

Chapter 2

Overview of NVLD

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This chapter provides an overview of the evolution of what we, today, call a nonverbal learning disorder (or nonverbal learning disability) (NVLD). Although there was increased interest in this disorder in the 1980s and 1990s, researchers and practitioners have not even been able to agree whether nonverbal learning disabilities should be abbreviated as NLD (mostly used on the West Coast) or NVLD (preferred by East Coast clinicians), nor have they arrived at an accepted definition for this condition, although Rourke's definition is the most frequently noted (Pelletier, Ahmad, & Rourke, 2001). We will use the abbreviation NVLD for the purposes of this book.

Estimates vary about how prevalent NVLD is, but the most frequently cited estimate is that 10–15% of all learning-disabled students have NVLD (Ozols & Rourke, 1988). It is imperative that practitioners know how to identify and treat students who are at risk for, and manifest, this disorder. Although data has been accumulating since Johnson and Myklebust's (1967) classic work, *Learning Disabilities: Educational Principles and Practices*, nonverbal learning disabilities are still the least known and the least understood learning disorder.

We begin with a review of the clinician's concept of the child with NVLD. Next we present a brief overview of the pioneers' thoughts about this disorder, and then we discuss the most common definition of NVLD, and then the current dominant model of the etiology of NVLD. Unfortunately, as is the case with other learning

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disabilities (LD) (Duane, 1991) and developmental disorders (DD) (Ozonoff & Rogers, 2003), the exact cause or causes of NVLD are not yet clear. However, the most current model of understanding NVLD which is from a neurological perspective commonly called the *white matter model* will be presented.

Additionally, we describe the symptoms as they manifest at different developmental stages, along with the professionals likely to become involved in each stage whose work is represented in other chapters of this book. Lastly we broaden our understanding of NVLD as a neurobiologically based learning disorder by looking at it through the clinical lens of multiple subtypes. Due to the limitations of space we present only a very brief review of these important topics. For a more comprehensive treatment we direct the reader to *Nonverbal Learning Disabilities in Children: Bridging the Gap Between Science and Practice* (Davis & Broitman, 2011).

Overview of NVLD

In order to help readers develop a *feeling* for this disorder, let us review a clinician's concept of the child with NVLD. Judy Lewis' overview on the website www.NLDline.com, which is based on educator Sue Thompson's (1997) groundbreaking work, *The Source for Nonverbal Learning Disorders*, is a useful reference. Lewis lists early speech and vocabulary development; remarkable rote memory; strong auditory retention; attention to detail, at times good early reading skills; and excellent spelling skills, as among the assets of some children with NVLD.

Five major categories of deficits and dysfunction are identified: motor, visual-spatial, organizational, social, and sensory. Motor deficits include poor coordination, severe balance problems, and difficulties with graphomotor skills. Visual-spatial/organizational deficits reflect a lack of image formation, poor visual recall, faulty spatial perceptions, and difficulties with executive functions. These executive functioning difficulties include decision making, planning, initiative, assigning priority, sequencing, motor control, emotional regulation, problem-solving, impulse control, establishing goals, monitoring results of action, self-correcting, and problems with spatial relations. Social deficits include difficulties comprehending nonverbal communication and adjusting to transitions and novel situations, along with deficits in social judgment and social interaction. The last category refers to sensitivity in any of the sensory modes: visual, auditory, tactile, taste, or olfactory.

Defining NVLD

The definition of NVLD is crucial to how we assess, diagnose, understand, and intervene for effected children. As is similar with dyslexia, NVLD's better known learning disorder cousin, NVLD is not currently in any formal eligibility or

diagnostic codes such as the Diagnostic and Statistical Manual of Mental Disorders-IV-TR (American Psychiatric Association, 2000). Some researchers do not view NVLD as a specific learning syndrome and argue against it even being considered as an *official* diagnosis (Pennington, 2009), while others argue that creating a formal diagnostic code will aid in the understanding, research, and treatment of NVLD and for insurance reimbursement for services (Davis & Broitman, 2011; Rourke, 1985). A recently released draft of the DSM-V does not include the diagnosis NVLD.

