ISSN-L: 2223-9553, ISSN: 2223-9944
Vol. 4 No. 6 November 2013

ESTABLISHING A PSYCHO-EDUCATIONAL PROFILE OF A BOY WITH NONVERBAL LEARNING DISORDER: A SINGLE-SUBJECT CASE STUDY

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ABSTRACT

This paper presents a case study of a boy (CA: 9 years 3 months) who is suspected of having nonverbal learning disorder. The study aims to provide a differential diagnosis by examining and establishing a psycho-educational evaluation and profiling using existing psychological assessment report (WISC-III) and six literacy tests. Though no significant discrepancies in the literacy tests (i.e., word recognition and comprehension) was found, psycho-educational evaluation found that the verbal scale subtests is higher than the performance scale subtests, both with significant discrepancies. Overall, use of instrumental profiling provided evidence that nonverbal learning disorder associated Asperger's Syndrome with dyspraxia may be present in this case study.

Keywords: Diagnostic assessment, WISC profile, Nonverbal learning disorder, Reading

INTRODUCTION

Nonverbal learning disability (NVLD) may be unfamiliar to many psychologists, diagnosticians, educators, and parents as it is largely unrecognized and under-identified as compared to other prevalent verbal learning disorders such as dyslexia. Due to the limited awareness of NVLD, many young children often went misdiagnosed (Schloerb, 2005). The limited awareness could probably be due to the small proportion of children being affected with NVLD. Also known as right-hemisphere learning disorder (Denckla, 1979, 1983; Pennington 1991; Rourke, 1989; Semrud-Clikerman & Hynd, 1990), it has long been neglected in the study of learning disabilities. Although research in NVLD is limited, there has been increased attention in the last few decades due to the growing number of students being identified with this learning disability.

Being nonverbal does not mean that the individual is not able to talk or communicate at all. Rather, it simply means the *absence* of language. Comparing to verbal disorders such as dyslexia which typically affects acquisition of language, reading, written output, comprehension, and mathematics, children with NVLD usually demonstrate deficits in spatial orientation, facial recognition, tactile perception, and visual-spatial-motor coordination problems (Schloerb, 2005).

This paper focuses on a case study with a boy suspected with NVLD using existing psychological assessment report to evaluate and establish a profile of the diagnosis. The following section briefly discusses the terminology, definition, diagnosis, history, subtypes, prevalence, characteristics, and etiology of NVLD before looking into the case study.

LITERATURE REVIEW

Terminology of NVLD

Over the years, several terms or labels have been used by researchers such as *right-hemisphere deficit syndrome in children* (Voeller, 1986), *syndrome of nonverbal learning disabilities* (Rourke, 1989), *developmental right-hemisphere brain syndrome* (Gross-Tsur et al., 1995), *right-hemisphere learning disorder* (Rourke, 1989; Semrud-Clikerman & Hynd, 1990), and *non-verbal learning disorder* (Ris & Nortz, 2008). The term nonverbal learning disorder (NVLD) is used for the purpose of this paper as this terminology has been accepted by recent researchers conducting studies on this learning disability.

Definition of NVLD

According to the Educator's Diagnostic Manual of Disabilities and Disorders (EDM), the nonverbal learning disabilities (NVLD), as a collective entity, is defined as follows:

> *"[a] neurophysiological disorder originating in the right hemisphere of the brain. Reception of nonverbal or performance-based information governed this hemisphere is impaired in varying degrees, including problems with visual-spatial, intuitive, organizational, evaluative, and holistic processing functions"* (Nonverbal Learning Disorders Association, 2004).

Since there is no diagnosis and definition in both the Diagnostic and Statistical Manual of Mental Disorders-IV (DSM-IV; American Psychiatric Association, 1994) and the International Statistical Classification of Diseases and Related Health Problems (ICD-10; World Health Organization, 1992), researchers have used the most widely accepted definition of NVLD which relies on the deficits in visual-spatial-organizational, tactile-perceptual, psychomotor, and nonverbal problem-solving skills (Casey, 2012; Davis & Broitman, 2007, Grodzinsky, 2003; Ris & Nortz, 2008; Rourke, 1989, 1995, 2000; Pennington, 2009). .

Diagnosis of NVLD

Since NVLD is not formally recognized in the DSM-IV and the ICD-10, it can be diagnosed by a qualified psychologist or behavioral pediatrician. Besides employing a variety of diagnostic tools, interview with both the child and the parents to ascertain the child's areas of strengths and weaknesses should be addressed. Some of the tests that can be administered are listed below:

I. Wechsler Intelligence Scale for Children - 4th edition to assess the overall intellectual functioning for individuals from six to sixteen years of age with fifteen subtests that provide four index scores: verbal comprehension, perceptual reasoning, working memory, and processing speed;

II. Kaufman Assessment Battery for Children – 2nd edition to assess intelligence children from three to eighteen years of age which consists of ten subtests;

III. Vineland Adaptive Behavior Scale – 2nd edition. Through an interview with caregiver or parents, this test assesses individual's personal and social functioning using a rating form;

IV. Rey Complex Figure Test and Recognition Trial. This test measures visual-spatial ability and visual-spatial memory from 6 to adult years of age;

V. Occupational therapy assessment to evaluate children's sensory integration, perceptual abilities, balance, and motor skills; and

VI. Speech therapy assessment from a qualified speech and language therapist to evaluate pragmatic language of children such as Test of Pragmatic Language.

ISSN-L: 2223-9553, ISSN: 2223-9944
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History of NVLD

Research on NVLD has been studied for the past 40 years. Originally, the concept of nonverbal language deficits was introduced by Johnson and Myklebust (1967) in their book on learning disabilities with children having difficulty with social perception. Years later, Rourke (1985, 1988, 1989, 1993, 1995) proposed that NLD is the combination of deficits in visual-spatial processing, tactile and motor skills, and mathematics (also see Rourke & Tsatsanis, 1996, for more detail). Others coined it as "right-hemisphere learning disability" (Denckla, 1979, 1983; Rourke, 1989; Rourke & Finlayson, 1978; Rourke & Strang, 1978; Semrud-Clikeman & Hynd, 1990).

