

Chapter two - literature review

Defining the causes of dyslexia

Turn of the century

Research over the decades has swung like a pendulum back and forth to argue the causes of dyslexia. What is known for sure is that children do experience considerable difficulty with learning to read and often enough, with mathematics as well. Causes and/or simultaneous deficits range from biological inheritance, neurological or processing deficits, phonological deficits, visual-spatial deficits, motor skill deficits, and automaticity deficits among others. Typically, these children experience letter reversals such as with {b,d, p} or {u, n} and word reversals such as {ibu, ubi} and {dan, nad}, or omit letters altogether such as {sipan} for {simpan} or {betuk} for {bentuk}. Some children even have mirror writing and supposedly reading, which causes severe difficulty with developing strong reading skills. A variety of other miscues can occur in the process of reading and writing such as mispronunciations, letter/syllable additions, letter/syllable substitutions.

Let us try to gain an understanding of the historical relevance and the current theories or accepted current causes based on the most recent research. As reported by Benton (1980), between 1896 and 1910, 28 papers were published on dyslexia, all which helped to establish the existence of the condition and define its characteristics. Some felt it was hereditary or resulted from cerebral damage or hemispheric dominance of visual memory images. In the early part of the century in 1917, James Hinshelwood, who was an eye surgeon, for lack of a better medical

understanding, described dyslexia as “word blindness”, a term which still shows up today in some literature. He too proposed a theory that dyslexia arises from “focal maldevelopment of the posterior parietal territory of the dominant hemisphere” (Benton, 1980). However, few researchers took interest to lend credibility to his theory.

The psychological period

The years of 1912- 1926 were known as the psychological period, where the emphasis of research was on the underlying problems and not the surface characteristics. Bronner (1917) stated that these difficulties involved perception (visual and auditory), memory, interpretation of symbols, motor processes, comprehension, emotions and complex associations. Varied performance patterns showed up in the research and as such, led to two schools of thought, one focusing on perceptual and cognitive disabilities, the other focusing on environmental variables.

Orton's mark in a neurological theory

Later, in 1937, Samuel Orton, a neurologist, suggested the term of “stropho-symbolia”, a more sophisticated term meaning to “twist symbols”, which laid the focus not on the inability to see words, but on the processing level. As remembered by Lauretta Bender (1987), who herself was diagnosed by Orton and was also a close research associate of his, Orton basically rejected Hinshelwood's concept of word blindness back in 1925 and adopted a more functional idea of “developmental language disability” based on hemispheric dominance. These early suggestions guided most research up until the 70's in the direction of

neurological studies of hemispheric dominance and visual processing problems, until later research turned towards language processing deficiencies. Furthermore, Bender (1987) stated Orton was ahead of his time when before he died in 1948, he had proposed that dyslexia was caused by “a failure of elision of the images from the non-dominant side of the third level or symbolic level of the visual sensory cortex and, therefore, a confusion between the visually presented stimulus and its remembered concepts”.

Researchers still continued to look at other varying aspects and as such, a wealth of knowledge has been gained from the cognitive, educational, social, behavioral, emotional and genetic aspects of dyslexia. However, bringing all of this together to come up with a definition and the causes of dyslexia that all could agree upon continued to present a major challenge to professionals in the various domains.

The language processing theory period

In the 80's came the changing trend towards language processing deficits. Researchers in psychology drifted from the growing evidence of medical practitioners leaning towards neurological causes and focused research more on the processes of reading and the assessment required to help teach these children. Phonological deficits were the primary target of much research and even until today, many support phonics methods, such as the Orton-Gillingham method for teaching children with dyslexia.

A classic study by Denckla in 1972, reported by Snyder (1995) on serial rapid naming started another trend covering two decades of research

documenting difficulties of dyslexic children in rapid naming of objects, but most failed to agree as to the underlying causes. This became more of a means of assessment rather than a search for the causes, which were thought to be cognitive processing deficits. More evidence continued to be produced to support phonological processing deficits (Stone & Brady, 1985) and morphological usage (Smith-Lock, 1995) in dyslexic children. By 1988, so much research had been accomplished in the speech and phonics domain, but unfortunately, the results were all mixed and no cohesive definition or cause of dyslexia could be achieved. Stanovich (1988) finally proposed that rather than look at general central cognitive processes, researchers should be more specific and look at modular processes such as word and syllable (phonics) recognition. He concluded that considerable evidence showed that varying phonological processing was linked to variance in reading ability.