We assert that NVLD should be a formalized diagnosis, not only to aid research but also to make it easier for parents to be able to receive benefits for intervention for the disorder. In addition, we believe that having a formalized diagnostic category will be a useful heuristic tool for guiding assessment and intervention. But let us begin with a historical perspective for how our understanding of the syndrome of NVLD has progressed over time.

Historical Perspective

Josef Gerstmann, an Austrian-born neurologist who fled Nazi Europe to the United States in the late 1930s, wrote the first published article on symptoms which seemed like what we now call nonverbal learning disorders (Gerstmann, 1940). He conceptualized a syndrome that took his name, the Gerstmann syndrome (Gerstmann, 1940). This syndrome consisted of difficulties in the areas of finger agnosia, right-left orientation, agraphia, and acalculia. From the beginning, these nonverbal processes were linked to problems in math and writing, but for Gerstmann, the primary focus was on sensorimotor or fine motor control and function.

In 1967, Johnson and Myklebust (Johnson & Myklebust, 1967) added to our thinking about NVLD in their book entitled *Learning Disabilities: Educational Principles and Practices*. In this work they described their version of the syndrome of nonverbal learning disorders. Whereas Gerstmann (1940) had noted fine motor difficulties and difficulties with math and writing, Johnson and Myklebust (1967) observed additional difficulties in visual-spatial processing and something they called *social perception*. They suggested that children with these learning disabilities had difficulties in understanding gesture, nonverbal motor learning, body image, spatial orientation, right-left orientation, and social perception. Additionally, these children also demonstrated distractibility, perseveration, and disinhibition. Johnson and Mykelbust's vision generally holds true to current thinking about NVLD. Later work by Landau and colleagues (Landau, Gross-Tsur, Auerback, Van der Meere, & Shalev, 1999) found overlap between learning disabilities and ADHD and executive function issues.

The next major advances in research and thinking about NVLD were made by Byron Rourke and his many colleagues. Rourke is the leading exponent of the dominant model and/or definition of NVLD today. After decades of research and two seminal books, *Neuropsychology of Learning Disabilities: Essentials of Subtype*

Table 2.1 Rourke's diagnostic criteria for NVLD

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1. Target test at least 1 standard deviation (SD) below the mean
 2. No, or very minimal, simple tactile imperception and suppression versus very poor finger agnosia and/or finger dysgraphesthesia
 3. The highest scores on two subtests of the Verbal Scale of the Wechsler Intelligence Scale for Children-III (WISC-III): Vocabulary, Similarities, or Information
 4. Two of the subtests from the WISC-III nonverbal subtests of Block Design, Object Assembly, or Coding fall among the lowest scores of the Performance Scale
 5. Wide Range Achievement Test-Revised (WRAT-R) standard score for reading is at least 8 points higher than arithmetic
 6. Tactual Performance Test, right, left, and both hand times become progressively worse vis-à-vis the norms
 7. Normal to superior grip strength versus mildly to moderately impaired Grooved Pegboard
 8. WISC-III: VIQ exceeds PIQ by at least 10 points
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Analysis (1985) and *Syndrome of Nonverbal Learning Disabilities: Neurodevelopmental Manifestations* (1995), Rourke has left a significant mark on the field both by trying to establish a diagnostic set of criteria for NVLD and offering a theory for the cause of the disorder.

Diagnostic Criteria for NVLD

Rourke's diagnostic criteria have remained fairly stable over time. Most recently, Rourke and his colleagues (Pelletier et al., 2001) have stated that the following criteria have to be met to determine NVLD (Table 2.1):

The following conditions meet Rourke's criteria for a *diagnosis* of NVLD:

- Children presenting with the first six criteria would definitely be diagnosed with NVLD.
- If seven or eight of any of the features are present, it would constitute a positive diagnosis.
- Five or six of any of the criteria suggest probable NVLD.
- Three or four of any of the criteria suggest questionable NVLD.
- One or two of any of the criteria suggest low probability of NVLD.

Those of us who do assessments will find problems with Rourke's algorithm. First, all of the instruments would be considered outdated today. Second, although many newer, better standardized tests are available, none have been utilized to update the definition. This will be addressed in the chapter on assessment. We turn now to the question of the etiology of NVLD.