Subtypes of NVLD

The EDM (Pierangelo & Giuliani, 2007) classified NVLD into three types of deficits as noted by the Nonverbal Learning Disorders Association (2004). They are the motor deficits, social deficits, and visual-spatial-organizational deficits.

According to Grodzinsky (2003), three subtypes of NVLD are proposed: (1) predominant deficiency in visual processing speed and organization, (2) predominant deficiency in spatial visualization, and (3) predominant deficiency in social perception. The profiles of each subtype are shown in Table 1 below.

Table 1. Profiles of Subtypes of NVLD (Grodzinsky, 2003)

Subtype A	Subtype B	Subtype C
Neuropsychological Profile	***Neuropsychological Profile***	***Neuropsychological Profile***
poor attention to visual detail than to auditory	poor performance in visual task (e.g., Object Assembly & Block Design)	difficulty understanding gestures, interpreting & differentiating facial expressions
inattentive (easily distracted)	left-right confusion	insensitive to voice intonation
Hypoactive	difficulty learning sports	difficulty in conversational turn taking (pragmatics)
slow visual processing speed	difficulty learning time concepts and math	introvert, flat affect
	poor body organization (difficulty drawing a person)	rigid with routines, have difficulty when rules change
Educational Profile	appear clumsy (poor sense of direction & easily bump into things	prone to depression
slow in reading	Poor propioception (hard to know where their body is in space)	difficulty with cause & effect relationship
slow writing output	poor self-help skills	
poor spelling skills		***Educational Profile*** read early but lacks expressive quality
careless in mathematics	***Educational Profile***	average math ability
difficulty recalling math facts	good reading skills	no issue in writing
	poor comprehension skills	
	difficulty in math (poor conceptual ability & poor sense of time poor handwriting (illegible, inconsistent letter formation, slow written output)	
	talkative	

Note: Subtype A: predominant deficiency in visual processing speed and organization, Subtype B: predominant deficiency in spatial visualization, Subtype C: predominant deficiency in social perception.

Besides the above subtypes profile by Grodzinsky (2003), Chia (2012) also mentioned that there are three models on the subtypes of NVLD: (1) Forrest's model, (2) Mamen's model, and (3) Palombo's model. Each of these models will be briefly discussed in the following sections.

Models of NVLD

Forrest's Model (Type 1)

According to Forrest (2004), this type of NVLD is termed as visual-spatial disorder. It has two different subtypes, namely one with deficits in social skills and math problem and the other with deficits in social skills but without math problem (see Figure 1).

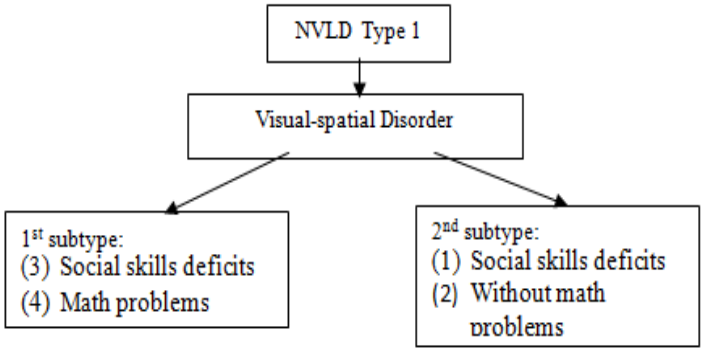

Figure 1. Forrest' Model of NVLD (Type 1) (adapted from Chia, 2012)

Mamen's Model (Type 2)

In Mamen's model (2006, 2007), she classified NVLD into four clinical subtypes as (1) perceptual, (2) social, (3) written expressive, and (4) attentional (see Figure 2).

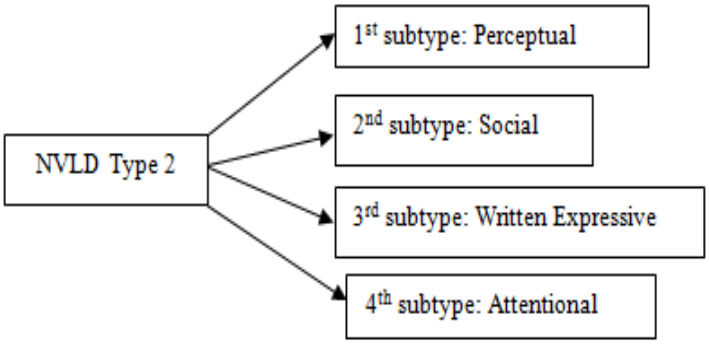

Figure 2. Mamen's Model of NVLD (Type 2)

In the subtype of perceptual NVLD, children usually exhibit problems in organizational skills such as poor time management. They have deficits in pattern recognition, visual attention, nonverbal problem-solving, and part to whole integration. Academically, these children are weak in maths, especially in geometry, graphs, and measurements where visual-spatial skills are very much required (Mamen, 2006, 2007). Children with the second subtype of NVLD normally show deficits in social and communication skills with great difficulty making friends. This is due to their difficulties in nonverbal communication as they find it hard to

read social cues from others (body language, facial expression, intonation, and humor). The academic concerns for these children are usually lack of participation during class lessons, weak listening and reading comprehension, and difficulty following instructions (Mamen, 2006, 2007).

The third subtype of Mamen's model is written expressive, where children usually demonstrates difficulty in written output such as poor and/or disorganized writing that result in untidy handwriting. They often have problem in spelling due to slow visual-processing deficiency that affects the learning of orthographic features of letters and words, resulting in inconsistent letter formation (Mamen, 2007). Finally, the fourth subtype, attentional, is evident in children with poor attention span with distractibility problem. Their poor visual attention often caused them to stay off-task and daydream most of the time. Grodzinsky (2003) described such children as being hypoactive as their symptoms resemble to Attention deficit /Hyperactivity Disorder. With problems in focussing attention, these children often have problems with accuracy in maths and written work and usually hand in incomplete work (Mamen, 2006, 2007). Such children tend to be diagnosed with Attention Deficit Hyperactivity/Disorder (ADHD): predominantly inattentive type (Semrud-Clikeman et al., 2010). However, Rourke (2000) suggested that the problems in attention are caused by visual perception and tactile difficulties rather than a diagnosis of ADHD.