Current research trends in language processing deficits

Twin studies (Defries & others, 1991) have proven beyond a doubt that while there is no sex difference, there is a definite evidence of inheritance of dyslexia. About 60% of deficit areas were the same in twins. In another research project of visual and auditory information processing, it was found that these factors affect dyslexics more than normal children (Reddington & Cameron, 1991).

Phonological deficits are ever emerging as a factor that causes dyslexia. Fawcett & Nicolson (1995) conducted tests with non and dyslexic children and found strong evidence that children with dyslexia perform much worse than

normal readers in phonological awareness. Elbro (1991) came to the same conclusions when he tested two matched groups, one dyslexic, one not, and found the variance of reading ability was due to phonological discrimination ability. Converging evidence from longitudinal studies shows that spoken language impairments, reading, spelling skills and phonological deficits in dyslexics are common (Snowling, 1995). Badian (1994) wanted to establish if there was a difference between the dyslexic poor reader and the “garden variety” poor reader and found that while both had phonological processing deficits, they were worse for dyslexics.

Current research trends in supporting biophysical causes of dyslexia

With the use of magnetic resonance imaging (MRI), researchers were able to study deviations in human brain morphology and concluded with direct evidence that dyslexics show variations in specific regions of the brain (Hynd & others, 1991). This supports the theory that dyslexia is in fact, a neurological disorder. Research findings from autopsy studies with neuroimaging, functional imaging and electrophysiological measures have also shown that dyslexia does have neurological origins (Riccio & Hynd, 1996).

The last few years have seen the majority of psychology researchers looking more closely at supporting the language processing problems alongside with the neurological community furthering their technological developments on the neurobiological theories. Essentially, the psychologists research is geared towards developing answers for more appropriate remedial techniques, while the medical community is geared towards defining the etiology. Where normally two

professions work in completely separate circles, the years have seen them bring their efforts together in search of answers for both and a new field of neuropsychology was the result. The latest announcement from Shaywitz (1998) also confirmed through MRI that brain activity was different for the dyslexic reader than normal readers.

Assessment of dyslexia

Visual motor integration testing for reading ability or disability

The domain of reading has a multitude of areas that are researched. One particular area is the correlation of visual-motor integration and reading ability. Earlier pioneers, known as the perceptual-motor theorists, felt that there was a strong relation, but as time and more research evolved, theories changed and some came full circle.

Warner & Strauss, though their studies were with mentally retarded children, were the early pioneers who confirmed a deficiency in visual-motor abilities. Their many studies provided the foundation on which Kephart, Cruickshank, Getman, Bender and Frostig also developed their theories through further research.

Kephart conceptualized that input and output were inseparable and therefore held the theory that perceptual and motor activities were not separate, but inter-related, and so supported the term "perceptual-motor". He further dwelled upon the importance of brain laterality, which caused the ability (or inability) to distinguish directionality. Hence, he reasoned this was why children would reverse

letters. This rationale was the basis for his perceptual-motor integration training activities in remediation for children.

Johnson & Mykelbust (1967), de Hirsh (1967), Kirk (1976) and Orton (1966, 1971) drew the same relation into children with specific learning disabilities and recognized the link, but were more focused as language theorists, that is, more towards the remediation of the problems children were experiencing with language learning.

In the UK, Bronner (1917) seems to have been the first known person to study the nature of perceptual deficits and their relation to reading disability. She attributed reading disability to faulty visual memory in some, to poor auditory discrimination in others. Still in others with reading difficulty, neither showed up. Orton (1937) noted that Gates in 1922, Bachmann in 1927 and Ombredane in 1937, on the other hand, disagreed that neither had a role to play in reading disability. They felt the cause was more towards environmental factors such as economic background, defective teaching or emotional disturbances. Orton (1925, 1937), through years of research, further "splintered" the classification of difficulties and attributed them to either of developmental word deafness, developmental motor aphasia, developmental alexia, developmental agraphia and strephosymbolia. Patients could display one or a combination of these and, he noted, were often left-handed. He theorized that there was an intermixture of control in both hemispheres of the brain and that a conflict arose between the mirror images in the two hemispheres as children attempted to build associations between letters and spoken words.

