

ABSTRACT

A Cerebellar Deficit in Dyslexia and How it Affects the Classroom

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The cerebellar deficit hypothesis is one theory explaining developmental dyslexia. Reviewing the current literature, I explained the theory, identified some key components of dyslexia research that are agreed upon, and acknowledged other concepts needing more study. The cerebellum is involved in at least some cases of dyslexia, dyslexia manifests itself differently in different individuals, and many dyslexics learn to cope with dyslexia by adulthood. Interviewing two classroom teachers, I observed that teachers between school districts are not consistently trained, the quality of dyslexia intervention differs between districts, and the schools surveyed did not track dyslexia intervention success rate. We need to reorganize dyslexia intervention because there is no way to determine if current interventions are successful. While more research is necessary from both an educational and scientific standpoint, I conclude by suggesting reorganization strategies for dyslexia intervention that would positively impact the classroom.

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A CEREBELLAR DEFICIT IN DYSLEXIA AND HOW IT AFFECTS THE
CLASSROOM

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DEDICATION

I would like to dedicate this work to my parents who always encouraged me in my academic endeavors and whom without, I would not have gotten this far in my life.

CHAPTER ONE

Introduction

The primary years that a child spends in the classroom are perhaps the most important ones of their lives. During this span of time they undergo significant cognitive and personal developments, evident in their ability to master basic concepts with each passing year while adding new layers of complexity. Students with learning impairments such as developmental dyslexia, however, often view the educational system as frustrating. They conclude that future schooling is something too difficult to pursue. Despite these perceptions, disabilities like dyslexia can be overcome if given the proper instruction and attention, so that these students might benefit from further educational opportunities.

Developmental dyslexia is a common diagnosis within elementary-aged children. Estimates of the prevalence of dyslexia span from as little as two percent of the population to as high as twenty percent (Habib, 2000; Nicolson & Fawcett, 2008; Shaywitz, 2003). This disparity results in part from an inability to define dyslexia precisely. For the purposes of this paper, developmental dyslexia is characterized by a student's "unexpected difficulty in learning to read" (Shaywitz, 2003) despite adequate cognitive resources in other domains. Those with dyslexia usually develop problems that arise within two years of beginning formal education. These problems include an increased difficulty in learning how to read that is not commensurate with their level of intelligence. Specifically, troubles appear in phonological processing and spelling. While there are many different kinds of remedial instruction, these students continue to

have trouble despite these interventions in the classroom. Most dyslexics also demonstrate complications with general automatization (Nicolson, Fawcett, & Dean, 2001; Stoodley, Fawcett, Nicolson, & Stein, 2006).

Researchers have offered many hypotheses to explain dyslexia, including the phonological deficit hypothesis, the magnocellular theory, and the cerebellar deficit hypothesis. The phonological deficit hypothesis states that dyslexia is due to a breakdown in the “phonological module” of the brain and presents itself as difficulty learning to read (Nicolson & Fawcett, 2008). The magnocellular theory postulates the magnocells of the lateral geniculate nuclei are dysfunctional, leading to the deficits seen in dyslexics (Nicolson & Fawcett, 2010). The lattermost argument, the cerebellar deficit hypothesis, offers a unique perspective as to the origins, causes, and effects of developmental dyslexia. Nicolson and Fawcett (2010) propose the cerebellum may be at the center of some kinds of dyslexia.

Further, empirically validated findings do not always translate to changes in the classroom, an occurrence I plan to investigate. Classroom teachers may be unaware or skeptical of the scientific literature on dyslexia, relying instead on personal, anecdotal knowledge. Attempts to explain the current scientific literature to teachers will likely improve remedial education. Finally, I will explore other routes of research that are necessary to facilitate intervention for dyslexic students.