Etiology of NVLD: White Matter Model

Unfortunately the exact cause or causes of NVLD are not yet clear. We will, however, review the most current model of understanding NVLD which is from a neurological perspective commonly called the *white matter model*. For a more comprehensive review of the current available information from the areas typically addressed when considering the causality of NVLD—genetics, neurobiology, and environment—we refer the reader to Rourke’s *Syndrome of Nonverbal Learning Disabilities: Neurodevelopmental Manifestations* (Rourke, 1995) or *Nonverbal Learning Disabilities in Children: Bridging the Gap Between Science and Practice* (Davis & Broitman, 2011).

Initially, authors like Semrud-Clikeman and Hynd (1990), Voeller (1986), and Weintraub and Mesulam (1983) conceptualized these nonverbal difficulties as *right hemisphere learning disorders*, all of which (including Rourke’s later work) were based on Goldberg and Costa’s (1981) original conceptualizations of how the left and right hemispheres differed in terms of their neuropsychological functions. Denckla (1991) elaborates on this stating “in fact, the frequent association of an attentional/executive functional component and a visuoperceptual/simultaneous information processing component has made the term ‘right hemisphere LD’ seem more appealing in terms of the parsimony afforded by an anatomical expression that captures the affiliation of its behavioral manifestations” (p. 718), although she also cautioned that her conclusion may have been a bit premature.

Moving on from the right hemisphere model, Rourke (1995) postulated that it is more likely that deficits in subcortical white matter are responsible for the symptoms seen in NVLD. Rourke and colleagues (Rourke, 1995; Rourke, Ahmad, Collins, Hayman-Abello, & Warriner, 2002) have written about the neuropsychological symptoms that develop from damage to or a disturbance in white matter, as opposed to gray matter. Hale and Fiorello (2004) describe and have a useful metaphor for the differences between the two. “Recall the central nervous system is primarily composed of gray matter (the nerve cells) and white matter (myelinated axons that speed transformation of information). We like to think of the gray matter as the houses and neighborhoods, and the white matter pathways as the streets and highways” (p. 45). The white matter then is the means by which information is generally transmitted within and between the two hemispheres. It is commonly believed that these white matter disruptions can be from a myriad of different causes but ultimately all create somewhat consistent sets of difficulties. To borrow Rourke et al.’s own words (2002):

The syndrome of NLD [which here is referred to as NVLD] is characterized by significant primary deficits in some dimensions of tactile perception, visual perception, complex psychomotor skills, and in dealing with novel circumstances. These primary deficits lead to secondary deficits in tactile and visual attention and to significant limitations in exploratory

behavior. In turn there are tertiary deficits in tactile and visual memory and in concept-formation, problem-solving, and hypothesis-testing skills. Finally, these deficits lead to significant difficulties in the content (meaning) and function (pragmatics) dimensions of language. (pp. 310–311)

This approach to understanding how these disorders manifest has often been referred to as a *cascade* (Schultz, Romanski, & Tsatsanis, 2000) or *downstream* (Fine & Semrud-Clikeman, in press) effect whereby all the deficits that develop, including some neuropsychological, executive function, academic, linguistic, and social difficulties, are the *result* of the initial or *core* difficulties of tactile perception, visual perception, and complex psychomotor skills, and in dealing with novel circumstances. However, here as well, findings can be somewhat inconsistent. For instance, in Wilkinson and Semrud-Clikeman's (2008) study of motor speed in children and adolescents with nonverbal learning disabilities, they found no evidence of tactile perceptual difficulties. As of yet we do not have enough consistent empirical support to either endorse or refute the remainder of this theory, but more data is accruing. In addition, we have yet to find research which might determine the genetic contribution to the more idiopathic form of NVLD and no theory has been proven. It is clear, however, that NVLD *can* result from medical conditions that seem to cause more damage to right than left hemisphere regions. The Australian Government's Website dedicated to nonverbal learning disorders (<http://www.nld-line.com/childdrema2.htm>) lists the following disorders that result in NVLD-like symptoms:

- *Hydrocephalus*—where increased fluid pressure inside the brain may damage white matter more than gray.
- *Turners syndrome*—a genetic problem in girls with only one X chromosome instead of two. This can alter brain development, leading to an NVLD pattern of problems.
- *Fragile X syndrome*—another genetic disorder of the X chromosome, usually manifests in males. It can alter brain development, leading to different patterns of developmental problems including NVLD.
- *Tumors, calcification, cysts, and brain injury*—any process that selectively damages the right side of the brain can lead to the clinical picture of NVLD. Rare cases have been described where damage was on the left side in fetal development. Somehow, the left-brain functions were taken over by the right side, enabling children to develop language skills, and normal right-side functions were impaired.
- *Multiple sclerosis, and other disorders of white matter*—though very rare in childhood, these disorders cause many neurological problems.
- *Agenesis of the corpus callosum*—where the major communication fibers between the left and right side of the brain fail to develop correctly.
- *Congenital hypothyroidism*—occurs when the fetus is deprived of normal amounts of thyroid hormone during the pregnancy.
- *Fetal alcohol syndrome*—is caused by alcohol damage to the developing fetus.

- *Treatment for leukemia and brain tumors*—the radiation used to treat leukemia and tumors in the brain can damage white matter (Teeter & Semrud-Clikeman, 1997).
- *Others*—including velocardiofacial syndrome, Williams syndrome, de Lange syndrome, and Sotos syndrome.

Despite this list, we do not find medical causes in most of the children with NVLD. For this reason we will next present NVLD primarily as a developmental disorder.

NVLD: A Developmental Orientation

In this section we offer a look at how a child with NVLD can manifest at different developmental stages. We briefly address signs of NVLD in early (preschool) development, early schooling, later elementary and middle school, and high school. It is important to note that the presenting symptoms change across development and are often difficult to identify.

Early Developmental Signs of NVLD

Piaget (Inhelder & Piaget, 1964) refers to the first stage of development as the sensorimotor stage, whereby much of learning is about the child's interactions with his/her environment and on a sensory level. However, the usual amount of or exposure to sensorimotor learning is less for an NVLD child. As Rourke (1995) notes, in describing NVLD children, "these children remain essentially sedentary, exploring the world not through vision or locomotion, but rather through receiving verbal answers to questions posed about the immediate environment" (p. 8). The disparity between precocious language development, especially vocabulary, and the delays in motor development in the child are most notable in the early years.

Anecdotal reports from parents of children with NVLD often state that their child would sit and point at an object, saying what they wanted rather than crawling towards it. In anticipation of normal exploration, one parent spoke of how she *baby-proofed* her house to protect her child, yet her child never crawled to or tried to open anything. Many of these children do not use typical toddler toys or enjoy coloring or drawing. They are usually disinterested in or unable to put puzzles together (Johnson, 1987). Parents are often confused when their extremely verbal child is not developing consistently across developmental lines. They may create unwarranted and inaccurate expectations, based upon inappropriate assumptions about their child's superior language development. Problems for the child can become exacerbated when poor motor and spatial development can disappoint and confound the parents. Early sensorimotor exploration is important in the child's development, since learning depends upon the interaction of the child with the environment

(Piaget, 1972). The brain develops secondary to its interactions with the environment, developing neural networks that then create neural efficiency. Although NVLD children are interacting with their environment, it is often more verbal and observational and less motoric and spatial, which alters development of the neural networking. As the old saying goes, *neurons that fire together wire together*. It is likely that less interaction and practice exploring the environment with the body may lead to less efficiency in motor skills compared to children with many more hours of practice. In turn, as they grow older, children with less confidence in their motor skills may be less inclined to engage in activities demanding it, further reducing their skill growth and development.

Early Schooling

Kindergarten teachers may notice problems in fine motor skills that have not been noted earlier in a child with NVLD. The child may struggle more than his peers with items such as scissors, crayons, or pencils. As demands for writing and drawing increase, the teacher may notice immaturity in children with NVLD compared to typically developing peers.