Palombo's Model

According to Palombo's model (2006), NVLD is divided into two subtypes. The first subtype is related to neurolinguistic perceptual deficits with problems in social imperceptions while the second subtype relates to social-cognition deficits. The second subtype can be further divided into two more types: (1) Subtype 2A with two additional problems in social relatedness and reciprocity unrelated to visual-spatial issues, and (2) Subtype 2B with three additional problems in reciprocal social relations (limited communicative exchanges), verbal and nonverbal processing (pragmatic communication, difficulties in humor, metaphor, and analogy) and affective problems (see Figure 3)

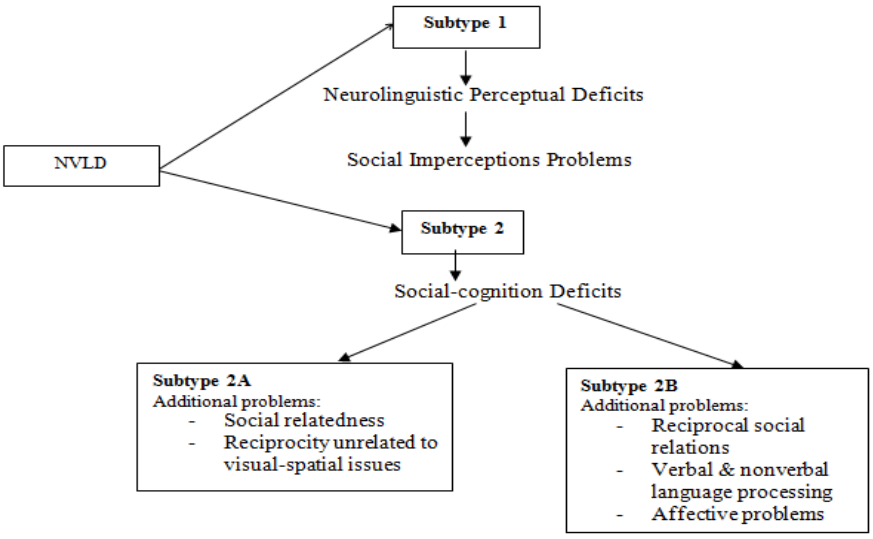

Figure 3. Palombo's Model of NVLD (Type 3)

Prevalence of NVLD

Compared to autism, dyslexia, or ADHD, the estimated prevalence rates of NVLD is considerably less with about 5 to 10% within a learning disability clinical sample (Rourke,

1989). Denckla (1979) found a much lower prevalence of 1% in a clinical sample of 484 cases while Pennington (1991) reported a range from 0.1 to 1% of the general population in the United States among an approximate 10% of all the learning disabilities cases. As NVLD is a rare disorder, there are no accurate reports on the current epidemiology of NVLD in Singapore.

Characteristics of NVLD

According to Palombo (1996), NVLD is associated to impairments in visual-spatial processing of information, reception, expression, and processing of affective communications. Children with NVLD have problems in their gross motor skills as they appear to be clumsy, bumping into things due to poor visual-spatial relations. When compared to peers of the same age, children with NVLD have difficulties in their self-help skills, such as hand washing, grooming, feeding and dressing skills. Socially, they have problems in friendship formation as these children find difficulties interacting with other children in groups. Though they are able to read well due to their early vocabulary development, but reading comprehension, especially making inferences, is a big challenge for them. In addition, they have poor handwriting due to illegible written output and difficulties in arithmetic with simple mathematical computation.

In a parent's guidebook by Stewart (2007, pp. 6-7), children with NVLD generally exhibit the following characteristics: socially inept, appears to be physically clumsy, difficulty with mathematics, and difficulty in visual-spatial processing. However, their strengths lie in strong verbal memory, strong auditory linguistic skills (ability to remember information heard), and well-developed rote verbal skills (accurate, specific use of words). Other researchers (Casey, 2012; Rourke, 1995; Semrud-Clikeman & Glass, 2008) cited that children with NVLD often demonstrate deficits in the areas of psychomotor and perceptual, arithmetic, reading comprehension, gross and fine motor skills, social and interpersonal skills. Academically, NVLD affects students in graph motor skills in the early years, mathematics, and science (deficits in complex problem solving and concept formation). Their reading comprehension is considered to be more impaired than word reading skills (Rourke, 1995). In contrast, students with NVLD possessed strengths in rote memory, single word reading skills and spelling ability (Rourke, 1988, 1989; Semrud-Clikeman & Glass, 2008). Numerous studies had been conducted and agreed that one of the hallmark characteristics of students with NVLD is stronger verbal than nonverbal (performance) cognitive abilities (Harnadek & Rourke, 1994; Rourke, 1988, 1995; Pennington, 1991, 2009).

Socially, children with NVLD have difficulties with nonverbal communication. For example, they have problems reading others' facial expression, body gestures, and vocal intonations. Expressively, they speak in a flat monotone and do not vary their intonations during communication. With their deficits in social skills, these children are often mistaken to be rude as they face challenges to decode social cues when interacting with people. Thus, emotional problems will arise with high anxiety, low self-esteem, depression, obsession, and inattention (Palombo, 1996).

Etiology of NVLD

The first comprehensive etiological model for NVLD was proposed by Rourke (1982) based on discrepancies between the right and left hemispheres. Years later, to account for a diverse range of deficits in this disorder, he expanded his model to propose that deficits in sub cortical white matter were the causes in NVLD (Rourke, 1987, 1988). A possible contributing factor to NVLD might be due to the white matter lesions, or demyelinization in the human brain (Rourke, 1993).