CHAPTER TWO

Definition of Dyslexia

What It Is

Early twentieth-century explanations definitions of dyslexia ranged from an issue of visual or auditory disorders to a lack of motivation (Nicolson & Fawcett, 2010; Shaywitz, 2003). More recently, the World Federation of Neurology (1968) defined developmental dyslexia as “a disorder in children who, despite conventional classroom experience, fail to attain the language skills of reading, writing and spelling” proportionate with their cognitive aptitude. The American Psychiatric Association’s Diagnostic and Statistical Manual of Mental Disorders IV-TR (2000) defines dyslexia as when “reading achievement, as measured by individually administered standardized tests of reading accuracy or comprehension, is substantially below that expected given the person's chronological age, measured intelligence, and age-appropriate education.”

As Nicolson and Fawcett (2010) point out, both of these standard definitions require a child’s failure before any diagnosis can be made. The APA DSM IV-TR requires a child’s reading achievement to fall below what is expected, and the World Federation of Neurology requires a child to fail to attain language skills after adequate instruction. If we are to help dyslexic students succeed in the classroom, earlier identification of at-risk students is critical. However, neither the APA DSM IV-TR nor the World Federation of Neurology have approached developmental dyslexia as an issue that can be prevented before a child fails.

In terms of “curing” dyslexia, any acceptable definition must require a form of identification before a child fails in school. Without early identification, a child will continue to fall behind in school. Gladwell (2008) explains that to become an “expert” at some task, a person must engage in 10,000 hours of practice of that skill. The same goes for reading; if a child is to become an expert at reading, they must practice. If they avoid reading at a young age, they are just going to fall further behind their peers who are beginning to enjoy reading. These children will not become “experts” at reading. We, as a society, must be able to identify children with dyslexic tendencies at a young age, before they fail in school.

Causes

The causes of dyslexia (and there almost certainly are many) have yet to be identified. Genetics play an important role in the dyslexia. Shaywitz (2003) reviews some case studies where a parent struggled in school, likely because of dyslexia, and their child, many years later, faced similar problems. This suggests at least a basic inheritance between parent and child.

Samuelsson et al. (2005) explored the genetic and environmental influences on prereading skills in pairs of twins in Australia, Scandinavia, and the United States and found both environmental and genetic influences on prereading skills such as print knowledge, general verbal ability, phoneme awareness, phonological awareness, vocabulary, and rapid naming. All of these prereading skills are associated with later reading ability. Marino et al. (2010) studied specific genes that have been passed down

through nuclear families; the DCDC2 and DYX1C1 genes have been identified as making one susceptible to language and math issues. Scerri et al. (2010) determined several genes on chromosome 18 as candidates for dyslexia susceptibility including MC5R, DYM, and NEDD4L, based on data from UK and US families that each contained at least one child diagnosed with dyslexia. Scerri et al. (2011) determined that DCDC2 is associated with reading disabilities, and CMIP and KIAA0319 are associated with reading disability and specific learning impairments.

Beyond the genetic basis of the disease, we also know that developmental dyslexia seems to affect males disproportionately (Shaywitz, 2003). While this may suggest that dyslexia is sex-linked, the numbers of dyslexic boys and girls are not that disparate. For example, the Connecticut Longitudinal Study identified the prevalence of research-identified boys with reading disabilities as high as nine percent compared to girls, reaching only about seven percent (Shaywitz, 2003). However, this finding could imply a relationship that is yet to be identified. Perhaps boys are more easily identifiable as dyslexic because they are more likely to act out in class, as Shaywitz (2003) suggests. Another possibility is some underlying genetic cause such as dyslexia being a sex-linked trait. However, Hawke, Wadsworth, and DeFries (2005) studied the genetic etiology of males and females with reading disability and found no significant difference.

While there certainly appears to be a genetic component to developmental dyslexia, how exactly it manifests is unclear. We are getting closer to finding genetic reasoning to developmental dyslexia, but unfortunately, there are many disagreeing hypotheses as to how these genetics affect the cognitive basis of dyslexia.

