children show deficits in retrieval of facts because of a long term memory deficit. This type of math disability is commonly identified as a Learning Disability in Math Problem Solving.

Broad CHC factors that may be related to this type of math disability include: Long Term Retrieval, Processing Speed, Fluid Reasoning and Comprehension-Knowledge. Narrow CHC factors may include: Working Memory, Phonetic Coding, and Perceptual Speed.

3. ***Spatial*** (right hemisphere), in which children show deficits in the spatial representation of number. This type of math disability has not been shown to have a significant relationship to measures of visual spatial processing until adolescence and advanced math concepts.

Broad CHC factors that may be related to this type of math disability include: Processing Speed, and Fluid Reasoning. Narrow CHC factors may include: Phonetic Coding and Perceptual Speed.

There are individuals who have learning disabilities in math and in basic reading.

- ***Math Disability with Basic Reading Disability***, in which children with both disabilities perform lower than children with only a math disability or only a reading disability. Cognitive factors include retrieval of information, working memory deficits and deficits in conceptual knowledge. Children who have disabilities in math and reading have more severe disturbances in oral language than children who are impaired only in word recognition.

Fletcher, J.M., Lyon, G.R., Fuchs, L.S., and Barnes, M.A. (2007) Learning Disabilities: From Identification to Intervention. New York: The Guilford Press.

Fuchs, et al (2006) conducted a path analysis to study math competencies along dimensions of cognitive processing measures. Their mapping demonstrated cognitive factors that are the strongest predictors of math competencies.

Math Competencies	Arithmetic Word Problems	Algorithmic Computation	Arithmetic
Cognitive and Processing Competencies	Language Nonverbal Problem Solving Concept Formation Attention Sight Word Efficiency	Attention	Processing Speed Phonological Decoding Attention

Fuchs, L. S., Compton, D. L., Fuchs, D., Hamlett, C. L., & Bryant, J. (2006) Modeling the development of math competence in first grade. Paper presented at the annual meeting of the Pacific Coast Research Conference. In Fletcher, J.M., Lyon, G.R., Fuchs, L.S., and Barnes, M.A. (2007) Learning Disabilities: From Identification to Intervention. New York: The Guilford Press.

Geary D. C., Hoard M. (2005). Learning disabilities in arithmetic and mathematics: theoretical and empirical perspectives, in Handbook of Mathematical Cognition, ed Campbell J. I. D., editor. (New York, NY: Psychology Press;), 253–267

Based on research from: McGrew, K. S. & Wendling, B. J. (2009). CHC cognitive-achievement relations: What we have learned from the past 20 years of research. (Institute for Applied Psychometrics). Retrieved September, 2009 from <http://www.iapsych.com/chccogachmeta2/map.htm>

Based on research from article: Revisiting the Relationships Between Broad Cattell-Horn-Carroll (CHC) Cognitive Abilities and Reading Achievement During the School-Age Years
Damien C. Cormier, Kevin S. McGrew, Okan Bulut & Allyson Funamoto.
(08-16), Journal of Psychoeducational Assessment. This is the accepted copy and has not been copyedited.

Language-Based Learning Disability

The American Speech-Language-Hearing Association (ASHA) defines a language-based learning disability as “problems with age-appropriate reading, spelling, and/or writing.” The ASHA definition ties the language-based learning disability to a reading or a writing disorder. ASHA further explains this correlation by highlighting the connection between speaking and writing. Manifestations of a language-base learning disability include:

- word-finding or word-searching difficulty
- lags in vocabulary comprehension
- lags in recall and ability to follow directions
- lack of acquisition of rote material such as math facts and multiplication tables
- inability to establish sound-symbol correlations

Current research places a particular emphasis on the relationship between language development and learning disabilities in reading, writing and mathematics. Findings indicate that language-based deficits occur with greater frequency than non-verbal processing deficits among the learning disabled population.

The child’s language development history is a key indicator in the diagnostic process. The following aspects are to be considered:

- listening comprehension relative to reading comprehension
- vocabulary comprehension relative to naming and word identification
- auditory processing relative to decoding abilities
- spoken language relative to written language

The Cattell-Horn-Carroll theory of cognitive abilities is the foundation upon which the assessment process will be based. The areas that relate to CHC narrow abilities in the areas of listening comprehension and oral expression are summarized below:

Listening Comprehension

- Phonological Coding: Synthesis
- Speech Sound Discrimination
- Memory for Sound Patterns
- Memory Span
- General Sound Discrimination
- Associational Fluency
- Semantic Processing Speed

- Lexical Knowledge - Receptive
- Listening Ability
- Verbal Language Comprehension
- General Information
- Information about Culture

Oral Expression

- Writing Ability
- English Usage Knowledge
- Communicative Ability
- Oral Production and Fluency
- Lexical Knowledge – Expressive
- Semantic Processing Speed

When is a Language Disability NOT a Learning Disability?

- There are overriding issues related to general language competence such as:
 - LEP/ELL issues
 - Pure morphological deficits
 - Pure syntactic deficits
 - Pure semantic deficits (delayed vocabulary development)
 - Spatial and temporal deficits
- The language deficits **do not** negatively affect reading, writing or math skills to the degree that those skill areas test 1.5 standard deviations below the mean for the student's age.
- The language deficits improve over time with therapeutic intervention by an SLP such that the point will likely be reached when the language disability/delay will no longer impact educational performance.
- The language deficits are manifested primarily in oral expression. Language comprehension as well as reading comprehension are adequate.
- A central auditory processing disorder is diagnosed by an audiologist
- An auditory processing disorder can be documented via a cross-battery assessment

Developmental language deficits must be differentiated from life-long language disabilities. The former may be remediated via specialized instruction and increased exposure to language instruction. The latter will require therapeutic techniques for utilizing strategies to compensate for the manifestations of the language-based learning disability.

For more information on language-based learning disability, refer to the ASHA website: <http://www.asha.org/public/speech/disorders/LBLD.htm>. The reader may also learn more about the relationship of CHC cognitive factors and achievement factors by visiting: www.iqscorner.com.