Physiological evidence has been growing in the last two decades that supports the findings that white matter is over-represented in the right cerebral hemisphere as compared to the gray matter in the human brain (Rourke, 1987). According to Rourke (1987), lesions in the white matter are related to a variety of neurocognitive, neurobehavioral, and psychosocial deficits, including visual-spatial abilities, tactile-perceptual skills, visual-motor integration, and other dysfunctions that are associated with NVLD.

In the study of (Rourke, 1995), he found that white matter of the brain is affected by a number of conditions that leads to the NVLD syndrome. Neurological disorders leading to white matter impairment include callosal agenesis (Smith & Rourke, 1995), hydrocephalus (Fletcher et al., 1995), multiple sclerosis (White & Krengel, 1995), encephalomyelitis, certain types of traumatic brain injuries (Ewing-Cobbs et al., 1995), and toxic encephalopathy (White & Krengel, 1995).

METHOD

Participant

One school-aged Primary school boy (Chronological Age: 9 years 3 months at the time of the study) was selected for the purpose of this study. He manifested reading problems in the areas of word recognition, vocabulary, reading and listening comprehension in English language. His parents had agreed to submit the child's psychological assessment reports administered by the psychologists from local hospital for the author to examine the participants' psycho-educational profiling as part of the current research study. At the end of the study, parents will be informed of their child's results with some suggested teaching strategies from the author as part of the intervention to improve the child's literacy skills.

Study Design

This study employed a convenience and purposeful sampling with a single-subject design to establish a psycho-educational diagnostic evaluation and profiling of one participant who exhibited literacy problems in English language. The intention of this sampling method was to provide rich and sufficient information related to the research topic.

Procedure

Participating subject's psycho-educational assessment reports is obtained from a local university administered by a qualified psychologist. Data were kept anonymous and confidential as part of the research ethics. The reports were studied and examined by the author to evaluate for the purpose of this study. The six standardized tests administered by the local psychologist were:

I. Wechsler Intelligence Scale for Children-Third Edition (Wechsler, 1991)
II. Comprehensive Receptive and Expressive Vocabulary Test-Second Edition
III. Word Recognition and Phonic Skills Test-Second Edition
IV. Peabody Individual Achievement Test-Revised (PIAT-R)
V. Salford Sentence Reading Test – Form X
VI. Oral and Written Language Scales-Second Edition

Statement of Aim

The purpose of this case study is to examine and establish a psycho-educational diagnostic evaluation of one school-aged boy who demonstrated literacy problems and is suspected to have nonverbal learning disability using a differential diagnosis.

Instrumentation

The six standardized test instruments were chosen for its excellent psychometric properties, popularity, availability, and ease of administration. The following section briefly describes each of these measuring instruments.

The Wechsler Intelligence Scale for Children-Third Edition (WISC-III) (Wechsler, 1991)

The WISC-III (Weschler, 1991) is one of the most commonly IQ assessment used for children from aged six to 16 years. It is individually administered with 13 subtests (6 verbal scales and 7 non-verbal or performance scales) to determine the presence of a learning disability. There is a high correlation of the scores on the WISC-III. It is highly correlated with academic performance and it provides valuable information as one of the measures in the diagnosis of several learning disabilities such as dyslexia (Pierangelo, 2003), non-verbal learning disability (Leavell, 1998), and autism spectrum disorder (Sigman et al., 1987). Table 2 shows the WISC-III subtests of both verbal and performance scales and their respective measures. For more information of the WISC-III and results interpretation, please refer to Kaufmann (1994).

Table 2. Subtests of the WISC-III

Verbal Scale Subtests	*Measures*
Information	General factual knowledge, long-term memory
Similarities	Abstract reasoning, categories, relationships
Arithmetic	Attention, concentration, numerical reasoning
Vocabulary	Word knowledge, verbal fluency
Comprehension	Social judgment, common sense reasoning
Digit Span	Short-term auditory memory, concentration
Performance Scale Subtests	*Measures*
Picture Completion	Alertness to essential details
Coding	Visual motor-coordination, speed, concentration
Picture Arrangement	Sequential, logical thinking
Block Design	Spatial, abstract visual problem-solving
Object Assembly	Visual analysis, construction of objects
Symbol Search	Speed of processing novel information
Mazes	Fine motor coordination, planning, following instructions

The WICS-III also provides useful information about a child's strengths and weaknesses from the subtest scaled scores. The norm mean for each subtest is ten with the importance lying on the child individual subtest mean either on the Verbal Scale or the Performance

ISSN-L: 2223-9553, ISSN: 2223-9944
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Scale and also how much variation from these means on the separate subtests on each scale. Table 3 shows a classification of the various ranges of the scaled scores and the denotation of each range.

Table 3. WISC-III Subtest Scaled Scores

Range of Scaled Scores	*Description*
1-3	*Developmentally Challenged*
4-5	Borderline
6-8	Low Average
9-12	Average
13-14	High Average
15-16	Superior
17-19	*Very Superior*

In addition, the WISC-III also provides four factor index scores:

a. Verbal Comprehension Index – VCI (consists of four subtests of Information, Similarities, Vocabulary, and Comprehension). The VCI measures verbal knowledge and comprehension obtained from formal education and it reflects on the application verbal skills to novel situations with the emphasis on auditory memory (Sattler, 1988, p.130).

b. Perceptual Organization Index – POI (consists of four subtests of Picture Completion, Picture Arrangement, Block Design, and Object Assembly). The POI "reflects the ability to interpret and organize visually presented materials while working against a time limit" (Sattler, 1988, p.130) with the emphasis of visual memory.

c. Freedom from Distractibility Index – FDI (consists of two subtests of Arithmetic and Digit Span). The FDI measures "an individual's ability to attend and concentrate on an assigned task. This index may also measure numerical ability as numbers are involved in all the subtests. Short-term memory and sequencing ability may be crucial components as well" (Searls, 1997, p.58).

d. Processing Speed Index – PSI (consists of two subtests of Coding and Symbol Search). The PSI measures components of "processing" and implies both cognition and speed (Kaufman, 1994; Searls, 1997) and this factor depends very much on visual memory and response speed of the individual.