Effects

Though every child learns to read differently, there is a very specific set of benchmarks that children encounter when learning to read. First, they must understand that the text on a page holds meaning. By listening to their parent read, following along with the (at that time) meaningless text, or looking at the pictures on a page, they begin to understand this. According to Clay (1998), the beginnings of school literacy are not simply the learning of individual sounds, letters, and words but actually putting a book in the hand. In fact, by mere observation, children will learn features of written language that adults do not even think to point out, a combination of words, sounds, and pictures instead of just mere letters and their component sounds.

Second, they must develop phonological awareness, an understanding of the sound construction of language. Dyslexic children often miss the correspondence between the sounds we hear that make up words and breaking down those words into letters. Specifically, dyslexics have problems with the manipulation of letters within words (Swan & Goswami, 1997). For example, Shaywitz (2003) explains that young dyslexic children often do not recognize rhyming relationships.

Without this ability, Shaywitz (2003) further explains, dyslexic students have trouble with a third goal of learning to read, blending sounds. Some dyslexics even have difficulty remembering the names of letters and identifying the sounds they make; they have difficulty learning to break words into their parts, or phonological decoding. Taking a word like “tap” and recognizing that it has three sounds (the sounds for each of the

letters “t”, “a”, and “p”) is something that would be very challenging for a young dyslexic.

Becoming a skilled reader takes practice; dyslexics’ benchmarks of reading development are significantly slower than non-dyslexic children (Shaywitz, 2003). In his book *Outliers*, Malcolm Gladwell (2008) explains that in order to develop fluency in a skill, an individual must engage in 10,000 hours of that skill. The late benchmarks of poor readers are due to dyslexics not reading as much as their counterparts. When they encounter something challenging like reading, they are more likely to avoid it and therefore decrease their exposure time to the printed word.

When learning to read, children are able to use the context surrounding a word, such as a picture on the page, to discover its meaning. When they use this approach, however, they are not fully decoding the word phonologically. When they do not decode the word, they are not storing the phonological counterpart of the word in their memory. The next day in class when they face that same word, they may recognize the picture on the page and recognize that word. Unfortunately, without the context of the picture, at another exposure to the word without the picture, they may not recognize the word. This significantly slows down their reading (Shaywitz, 2003). Pinel (2009) explains that reading aloud has two components: a lexical procedure where a reader recognizes a word based on prior experiences with that word and a phonetic procedure that allows a reader to recognize each letter in a word and “sound it out” accordingly in order to retrieve the word. Many dyslexics, because they often skip the phonetic procedure of learning to read, have a smaller store of words that they recognize from their lexical store. Reading

aloud, then, becomes a daunting task for a dyslexic student who, though may be able to figure out the gist of their reading material because of its general context, would have difficulty pronouncing each word.

Another common error made by dyslexics is substitution errors. Dyslexic students often substitute words that sound similar when reading and speaking, such as switching the word carnation for coordination. Other times, they mistake words that have similar rhythm but really do not sound the same, like graduation and celebration. Probably the most rarely seen substitution error among non-dyslexics but most pronounced in dyslexics are the “deep substitution” errors prevalent when listening to a dyslexic read. Many of the errors made in reading and speaking are purely conceptual, for instance, asking “What’s for breakfast?” instead of “What’s for dinner?” When speaking, they are called paralexical errors; dyslexics make these substitution errors much more than is generally supposed across the entire population.

There is a strong comorbidity of dyslexia and other developmental disorders like ADHD in terms of epidemiological, genetic, neurological, and therapeutic constructs (Germanó, Gagliano, & Curatolo, 2010). In fact, dyslexia is often masked among dyslexics. While their ADHD is treated with medication, the dyslexia is not.

Dyslexics have severe difficulty in developing fluency, “reading... accurately, quickly, smoothly, and with good expression” (Shaywitz, 2003). Fluency is acquired through practice. Dyslexics, often frustrated by their attempts at reading, read less and therefore either develop fluency much later than their peers or, in some cases, never develop fluency at all (Shaywitz, 2003).