The teacher may turn to an occupational therapist (OT) for consultation and guidance. After observing the child, the OT might provide an evaluation or offer treatment. Sensory integration therapy (Ayres, 1994) might be offered to treat what the OT views as a sensory integration disorder, although this is still considered a somewhat controversial intervention (see Chap. 3). If the child's issues are in the mild to moderate range, this may be all that is offered.

Sometimes children with NVLD may be referred for help with non-phonological reading difficulties (Pennington, 1991), but intervention may be a premature. Rourke (1995) notes that these difficulties may well be developmental for children with NVLD and most children with NVLD develop basic reading skills without intervention. However, Griffin and Gresham (2002) theorize that these reading problems are often associated with difficulties in visual processing problems, like tracking. Tracking refers to the ability of the child to stay on the correct line of reading or math without veering off course creating confusion and extra time for the student to reorient oneself. They further theorize that these problems are due to visual-spatial processing difficulties and claim that NVLD children frequently require tracking training with as many as thirty percent needing to be retrained in order to read fluently. He suggests performing a thorough optometric examination that includes an assessment of visual tracking.

Often children with NVLD develop early math difficulties, although some use their verbal memory strengths to help them compensate through third grade, and occasionally beyond. If not earlier, during this period concerns begin to develop about social perception and pragmatic language development. Further, boys and girls with NVLD can present with clinical signs of anxiety, depression, attention problems, obsessional preoccupations, and self-esteem problems (Palombo &

Berenberg, 1999). It remains unclear whether children with NVLD experience difficulties with peers because of processing issues, for example: difficulty processing facial expressions and social signals, executive function difficulties, novel problem solving, or due to another yet unknown reason. They might even result from reduced interaction with peers due to their sensorimotor issues (Hale & Fiorello, 2004). Clearly further research is required to evaluate these hypotheses.

With difficulties in the social area, especially with pragmatic language problems, the next professional to become involved is most often a speech and language therapist. During earlier stages these children might have been seen for articulation issues connected with poor oro-motor functions, while in early elementary school they are more likely seen for pragmatic language difficulties in social discourse. Children with NVLD often do not use appropriate vocal intonations. They might speak in a flat monotone or with a singsong voice. It can be difficult to read their mood from their facial expressions and they may seem wooden and constricted (Palombo & Berenberg, 1999). In speech and language nomenclature these issues are often called *semantic-pragmatic* disorders (Volden, 2004). It is believed to bode well for youngsters if these issues are identified early and intervention begins before the child falls behind allowing secondary features, especially anxiety, to develop (Palombo & Berenberg, 1999).

Even though children with these processing difficulties may struggle and become frustrated by math and written expression, they tend not to be referred to special educators because they perform *well enough*. Their superior verbal skills often cause educators and parents to assume that their difficulties arise from insufficient effort, or difficulty paying attention. Rourke (1995) wrote that young children with these symptoms are often misdiagnosed with ADHD. Unfortunately such misdiagnoses can lead to a host of self-esteem problems and psychological issues, particularly when appropriate interventions are withheld.

Later Elementary and Middle School Signs

As academic subjects become more abstract, and more independent work is expected, children with NVLD often begin to experience greater difficulties. Executive function problems increase. At the same time more demands are placed on social skills creating significant additional stress and frustration that can elevate anxiety which also makes academic progress difficult.

At this point academically oriented professionals often become involved in the lives of children with NVLD. Teachers become alarmed and mention their concerns at parent conferences. Parents ask for help for their children, and public or private school wheels are set in motion. Student Study Team (SST) meetings are called or Individualized Educational Plans (IEP) are developed, the latter based upon psycho-educational evaluations in order to develop appropriate interventions (Hale & Fiorello, 2004; Telzrow & Bonar, 2002).