The WISC-III has been useful in the assessment of learning as well as screening for developmental delay/disabilities. For instance, individual diagnosed with dyslexia often have significantly higher PIQ than VIQ with FSIQs falling within the average range or above (Searls, 1997). Children with Asperger's Syndrome generally have a significantly higher VIQ than PIQ with FSIQs falls in the range between average and high average (90-120 range) (McLaughlin-Cheng, 1998). More will be discussed in the Results and Discussion Section.

The WISC-III is useful as it possessed strong evidence in both its reliability and validity. According to Kline (2000), the split-half reliabilities of the verbal IQ (VIQ) and the

performance IQ (PIQ) are both beyond.90 and the Full-Scale IQ (FSIQ) has a high reliability of *.97*. But the reliability of the subtests varies from *.65* to *.94*. The examiner should exercise some caution when posing questions to the examinee as it may be culturally biased and the test does not cater for the distinction of Full-Scale IQ below 40. Thus this makes it difficult and less useful to differentiate among levels of retardation (Pierangelo, 2003). This is why the current study does not use WISC-III alone in the diagnosis and profiling of any learning disability of the subjects.

Comprehensive Receptive and Expressive Vocabulary Test-Second Edition (CREVT-2) (Wallace & Hammill, 2002)

The CREVT-2 comprises of two subtests that measure both receptive and expressive oral vocabulary (word knowledge and meaning) for individual whose age range from 4 years 0 months through 89 years 11 months. Two forms (Form A and Form B) are available in this test. It was used in this study to identify if the subjects were significantly below their peers in oral vocabulary proficiency and also to note the discrepancies between receptive and expressive oral vocabulary. Oral vocabulary is probably the most important indicator of general learning ability that is required in order to perform well in school (Harris & Sipay, 1990). Comprising of word knowledge and word meaning which are essential to word recognition/identification and word learning, it is the precursor to emergent literacy in young children.

The overall reliability of CREVT-2 exceeds *.90* and 14 (58 per cent) of its 24 coefficients meet or exceed the more rigorous standard of *.95*, which is considered the desirable standard (Nunnally & Bernstein, 1994). The reliability of the CREVT-2 Form A for receptive oral vocabulary has a coefficient alpha (Cronbach, 1951) of *.93*; a test-retest reliability of *.96*; and a reliability coefficient for scorer difference of *.99*. The reliability of the CREVT-2 Form B for receptive oral vocabulary has a coefficient alpha of *.93*; a test-retest reliability of *.98*; and a reliability coefficient for scorer difference of *.99*. The reliability coefficient for alternate form (immediate) between Forms A and B is *.94* while that for alternate form (delayed) between Forms A and B is *.95*.

The reliability of the CREVT-2 Form A for expressive oral vocabulary has a coefficient alpha (Cronbach, 1951) of *.89*; a test-retest reliability of *.94*; and that of scorer difference is *.99*. Similarly, the reliability of the CREVT-2 Form B for expressive oral vocabulary has a coefficient alpha of *.89* but a slightly lower test-retest reliability of *.93* as well as lower reliability coefficient for scorer difference of *.97*. The reliability coefficient of alternate form (immediate) between Forms A and B is *.88* while that of alternate form (delayed) between Forms A and B is *.91*.

Finally, the reliability of the CREVT-2 Form A for general oral vocabulary has the same coefficient alpha (Cronbach, 1951) of *.95* for both Forms A and B, same test-retest reliability of *.96* and same reliability for scorer difference of *.99*. The reliability coefficient of alternate form (immediate) between Forms A and B is *.94* while that of alternate form (delayed) is *.95*.

Word Recognition and Phonic Skills Test-Second Edition (WRaPS-2) (Moseley, 2003)

The WRaPS-2 can be group or individually administered and is designed to measure a child's word recognition ability based on his/her word recognition standardized score expressed in terms of (a) word recognition age equivalent, (b) ten stages of word recognition, and (c) the length of a word that is recognized about 80 per cent of the time (Moseley, 2003). It is suitable for use with pupils aged 4 years 6 months to 9 years 0 month.

The WRaPS-2 also assesses children's phonic skills and helps to pinpoint problems in the initial stages of learning to read. It provides a standardized score and word recognition age for each child; a reliable diagnostic profile of strengths and weaknesses in phonic skills; a measure of each child's knowledge of high frequency words. "WRaPS2" has been extensively refined in the light of on-going research, and is now available in parallel forms A and B. Fully re-standardized, the coverage of the test has been extended to map fully to the Literacy Strategy Progression in Phonics 'steps', making it. The practical suggestions for teaching follow-up have also been expanded. "WRaPS2" is easily administered to a full class in a single period, and is quickly scored using the scoring keys - which also now provide a sharper diagnostic analysis. The test format ensures that almost all children can identify some features of spoken words in printed form, and can complete the test without experiencing failure. Using the parallel forms, "WRaPS2" can be repeated at intervals to assess progress from Reception to Year 4, and in working with older pupils with reading difficulties. This re-standardized new edition matches exactly to the National Literacy Strategy; provides a second parallel test form that enables 'before and after' assessment; and extends the upper range of the test.

WRaPS-2 was selected in this study because of two reasons. Firstly, word recognition is “an important measure of children’s developing knowledge about written language as well as the major route to meaning, a fundamental pre-requisite for comprehension” (Moseley, 2003:5). Secondly, the WRaPS-2 can provide a diagnostic profile of strengths and weaknesses in phonic skills which indicates whether the child is sensitive to the appropriate range of cues at a given level of development.

The WRaPS-2 was standardized in 2002 to 2003 on 4775 pupils in 111 schools, after extensive piloting to ensure good item discrimination and equivalence between Forms A and B. It also possessed excellent psychometric properties of high internal consistency with an overall Cronbach’s (1951) alpha value of *.97* in both Forms A and B. Even in the Reception year, where children are most likely to resort to guessing, the alpha values are *.86* and *.84*. In addition, a word length score (WLS) was calculated to represent the length of word correctly recognized at least 80 per cent of the time. This too proves to be a reliable index, with an alpha value of *.87*. Its validity as a measure of progress in word recognition is confirmed because it is strongly correlated with performance on each test (r = *.89* with Form A raw score and *.93* with Form B).