Nicolson and Fawcett (2008) emphasized the significance of asking what the cause of the learning disability that manifests itself as dyslexia instead of simply asking what causes dyslexia. As such, other deficits have been observed in dyslexic individuals. Automaticity problems are common among dyslexics, extending to simple motor skills (Nicolson & Fawcett, 2008). Nicolson and Fawcett (1990) were the first to demonstrate poor motor balance in dyslexic children when compared to controlled children. Yap and van der Leij (1994) replicated their study, finding automatization deficits in dyslexic children. They compared dyslexic and non-dyslexic children performing two tasks at once, one that could be performed automatically and another that required attention. Both groups of researchers found an automaticity deficit in dyslexic children. Balance, an automatic task used in these studies, was severely impaired in dyslexic children. In the realm of reading, automaticity is necessary for the lexical procedure of reading; a reader must retrieve words from their lexical store automatically. Readers must recall the sounds represented by certain letters as well.

Handwriting is another concept within the realm of automaticity. Handwriting is dependent on the same automatic skills that dyslexics have been found to be lacking when asked to perform multiple tasks. Because so much of the attentional resources of the dyslexic writer are being used to focus on the writing of the words themselves, their ability to construct profound thoughts, sentences, and ideas is severely limited. Nicolson and Fawcett (2008) consider poor handwriting a symptom of this automatization deficit.

Beyond orthographic coding, dyslexics also struggle with spelling. Shaywitz (2003) identifies spelling as one of the “tell-tale signs” of a young dyslexic; while

inventive spelling is expected through Kindergarten-aged children, many dyslexics will spell words so poorly that they are often unrecognizable.

Finally, difficulties associated with dyslexia often impair one's self-esteem. Shaywitz (2003) describes dyslexia as inflicting pain and placing a major burden on self-esteem. These students often lose the ability to motivate themselves, requiring constant positive reinforcement from teachers and other academic mentors. She further explains that dyslexics will often refer to themselves as dumb.

Relevant Theories

While many theories exist in the literature about the underlying neurobiological cause of developmental dyslexia (Nicolson & Fawcett, 2008), three main theories persist—the phonological deficit hypothesis, the magnocellular hypothesis, and the cerebellar deficit hypothesis (Reid, Szczerbinski, Iskierka-Kasperek, & Hansen, 2006).

The phonological deficit hypothesis of developmental dyslexia explains that dyslexics fail to develop a phonological awareness of words—the ability to recognize the sounds that particular phonemes make within words, how these sounds blend together, and the ability to manipulate these sounds within words and sentences. Phonological decoding ability is faulty in dyslexics, producing a lack of sensitivity to the phonological structure of words. This theory accounts for that specifically, saying that the developmental dyslexia is due to some error in the “phonological module” of the brain (Nicolson & Fawcett, 2008), though never specifically naming what accounts for that deficit in the phonological module. While “there is a compelling body of evidence that

supports the existence of a robust association between developmental dyslexics' phonological awareness deficits and their reading disability" (Swan & Goswami, 1997), no need exists to search for the underlying cause of that phonological deficit in the phonological module within this theory. As Nicolson and Fawcett (2008) explain, we want to address what causes the learning disability that we observe as reading problems. While dyslexics certainly suffer from a phonological deficit, this deficit endures merely as a key to some greater underlying cause, not explained by this hypothesis.