Providing the best assistance for the student can become problematic because so much depends upon who gets involved and what they already know. The child's parents also need to educate themselves to become more knowledgeable as they will become increasingly involved in their child's treatment team. Helpful books for parents include Sue Thompson's *The Source for Nonverbal Learning Disorders* (1997); Pamela Tanguay's *Nonverbal Learning Disorders at Home* (2001) or *Nonverbal Learning Disorders at School* (2002); Kathy Allen's *Star Shaped Pegs, Square Holes: Nonverbal Learning Disorders and the Growing Up Years* (1998); and Rondalyn Whitney's *The Nonverbal Learning Disorder Guide for Teachers, Parents, Employers, and Therapists* (2000). The SST or IEP teams could advise them to join the Nonverbal Learning Disorders Association (www.nlda.org) or to become familiar with websites such as Judy Lewis's www.nldline.com, Pam Tanguay's www.NLDontheweb.org, or the Charles Schwab Web site, www.schwablearning.org. More information related to working with the families will be provided in a later chapter.

High School Signs

If the child with NVLD has managed to navigate the comprehensive middle school environment, the high school experience becomes the next challenge. During high school, social skills can become a source of even greater concern, as social stresses, such as the demands of dating, are increased. Advanced math and sciences will also be more challenging. Increased demands on executive functioning, as in written expression and advanced reading skills, can present major challenges.

Research is mixed regarding whether students with NVLD are more at risk for psychiatric disorders, like depression, with some finding increased levels of depression (Brumbach, 1985; Fletcher, 1985; Rourke, Young, & Leenaars, 1986) and others not finding that children with NVLD are at increased risk for psychiatric disorders (Forrest, 2004; Mokros, Poznanski, & Merrick, 1989). It is possible that these contradictory findings are due to the significant differences in age groups, race, and income among the different studies or differing definitions for diagnosis given the wide range of diagnostic criteria used in research on NVLD.

However, with interventions, accommodations, and modifications students with NVLD are often able to tap into their skill sets and experience success as emphasized by Brooks (1991) and his concept of *islands of competence*. By this he is referring to the fact that students with learning disabilities have relative strengths and weaknesses and it is at least equally important that the student's strengths get recognized and enhanced as it is to remediate any relative weaknesses or deficits. Skill sets might include acquisition of a second language, drama, certain aspects of the arts, language arts, and some of the language-based sciences.

Generally the support team continues to be involved in the student's program if not via the Individual Educational Plan (IEP) process then sometimes utilizing the Section 504 laws. Transition planning becomes essential and decisions about further education need to be made. In our experience, students who have not become too de-motivated, depressed, or demoralized can move on to successful adulthood if they, with the help of their parents and coaches, choose wisely with special regard for their strengths. Students with NVLD often interact better with adults than with their peers. Personal accounts written by people with NVLD suggest that adulthood may bring more successful interactions and relationships. Debbie Green, for example, in *Growing Up with NLD* (1999) writes of her joys as a teacher. Laurie E. Reed talks of her career as an occupational therapist in *Unaware: Living with Non-Verbal Learning Disabilities* (2001). These authors emphasize that early accurate diagnosis and appropriate intervention is crucial to the well-being of the person with NVLD. To add in that process we next suggest broadening our understanding of NVLD to consider it a neurobiologically based learning disorder and by looking at it through the clinical lens of multiple subtypes.

NVLD Subtypes

Historically, Rourke (1985, 1991) and others (Drummond, Ahmad, & Rourke, 2005; Harnadek & Rourke, 1994; Johnson & Myklebust, 1967; Pennington, 1991) spent a significant amount of time clarifying the differences between what are often referred to as verbal or phonologically based learning disorders and nonverbal learning disorders. More recently, some theorists are suggesting that, as with many developmental disorders, NVLD should be considered as a disorder with different subtypes (Davis & Broitman, 2007; Grodzinsky, 2003; Mamen, 2006; Palombo, 2006). This notion fits with our clinical experience. This section reviews the most recent developments in the understanding of NVLD as a disorder with multiple subtypes or components.