Peabody Individual Achievement Test-Revised (PIAT-R) (Markwardt, 1989)

The PIAT-R is chosen as it is a comprehensive assessment test which is used to screen any individual with specific learning disorder/disability and to determine an individual strengths and weaknesses in the academic domains. It is an individually administered, nationally norm-referenced measure of academic achievement and is used with students from 5 years 0 month through 22 years 11 months. The test is designed to provide a wide range assessment of six content areas, i.e., General Information, Reading Recognition, Reading Comprehension, Mathematics, Spelling, and Written Expression. The subtests of PIAT-R measures:

I. *General Information* - 100 open-ended questions that are orally presented which are used to measure student’s general knowledge that is related to science, social studies, humanities, fine art, and others.

II. *Reading Recognition* - 100 items measure recognition of printed letters and the ability to read words aloud. Items 1 to 16 are multiple-choice questions which measure pre-reading skills and items 17 to 100 measure decoding skills which require students to read individually.

III. *Reading Comprehension* - 82 items measure reading comprehension which the student chooses one of four pictures that best illustrates a sentence.

IV. *Written Expression* - assesses written language skills for two levels. Level I (K1) tests pre-writing skills. Level II (Grades 2-12) requires the student to write a story about a picture.

V. *Mathematics* - 100 multiple choice items test knowledge and application of math concepts and facts.

VI. *Spelling* - 100 multiple choice items measure recognition of correct word spelling. Items 1 to 15 are multiple choice questions which assess reading skills while items 16 to 100 requires the student to choose from four choices the correct spelling of a word read orally by the tester.

Besides this, PIAT-R also provides a Written Language Composite which is obtained by combining scores on the Spelling and Written Expression subtest. It also provides a Total Reading score which is a combination of scores from the Reading Recognition and Reading Comprehension subtests for overall indexes for written expression and reading achievement.

According to Markwardt (1998), the PIAT-R has a test-retest reliability for subtests and the total battery for selected grades ranges from $r = 0.67$ to $r = 0.98$ (median = 0.91). The internal consistency of the assessment test has coefficients which ranged from $r = 0.87$ to $r = 0.98$ (median = 0.95).

Salford Sentence Reading Test – Form X (Vincent et al., 2000)

Based on a series of sentences of graded difficulty, the Salford Sentence Reading Test (Revised) (Vincent et al., 2000) provides a quick and simple individual test of oral reading. Two equivalent forms, X and Y, each consist of 13 short sentences, are presented in order of increasing difficulty. A Record Sheet is also provided to record the number of errors the participant make with the reading age stipulated below for every sentence. To administer, the participant can begin at any point on the test where he/she is able to read two consecutive sentences without any errors. Testing will stop when the child makes the sixth error and the error will be marked in the Record Sheet by circling each word that is read incorrectly. An error will not be counted if the child reads a word wrongly but corrects it spontaneously and it will be recorded when the child is unable to produce a word after 6 seconds.

This test also possessed excellent psychometric properties. It has a Cronbach alpha of *.95* on both forms of the Word Reading Test, and *.97* for the Sentence Reading Test. In addition, the correlation between word reading and sentence was also strong with Pearson for both forms of the Word Reading Test of *.95* and Sentence Reading Test of *.96.*

Oral and Written Language Scales-Second Edition (OWLS-2): Listening Comprehension (LC) Scale & Oral Expression (OE) Scale (Carrow-Woolfolk, 1995)

The OWLS is selected to assess the receptive and expressive language for children and young adults. It is an individually administered assessment that is suitable for ages 3 through 21 years. It consists of the Listening Comprehension Scale (LCS) used to measure receptive language and the Oral Expression Scale (OES) to measure expressive language. Depending on the examinee's age, the LCS consists of 3 examples and 111 items which take about 5 to 15 minutes to administer, while the OES consists of 2 examples and 96 items and take about 10 to 25 minutes to administer. Tasks in the LCS include the components of lexical (vocabulary), syntactic (grammar), and supra-linguistic (higher-order thinking) skills. In contrast, tasks in the OES include the components of lexical, syntactic, supra-linguistic, and

pragmatic (functional use) language skills. Results derived from OWLS-2 can be used to determine broad levels of language skills as well as specific domain in listening and/or speaking. In this study, the author only considered using the results of the LCS.

Table 4 shows the OWLS-2 LCS and OES subtests and their respective measures. For a more comprehensive details and explanation of the language scales, please refer to the Pearson Education website at http://ags.pearsonassessments.com/assessments/technical/owls.asp

Table 4. Subtests of OWLS-2: Listening Comprehension Scale & Oral Expression Scale

	Listening Comprehension Scale
Lexical Skills	Measures comprehension of nouns, verbs, modifiers, personal and demonstrative pronouns, idioms, words with multiple meanings, words that represent directions, quantity, spatial relations, etc.
Syntactic Skills	Measures comprehension of noun and verb modulators, (e.g., number, tense, gender, voice, person, and case)
Syntactic Construction Skills	Measures comprehension of embedded sentences, coordination, subordination, negation, direct/indirect objects, etc.
Supra-linguistic Skills	Measures language analysis on a level such as comprehension of figurative language and humor, derivation of meaning from context, logic and inference, and other higher-order thinking skills.
	Oral Expression Scale
Pragmatic Language Skills	Measures appropriate responses in specific situations, such as questions, courtesy, response, reasonable explanations, etc.

The OWLS-2: LCS & OES possessed excellent psychometric properties. According to Carrow-Woolfolk (1995), it has internal consistency reliabilities of *.84, .87* and *.91* for LC, OE and Oral Composite scores respectively. The test-retest reliability coefficients of the test are *.76, .81* and *.85* for LC, OE and Oral Composite scores respectively. Finally, the inter-rater reliability coefficient for the test is *.95*. Besides, correlations between OWLS scales and other measures of receptive and expressive language and also tests of cognitive ability and academic achievement were also reported to be high (Carrow-Woolfolk, 1995).