From the 1930's up until the 70's, the most substantial contributor to the field was Samuel A. Kirk (1971). From his early experiences through the 70's, his endless search and attempts at defining learning disabilities and developing a test to assess them, finally culminated in producing the Illinois Test of Psycholinguistic Abilities - the ITPA. The ITPA is made up of several subtests which cover the broad areas of language and visual -motor abilities of channels of communication, psycholinguistic processes and levels of organization. Like the Frostig tests, however, over time, reliability studies began to question the validity of the individual subtests - and whether they do, in fact, measure the specified independent functions.

During the 60's, Marianne Frostig became very well known through her research and theories developed at the Marianne Frostig Center for Educational Therapy. In 1961, she published the Frostig Developmental Test of Visual Perception (later revised by Hammill) and together with it, a training program to remediate the problem areas assessed by her test. The Frostig test has more scope in that it covers visual-ground discrimination, eye-motor coordination, form constancy, position in space and spatial relations. This test developed over time and established reliability and norms in several countries, which attested to its strength and "goodness of fit" at the time. However, subsequent reliability studies found that when the subtests were broken down, individually, they too did not actually differentiate among the various aspects of visual perception.

Reading assessment and intelligence assessment

Ingram (1970) supported S.T. Orton's findings in a large case study research project of 82 children with severe reading problems, through the Department of Child Life and Health in Edinburgh. Using as diagnostic tools the Stanford-Binet for Intelligence and the Schonell Graded Word Test, the final results broke down into two groups of children with "specific" reading and writing difficulty and those with "general" learning difficulty across domains, despite having adequate intelligence. From this point, he tried to determine whether their errors were more of visual -spatial origin or of audiophonic origin. He tested whether their mistakes occurred at the preliminary stage of reading in recognizing written symbols, associating them with the corresponding auditory image and then synthesizing them into words OR whether their mistakes occurred at the later stage where visual recognition of words is immediate, but contextual clues were used to "scan" sentences. All of the "specific" reading difficulty children made mistakes at the early stage and the "general" children made mistakes at the later stage. Some of each group had either neurological abnormality, hereditary histories of learning problems or no evidence of either, so it was in the end, difficult to classify them. Most of these were retrospective studies which tried to determine the causes of children's' problems after they were referred for difficulties. As usual, it pointed to the need for further study.

Katrina de Hirsch (1967) was one who chose to do prospective studies, whereby children could be tested during the preschool period and predictions could be made of likely risk of reading difficulty. A wide variety of 37 different

tests were given to 53 children whose IQ was within one SD of 100 on the Stanford Binet Intelligence Scale (1937 revision). They were tested twice - after first grade and after second grade. The intent was to develop a battery of tests that could predict which children were likely to suffer from reading and spelling difficulty. They found a series of ten tests that correlated with scores obtained on tests of reading and spelling given at the end of the first two grades of school. The tests were: ability to use a pencil, the Bender Visuo-Motor Gestalt Test, the Wepman Auditory Discrimination Test, the Number of Words Used in a Story Test, tests of categorization, the Horst Reversals Test, the Gates Word Matching Test, two tests of word recognition and one test of word reproduction. It was found that the auditory-perceptual and oral-language tools were far inferior of those who were screened out as failing readers. They all scored zero on the Gray Oral Reading Test at the end of first grade, but achieved their expected level at the end of second grade. De Hirsch (1967) commented that "the failing reader's perceptual, motor and linguistic responses were strikingly unstable...Their fragmented figure drawings, their poorly synthesized Bender designs, their inability to organize parts of a story into a meaningful whole suggested a relatively low level of integrative competence." The deficit accumulation seemed to indicate maturational lags.