Researchers such as Semrud-Clikeman (2001) and others (Forrest, 2004, Myklebust, 1975) continue to view NVLD somewhat differently than Rourke. Without citing specific numbers Semrud-Clikeman suggests that only some of the strengths and weaknesses proposed by Rourke need to be present for a child to be diagnosed with NVLD. More recently, a study by Wilkenson and Semrud-Clikeman (2008) found no differences between children with NVLD and those without NVLD on measures of sensory and tactile measures. Further, Semrud-Clikeman and her group are finding that other measures such as social perception (Fine, Semrud-Clikeman, Reynolds, & Smith, unpublished manuscript), cognitive flexibility, and fluid reasoning can also contribute to a differential diagnosis (Semrud-Clikeman & Glass, 2008). Thus, it appears that all symptoms listed by earlier studies do not carry the same weight for a diagnosis of

NVLD. This supports our view that various permutations with these symptoms may result in different behavioral manifestation of the disorder, or subtypes, and that the diagnostic criteria are still evolving. Further study is needed to better understand whether these possible subtypes are phenotypically distinct or whether there is overlap among them.

Grodzinsky (2003; Grodzinsky, Forbes, & Bernstein, 2010), Mamen (2002), and Palombo (2006) suggest that there are specific clinical symptoms or subtypes of NVLD that are important to understand in order to diagnose and treat the child or adult appropriately. An example of a similar situation can be found with the current definition of ADHD, which has evolved to include the inattentive, hyperactive/impulsive, and combined types. For a more detailed description of their perspectives we refer the reader to *Nonverbal Learning Disabilities in Children: Bridging the Gap Between Science and Practice* (Davis & Broitman, 2011). Rourke (2006), however, disagrees, suggesting that what are being referred to as subtypes are really just different symptom clusters within in unitary disorder (Rourke, <http://www.NLD-BPROURKE.CA>). Or in other words, these subtypes are really just variations in the expression of NVLD. As we have no available data documenting that visual–spatial issues alone are responsible for these differences, multiple lines of development, along the lines proposed by Howard Gardner (1999), could prove to be another valuable model from which to conceptualize the various manifestations of NVLD. We therefore suggest that it is important to expose school and other clinical personnel who are diagnosing, treating, and educating children with NVLD to viable alternatives of ways of understanding NVLD. We believe this would help ensure that the NVLD student is getting appropriate interventions for success in school and in life.

Our Subtype Model

From our review of the existing models and the current available empirical evidence base, along with our clinical experience, we believe that a four-subtype model has the most clinical relevance. We also believe that NVLD can best be viewed as a *spectrum* disorder. Children can have mild versions of some problems, for example, present without a specific functional impairment. Our observations suggest that the lack of functional impairment is mediated by overall intellectual potential, level of discrepancies between verbal and nonverbal measures, and parenting/intervention strategies which have enhanced coping mechanisms. It is our contention that all children who present with NVLD have visual–spatial and executive function difficulties relative to their non-impacted peers. Therefore we consider these deficits to be the primary components of NVLD, constituting our first and core subtype. In Table 2.2 we list most of the available research which contributed to our viewing

Table 2.2 Researchers supporting visuospatial reasoning difficulties

•	Cornoldi, Dalla-Vecchia, and Tressoldi (1995)
•	Cornoldi, Rigoni, Tressoldi, and Vio (1999)
•	Cornoldi, Marconato, and Molin (2003)
•	Denckla (1991)
•	Forrest (2004, 2007)
•	Grodzinsky et al. (2010)
•	Hain (2008)
•	Mammarella, Lucangeli, and Cornoldi (2010)
•	Semrud-Clikeman, Fine, and Bledsoe (2008a)
•	Semrud-Clikeman, Walkowiak, Wilkinson, and Christopher (2010)

visuospatial functioning as central to this disorder. Cornoldi, Venneri, Marconato, Molin, and Montinari (2003) have gone so far as to suggest that nonverbal learning disorders be replaced by visuospatial learning disability (VSLD), with which we would also be comfortable. In Table 2.3 we list most of the available research which contributed to our viewing executive functioning as a core aspect of this disorder. Aspects of organization, attention, and working memory are the most supported of the executive functions in the current research.

Children in this subtype may also have mild social and academic deficits which do not necessarily rise to the level of a significant discrepancy or a functional impairment needed for eligibility or diagnostic purposes.

Our second subtype includes children with visual–spatial and executive function difficulties that significantly impact their social functioning. These children need formal evaluations and treatment programs, e.g., pragmatic language therapy and social skills training, and would be likely to meet some form of eligibility or diagnostic criteria (Table 2.4).