Data Analysis

The author used the existing psychological assessment reports of the participant to establish a psycho-educational diagnostic evaluation and profiling based on WISC-III and the six standardized literacy tests using a differential diagnosis approach.

RESULTS AND DISCUSSION

Results of the participant is tabulated and discussed under three headings: (1) WISC-III, (2) Psycho-educational Diagnostic Evaluation and Profiling, and (3) Achievement Tests. Table 5 shows a summary of participants WISC-III results while psycho-educational diagnostic evaluation and profiling based on WISC-III is tabulated in Table 6. Finally, achievement results based on language abilities are shown in Table 7.

Table 5. Summary of WISC-III Results

Verbal Scale		*Performance Scale*	
Subtests	*Scaled Scores*	*Subtests*	*Scaled Scores*
I	13	PC	8
SIM	11	PA	15
A	9	BD	7
V	16	OA	6
COMP	16	Cod	6
DS	17	SS	8
		Maz	4

Note I: Information, SIM: Similarities, A: Arithmetic, V: Vocabulary, COMP: Comprehension, DS: Digit Span, PC: Picture Completion, PA: Picture Arrangement, BD: Block Design, OA: Object Assembly, Cod: Coding, SS: Symbol Search, Maz: Mazes

Table 6. Summary of Psycho-educational Diagnosis Evaluation & Profiling

Items	*Scaled Scores*	*Items*	*Scaled Scores*	*Items*	*Scaled Scores*
VCI	46	ACID	45	ACoDS	32
POI	36	SCAD	40	AIDS	39
FDI	26	SMP	19	ADS	26
PSI	14	L&C	43	SpC	21
		Con	38	CC	43
		Attn	32	SqC	38
				AK	38

Note: CA: Chronological Age, MA: Mental Age, VIQ: Verbal IQ, PIQ: Performance IQ, FSIQ: Full-scale IQ, VCI: Verbal Comprehension Index, POI: Perceptual Organization Index, FDI: Freedom from Distractibility Index, PSI: Processing Speed Index, ACID: Arithmetic, Coding, Information, Digit Span, SCAD: Symbol Search, Coding, Digit Span, SMP: Sensorimotor Processing, L & C: Language & Communication, Con: Conceptualization, Attn: Attention, ACoDS: Arithmetic, Coding, Digit Span, AIDS: Arithmetic, Information, Digit Span, ADS: Arithmetic & Digit Span, SpC: Spatial Category, CC: Conceptual Category, SqC: Sequential Category, AK: Acquired Knowledge Category.

WISC-III Results

The VIQ (124) was larger than the PIQ (88) with a point difference of 36. According to Rourke (1989, 1995) and Kustcher (2005), individuals with a significantly higher VIQ than PIQ have a possibility of a nonverbal learning disorder/disability (NVLD). In addition, they

found that the VIQ of children with NVLD would generally exceed their PIQ by at least 10 points. Based on studies by Stewart (2007), children with NVLD usually score highest on two or three verbal scale subtests – Vocabulary, Similarities, and/or Comprehension. In addition, they also scored low on two or three performance scale subtests of Block Design (BD), Object Assembly (OA), and/or Coding (Cod). The present finding is consistent with Stewart (2007) findings where Jim scored high on Vocabulary (V) of 16 points and Comprehension (COMP) of 16 points and low on Block Design (BD) of 7 points, Object Assembly (OA) of 6 points, and Coding (Cod) of 6 points. Such findings are further supported by Mamen (2002) in that children with NVLD are relatively weak on Object Assembly (OA) and/or Picture Arrangement (PA) subtests.

The mean Verbal Subscale (VS) is 14 and the discrepancy between the mean VS and each of the verbal scale subtests is +5 and -3, suggesting significant results. Whereas the mean Performance Scale (PS) is 8 and the discrepancy between the mean PS and each of the PS subtests is +4 and -7, again suggesting significant results. According to Rourke (1998), lower scores will be expected for tasks involving visual-spatial organization (object assembly, block design, symbol search, and mazes). The present findings are consistent to what Rourke (1998) expected. Jim also exhibited a profile of Asperger's Syndrome with dyspraxia. Leavell's profile (1998) is used to ascertain the possibility of NVLD and results demonstrated that Jim had sensorimotor processing problem as he scored poorly with 19 points (cut-off scaled score is 30). This deficit will affect his gross and fine motor coordination where the impairment is usually affected on the left side of the body (Casey, 2012).

WISC-III factor index indicates that Jim had high Verbal Comprehension Index (VCI) of 16, suggesting that he had superior auditory memory, especially in the subtests of Information and Similarities where long-term memory are measured. His high score of Vocabulary (16 points) also demonstrated that he had strong concept formation, abstract thinking, and school acquired knowledge. However, he did not performed well in the Perceptual Organization Index (POI) of 36 (cut-off scaled score is 40) and is obtained by adding PC, PA, BD and OA. Among the four performance subtests, scores of PC, BD, and OA fall on the low average (range from 6 to 8). According to Sattler (1988:130), POI is a nonverbal score and it "reflects a child's ability to interpret and organize visually perceived material while working against a time limit". Based on several studies (e.g., Harnadek & Rourke, 1994; Ris & Nortz, 2008; Rourke, 1989; Semrud-Clikerman & Hynd, 1990), one of the primary characteristics of children with NVLD is difficulty in visual-spatial processing. This could explain why Jim has difficulties on nonverbal concept formation and visual-motor-spatial coordination in the Block Design (BD) performance subtest and/or struggles with part-to-whole relationships using visual anticipation when performing Object Assembly (OA) subtest (Chia & Wong, 2010).