Supporting the new idea of de Hirsch was Jeanne Chall in the U.S. who had surveyed research on reading from about 1910 to 1965. She purported that there were two trends in teaching reading : those that stressed the decoding component from the start and those that stressed the meaning component from the

start, ie: phonics vs. whole word. She found that the trend towards decoding emphasis first had a much higher rate of later reading success. She cross-referenced her interpretations with that of Robert Dykstra in 1968 from the U.S. Department of Education (USOE) Cooperative Studies who also summarized that code-emphasis programs produce better overall primary grade reading and spelling achievement than the meaning emphasis programs. She was concerned as well with diagnosis and concurred with de Hirsch that prevention through early testing, ie in preschool, was growing ever important. Hence, this is where the use of such visual motor tests became more important during this period. With preschoolers who were yet able to read and write, but who could draw, the visual motor tests offered an early solution to predicting at risk children.

Some very specific research was done by Archie A. Silver and Rosa Hagin who sought to determine what defects in visual perception are associated with delayed acquisition in reading. They developed a "Search" assessment in 1975 called the "Scanning Instrument for the Identification of Potential Learning Disability". Out of a group of identified children with IQ's of at least 85 on the WISC and delayed acquisition of reading, all displayed some form of temporal and spatial distortions in the visual, auditory, and kinesthetic-tactile perceptual modalities. Among the group were found 1/3 with specific perceptual deficits, 1/3 with that plus neurological abnormalities and the last third had a variety of other developmental/emotional problems. This lead to the recommendation that children with reading difficulties should be evaluated by multi-disciplinary professionals. Visual perception, she recommended should be further evaluated to

determine if the problem includes deficits in visual discrimination, visual-motor ability or in visual memory. Hagin and Wechsler (1964) investigated the problem of axial rotation and orientation and found that children who could not correctly match or visually discriminate asymmetric figures were more likely to have difficulty in the acquisition of reading skills. Visual-motor function, they espoused, adds fine-motor coordination to the capacity for visual discrimination.

Worth mention are Doman and Delacato, who primarily had a neurological orientation, nonetheless, the structure of their perceptual-motor remediation programs overlapped in many areas. Their "Doman" program is well known around the world as a neurological development program and is often used with children of low mental ability and is trying to gain acceptance as a neurological remediation program for dyslexics. Findings of studies have delivered mixed results.

By the time the 80's rolled around, enough evidence in research was able to disprove the previously supposed correlation between visual-motor ability and reading ability. Lesiak and Bradley (1983) state clearly in their book on Reading Assessment for Placement that the assessment of visual and auditory perceptual skills NOT be a part of any test battery for children with reading problems. Scores of research studies in the late 70's failed to support a relationship between perception and reading test performance. Lesiak (1983) noted several prominent researchers in the field (Bateman 1979; Chall 1978; Hammil, Goodman & Wiederholt 1974; Hammer & Larsen 1974; Spache 1976) had finally concluded that testing perceptual deficits had little value in planning educational programs

for students with reading problems. Current research still questions the validity of testing visual-motor skills together.

When one considers the main thrust is in determining exactly where a student's weaknesses in reading lie, it makes sense to test just that - a student's reading ability. From my own very limited experience, I can observe the powerful difference of testing for both areas. Preliminary testing with the screening test for reading in Bahasa Malaysia that I developed when administered on a mere sample of 20 students, enabled me to specifically identify each student's areas of weakness or strength in reading ability.

The methods of assessing for dyslexia have now been established and determined by law in many countries. Most have very similar requirements, such as a reading ability test, a mental ability test and a series of qualitative data that is to be collected about the child's medical background, birth background, family economic status and general information about the child's family and home life, plus his school achievement and social adjustment among peers. By law, all students who are diagnosed with dyslexia must have all of these areas assessed and a full report written up to support any requests for special services within any given education system (ie: state or county). None however, require any type of visual motor tests. Current researchers (Ackerman & others, 1992 ; Dykman & Ackerman, 1992) still agree that it is important that both reading ability and IQ ability be measured in order to detect dyslexia. However, the debate is heating up about the use of IQ tests in assessing for dyslexia with the argument that even children with lower ability can learn to read and the attachment of a "label" like

dyslexia can sometimes do more harm than good. Practitioners agree that a direct instructional and diagnostic approach is most effective in teaching slow readers to read.