The third subtype is characterized by children with significant visual–spatial and executive function difficulties which are functionally impacting their academic work and again are likely to meet some formal eligibility or diagnostic criteria and would be in need of academic supports and interventions. These academic problems are most likely to be math related but can also be in areas like advanced reading comprehension, written expression (especially expository), geography, and math-related sciences (Table 2.5).

The fourth and final subtype is characterized by children with visual–spatial, executive function, social difficulties, and academic deficits, wherein all areas are functionally impaired. We do not believe that these are the only possible subtypes of NVLD but we do feel that all are justified at this state of our knowledge base, and ongoing research should pursue other possible models (Fig. 2.1).

Table 2.3 Researchers supporting executive functioning

• Cornoldi et al. (1999)
• Cornoldi et al. (2003)
• Denckla (1991)
• Fine, Semrud-Clikeman, Butcher, and Walkowiak (2008)
• Fine et al. (unpublished Manuscript)
• Hain (2008)
• Mammarella et al. (2006)
• Mammarella, Lucangeli, and Cornoldi (2010)
• Semrud-Clikeman, Walkowiak, Wilkinson, and Minne (2010)

Table 2.4 Researchers supporting social difficulties

• Bloom and Heath (2010)
• Fine, Semrud-Clikeman, Butcher, and Walkowiak (2008)
• Fine et al. (unpublished Manuscript)
• Palombo (2006)
• Petti, Voelker, Shore, and Hayman-Abello (2002)
• Schafer and Semrud-Clikeman (2008)
• Semrud-Clikeman and Glass (2008)

Table 2.5 Researchers supporting academic functioning difficulties

• De Smedt et al. (2007)	• Math
• Forrest (2004)	• Written math
• Humphries, Cardy, Worling, and Peets (2004)	• Narrative comprehension
• Mammarella, Lucangeli, and Cornoldi (2010)	• Math
• Mammarella et al. (2010)	• Math
• Rourke and Tsatsanis (1996)	• Reading comprehension
• Worling, Humphries, and Tannock (1999)	• Reading comprehension

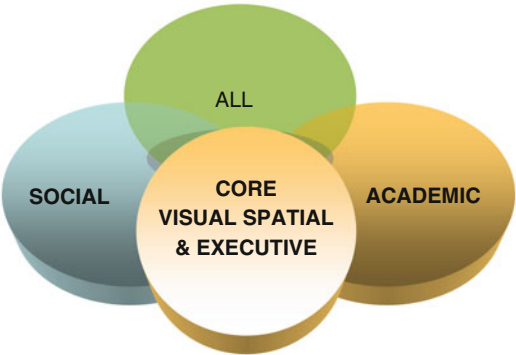


Fig. 2.1 Davis-Broitman model of NVLD

Conclusion

In this chapter we have offered an overview of the history of the development and understanding of nonverbal learning disorders. The most commonly used definition has been reviewed and we have considered how the child with NVLD might appear at different developmental stages. We have offered several ways to understand the varied roads to acquiring NVLD. Clinical observation suggests that at this time most NVLD children present without a clear cause (idiopathic). Hopefully future studies will offer more definitive answers to these important questions. The most important concept we would like for the reader to take from this chapter is that nonverbal learning disorders are complex and not necessarily as *specific* as the term specific learning disability might suggest. In our view, any assessment or remedial plan for a child with NVLD has to account for all potential symptom areas identified. However, we also believe that as more data accumulates a multidimensional model may at some time seem a more appropriate metaphor for NVLD than a subtyping model. Therefore, the SST or IEP teams for children with suspected NVLD should consist of a school psychologist, or his or her private practice alternative like an educational psychologist or neuropsychologist to look at the intellectual, neuropsychological/information processing, and executive function; a special education teacher for the academic concerns; a speech and language pathologist for the semantic-pragmatic difficulties; and an occupational therapist for possible fine/gross motor difficulties. Other professionals might include a school counselor for social skills interventions and/or a referral to a child psychiatrist or developmental pediatrician for possible medication if needed. In the chapters that follow you will hear from each of these professionals. They will describe how they diagnose and work with children and adults with NVLD.

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