Another WISC-III factor index that Jim scored poorly is the Processing Speed Index (PSI) of 14 points (cut-off scaled score is 20). PSI is comprised of Coding (Cod) and Symbol Search (SS) subtests where he scored 6 and 8 points respectively (refer Table 6). According to Kaufman (1994) and Searls (1997), PSI includes components of "processing" that implies cognition and "speed" that involves both behavior and cognition. Coding measures visual-motor dexterity and the child's ability to learn from visual-kinaesthetic stimuli where he needs to write and look at the same time. Writing is a big challenge for him as he exhibits a profile of dyspraxia whereby both Cod and SS is part of the components (dyspraxia profile is the sum of Coding, OA, BD, and SS). As for the subtest of SS, it measures the speed of visual search, speed of mental processing, and visual-motor coordination (Chia & Wong, 2010). This could also possibly explain why he failed the PSI as he scored poorly on these subtests.

In summary, the above findings suggest that Jim has a possibility of having NVLD that could possibly associates with Asperger's Syndrome and dyspraxia. However, relying on the evaluation and profiling using WISC-III alone is insufficient to confirm any prognosis. Hence, a differential diagnosis is necessary to further analyse his profile by examining the results of the literacy subtests below.

Literacy Tests (Reading Accuracy and Comprehension)

A summary of achievement results with reading accuracy (word recognition) and comprehension (reading and listening) of Jim based on the six standardized assessment tests are shown in Table 7 below. Among the tests administered, reading accuracy is denoted by Word Reading Age (WRA), reading comprehension by Reading Comprehension Age (RCA), and listening comprehension by Listening Comprehension Age (LCA) respectively.

Table 7. Summary of Literacy Test Results

Types of Tests	*Age Equivalent (CA: 9:03)*
CREVT-2	10:01 (VA)
WRaPS-2	8:06 (WRA)
PIAT-2	9:07 (WEA)
PIAT-2	10:04 (RCA)
SSRT	9:10 (SRA)
PIAT-2	10:03 (SpA)
OWLS-2	9:01 (LCA)

Note:

CA: Chronological Age in years and months
CREVT-2: Comprehensive Receptive & Expressive Vocabulary Test – Second Edition
WRaPS-2: Word Recognition and Phonics Skill Test – Second Edition
PIAT-2: Peabody Individual Achievement Test – Second Edition
SSRT: Salford Sentence Reading Test
OWLS-2: Oral and Written Language Scales – Second Edition
VA: Vocabulary Age
WRA: Word Reading Age
WEA: Word Expression Age
RCA: Reading Comprehension Age
SRA: Sentence Reading Age
SpA: Spelling Age
LCA: Listening Comprehension Age

From the achievement results in Table 7, Jim's vocabulary development (word knowledge and meaning) is on the average range with a Vocabulary Age (VA) of 10 years 1 month when compared to his Chronological Age (CA) of 9 years 3 months. This suggests that both his receptive and expressive oral vocabulary is about a year ahead based on CREVT-2. His verbal scale subtest on Vocabulary (V) from the WISC-III of 16 points from Table 1 also

explained that he has superior vocabulary. One thing to note is that his spelling skills is above average with a one year ahead of his CA and MA, probably due to his strong word decoding skills. His comprehension skills based on PIAT-2 and OWLS-2 were also within the average range. The overall results showed that Jim's reading accuracy (word recognition) and comprehension (reading and listening) were all within the average range with no significant discrepancy when compared to his CA and MA.

From the above literacy tests, results showed that Jim does not show any possibilities of having dyslexia, hyperlexia, and/or reading comprehension impairment. Though these tests cannot provide a definitive diagnosis of NVLD, results from WISC-III and the psycho-educational evaluation and assessment seems to offer converging evidence of Jim showing a profile of nonverbal learning disability with Asperger's Syndrome and dyspraxia.

LIMITATIONS AND FUTURE RECOMMENDATION

Due to the nature of the research design of a single-subject case study, the results cannot be generalized over a wider population. This could be explained by the rarity and difficulty of recruiting children with nonverbal learning disorder. Another limitation of the study is the coverage of instrumentation used. With the current study that utilized only six standardized test to measure the intellectual functioning and language abilities of the participant suspected with NVLD, it is still not comprehensive. According to Casey (2012), the impairments of NVLD include visual-perceptual abilities, tactile-perceptual abilities, fine motor skills (speed and dexterity), and higher-order problem-solving abilities (Harnadek & Rourke, 1994). Hence, future studies can consider including a more comprehensive battery of tests to encompass a wider range of the characteristics of NVLD. For example, tests such as Judgment of Line Orientation for visual-spatial perception, Children's Category Test for nonverbal problem solving, Grooved Pegboard Test for fine motor speed and dexterity, and Finger Tip Number Writing for tactile perception. Administered by a certified Occupational Therapist, these tests can be combined with IQ and language abilities test to provide a more comprehensive evaluation and profiling of the participant.

A comprehensive assessment is crucial in order to arrive at an accurate diagnosis of NVLD. These may include interviews from parents and teachers, and informal assessment procedures (written language samples, school work, medical records, etc.). Relying on psycho-educational assessment is insufficient to render a diagnosis as the key neuropsychological processes of NVLD are often excluded. As mentioned previously, the clinical features of NVLD are absent during the assessment and diagnosticians should rely on their clinical experience (since NVLD is excluded in DSM or ICD) Instead, a thorough knowledge of the description by (Rourke, 1989) and the latest research studies on NVLD is necessary to provide a more accurate diagnosis.

CONCLUSION

This study presents a case of NVLD, probably co-existing with Asperger's Syndrome with dyspraxia in a 9 years 3 months school-aged boy. Though there are insignificant discrepancies in the literacy tests, instrumental profiling using WISC-III revealed a NVLD profile. Using existing assessment reports from the psychologist, the author conduct a psycho-educational diagnostic evaluation and profiling of Jim using WISC-III. Results revealed significant differences in both the Verbal Scale (VS) subtests and Performance Scale (PS) subtests with higher scores on the VS than the PS. Such findings suggest the possibility of Jim having NVLD, associated with Asperger's Syndrome and dyspraxia.

ACKNOWLEDGEMENT

The author wishes to thank Dr Noel KH Chia, an assistant professor of special education at the National Institute of Education, Nanyang Technological University, Singapore, for his kind assistance in providing the case for this single-subject case study research.

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