Among other tests that were developed are the myriads of formal and informal reading assessments such as the Durrell Analysis of Reading (1980), the Neale Analysis of Reading (1988), the Test of Reading Comprehension (1987), the reading scales by Spache. Most assess the various skills required in reading such as basic sounds/phonics, consonants, vowels, blends digraphs, affixes and suffixes. In addition, the areas of phonics of syllables, and word spelling, basic sight vocabulary, recognition and comprehension. These are all norm-referenced tests that grew in popularity, but many proved to have questionable reliability.

At the same time, the use of Informal Reading Inventories (IRI) became widely used and recommended as well. Teachers could be easily taught to use these and as such, became a more readily available method of assessment for the growing numbers of students that were being reported with specific reading disabilities or dyslexia, due to the legal changes in Australia and the U.S. for example (NSW Department of Education, 1987; Hadadian 1996), that required a fair education for all, with remedial services provided for those who could prove via assessments that they needed it.

Research on reading difficulties in primary school in Malaysia has been limited in comparison to foreign counterparts. Efforts have been made with studies conducted on reading difficulties, but not focusing strictly on dyslexia. Atan bin Long (1969) wrote about the deficiencies in reading of primary level

children, many of whom arrive in standard one with out any prior knowledge of reading. He noted that the syllabus was uninteresting and assumed basic pre-reading skills of students and that in fact, this did not match the needs of the children. He recommended developing more materials that covered pre-reading skills and that could be attractive and interesting and motivating, such as colorful cards made up with phonetic sounds and the syllable or “suku kata”, which he suggested were essential to achieve the next level of early reading abilities.

Zaidah Haji Othman (1978) conducted a study of children for reading ability in standard two. The study covered letter recognition, syllable or “suku kata” recognition and word recognition. She too agreed that there was a lack of pre-reading skills among standard two students such as knowledge of syllables, their related phonetic sounds and how they combine to make words. Khamis Maarof (1984) took the effort to develop a year long program targeted at standard two children with weak reading skills. He based the program on learning the alphabet, then “suku kata” (syllables), then on to sound recognition of the letters and syllables and how they combine to make words. He concluded that with a structured reading readiness skill development program, children could be successful at learning, but also recognized socio-economic factors that could be of a hindrance to learners.

A more in-depth analysis of miscues was carried out by Siti Fauzeyah (1995) but it focused on second language learners and not on the first language of the curriculum. Nonetheless, through the use of an informal reading inventory, she was able to gain some insight as to the types of errors made by readers. Salleh

Masri Arshad (1989) also conducted a similar study of miscue analysis in primary school readers in Bahasa Malaysia. He too focused on the “suku kata “ knowledge and recognized this lack of pre-reading skills was an area of weakness of readers in Bahasa Malaysia. Asmee Tajuddin (1994) took a further step by conducting a case study to assess and develop a long term remedial program to successfully aid students who were experiencing reading difficulties. This was with a small number of students and seems to be a fairly strong model that could be replicated for future use on a larger scale.

Mental ability testing using the Raven’s Colored Progressive Matrices

Research has proven time and time again that this is a rare test, which is culture fair and that is able to assess the level of intelligence of individuals. It has been tested in many countries around the world, including limited studies in Singapore and Malaysia and I have been advised that norming studies, done by Professor Dr. Chiam Keng Heng of the University of Malaya Education Faculty, almost invariably represent that they have a close match to the established norms. The original version, the Standard Progressive Matrices (SPM) came first, with later editions of the Colored Progressive Matrices (CPM) - a shorter form for children -and the Advanced Progressive Matrices (APM) for adults (Raven, 1957)

Many correlation studies have also been done with the Stanford-Binet, the Wechsler Scales, and the Woodcock Johnson Tests, among others. Most show a high correlation, when studies were in caucasian English speaking populations. Differences may have showed up in other cultures, so subtest correlations of the above three subsequently proved a strong correlation even in various cultures

around the world. Interestingly, Sigmon (1983) found that when correlated against SES, perhaps sometimes the Raven fell a bit short - those from high SES often performed better. From Thailand, we have Vibulsri (1984) to thank for establishing norms for Thai children. Norming data came in 1989 to an International Seminar on Intelligence in Australia (Jenkinson, 1989) from China, Hong Kong, Brazil, New Zealand and Australia. This further indicates the wide use of the Ravens around the world. Consequently, it seems the three Ravens have become a widely accepted culture fair standard in measuring intelligence in cultures around the world, and more specifically, in the area of studies on exceptional children - from the "at risk" to the superior children.

Let us take a brief look at the historical KEY developers of intelligence testing Binet and Stanford, Wechsler, and later Alan Kaufman and Woodcock-Johnson. Back in 1916, the revised edition of the Binet-Simon Intelligence Scales were released in the United States as the Stanford-Binet, published by Lewis Terman (Terman, 1955). Through massive efforts of a team of researchers and fields of schools for reliability and validity testing grounds, this first test of intelligence was offered to the field of Psychology and Education in the United States. Among other things, Terman came to discover that some of the tests had great value for what they were measuring, yet others, had no known value of what they were measuring! Hence, there were over 40 years of research that went into this revision from Binet's original effort. The standardization of tests ranged from 2 years to 18 years and required the testing of hundreds of subtest types covering both verbal and non-verbal measures. It is in this basic construct that the waves of

“culture bias” set in -although it wasn’t pursued as a factor of contention until much later. David Wechsler (1958) came along in the 50’s with his series of tests - the Wechsler Scales. Over time, he developed the Wechsler Adult Intelligence Scale (WAIS) and the Wechsler Intelligence Scale for Children (WISC) and the Wechsler Pre-Primary Scales of Intelligence (WPPSI). All have now had a few revisions and updated norming and are now published as the WAIS-R and the WISC - III and the WPPSI-R. Wechsler noted that test administrators must know what it is they are wanting to establish with an IQ test. He noted the importance of having both verbal and performance skills to test since those with mental deficiencies of any kind would in most cases score better on the performance scores. The tests can reveal not only a person’s weaknesses, but also their strengths. Such intelligence tests have yet to be translated or constructed in Malaysia, but would be most useful for a more complete diagnosis of abilities for children with specific learning disabilities such as dyslexia. As such, we are confined to the use of the Raven’s CPM as a culture fair test of mental ability for this research project.

Later came the Woodcock-Johnson effort in 1977, with a revision in 1989. While earlier tests considered the “g” factor, this is the first test based on the Horn-Cattell “Gf-Gc theory”, that is, the theory of multiple intelligences. It consists of 21 tests that cover intelligence functioning in 7 areas (8 including the achievement section). What I enjoyed most out of McGrew’s (1994) review of the test was his smart call to order of the need for change in intelligence testing schemas. He reminded us of Piaget’s theory of cognitive development and that

when new experiences were encountered, people would be placed in a state of disequilibrium until the new information is accommodated. So he has challenged people involved with assessment into a state of disequilibrium regarding current intelligence testing practice. The inertia of tradition often keeps outdated beliefs alive, even though substantial evidence exists to question their validity.

Howard Gardner (1987) presented us with his Theory of Multiple Intelligences, which propounds the idea of 7 intelligences whereby each individual has different strengths in all areas of intelligence. The likes of Mozart, Einstein, Wandsworth or Thoreau prove that different individuals may be superb in one area, but not necessarily in other areas. He suggested that where dyslexics had low literary or verbal intelligence, these individuals may have strengths in other areas, which could be developed.

Next we have the Kaufman Assessment Battery for Children (K-ABC) which came out in 1983 (Kaufman & Kaufman). They too took a departure from the traditions of the Wechsler and the Stanford-Binet. There are several subtests that are combined to form scales of Sequential, Processing and Mental Processing Composites. A separate Achievement scale is also included. Hundreds of research studies have been done and the amount of positive evidence to support its validity and reliability are strong. More recently, the K-Bit - the Kaufman Brief Intelligence Test - came out as a short form to the K-ABC and seems to have become just as popular. They are among the top 3 tests, alongside the Johnson Woodcock and the Wechsler Scales that are used in testing today. However, the K-ABC is not acceptable for use to document a learning disability according to the