The magnocellular deficit hypothesis is an attempt to answer that question. The magnocellular deficit theory claims that dyslexics possess abnormal magnocells and normal parvocells. Magnocells are responsible for transmitting auditory and visual information speedily, whereas parvocells transmit detailed information about auditory and visual stimuli at a slower rate (Nicolson & Fawcett, 2008). In fact, Livingstone, Rosen, Drislane, and Galaburda (1993) found a significant difference between dyslexic brains and control brains; the magnocellular layers of the dyslexic lateral geniculate nuclei were smaller and had fewer cells than the control brains. Unfortunately, the magnocellular theory has not been supported in subsequent tests. Roach and Hogben (2004) studied magnocellular function in dyslexics and non-dyslexics and found no significant difference between the two groups. Johannes, Kussmaul, Münte, and Mangun (1996) looked at the possibility of a magnocellular deficit in dyslexics through a series of visual stimulation rate tests. They, too, were unable to find a significant difference between dyslexics and controls.

A third hypothesis is the cerebellar deficit hypothesis which states that a faulty cerebellum causes the reading and automaticity problems of most dyslexics. Before any assumption of a cerebellar deficit causing dyslexia can even be approached, we must first determine if the cerebellum even has a role in language, considering that we usually equate the cerebellum with motor function (Stoodley & Stein, 2011). Justus (2004) found that cerebellar damage resulted in distinct grammatical morphology. Significant literature is available that tests or discusses the hypothesis of a cerebellar abnormality in dyslexics.

The cerebellar deficit hypothesis offers a cognitive profile in the ability to automatize simple tasks (Nicolson & Fawcett, 2008). Without the ability to easily automatize reading-related tasks, it is clear why dyslexics have difficulty learning to read—it takes them much longer to automatize basic skills that are necessary to reading which other young learners have no problem accomplishing quickly.

The cerebellar deficit hypothesis is the only of the major theories that accounts for the large scope of effects prevalent with dyslexics. Not only does it provide evidence for the reading deficits, but a cerebellar deficit also provides evidence for the motor deficits, articulation deficits, and the learning deficits seen in dyslexic individuals (Nicolson & Fawcett, 2008). It offers an answer to the question raised previously, suggesting that the cerebellum may be the underlying cause of the condition that presents itself as this specific reading impairment. The cerebellar deficit hypothesis of developmental dyslexia suggests a multi-faceted syndrome with many overt deficits and strengths contributing to the outcome we observe in the classroom.

CHAPTER THREE

Cerebellar Deficit Hypothesis

Typical Role of the Cerebellum

The cerebellum is responsible for initiating smooth movements, maintaining posture and balance, regulating motor learning, and automatization of learned skills (Leiner, Leiner, & Dow, 1989; Leiner, Leiner, & Dow, 1995; Nicolson & Fawcett, 2008; Stoodley & Stein, 2011). The cerebellum regulates motor systems by transmitting input from frontal cortex and sensory systems, correcting through a motor error system. When receiving input from the visual system for example, the cerebellum relays information necessary for limb movement correction (Stoodley & Stein, 2011), perhaps that one's arm is reaching too high to grab a pencil from a desk. Motor learning, then, is a skill that takes practice to accomplish automatization. The cerebellum removes some of the burden of long-term motor learning from the frontal cortex. Nicolson and Fawcett (2008) explain that the cerebellum is responsible for remembering the intricacies of writing letters or producing sounds when speaking. After sufficient experience with a certain letter, most children would be able to identify the sound corresponding to a letter. Thus, cerebellar activity is crucial in skilled reading.

Though somewhat controversial, the cerebellum also has non-motor pathways to the cerebral cortex (Leiner et al., 1995). The newly-evolved cerebrocerebellum connects to the left frontal lobe, the area most critically involved in language. This lateral portion of the cerebellum is activated during the cognitive processing of words but is silent during the motor task of speaking those words (Leiner et al., 1989). These data suggests

that there is more to the cerebellum than regulating classical motor activity. Leiner et al. (1993; 1995) discuss the cerebellar dentate nucleus' projections to the frontal lobe, an area well-known for cognitive processing or "manipulation of information." Specifically, the dentate nucleus of the cerebellum has projections to Broca's area, the area critically responsible for language production in humans (Leiner et al., 1993).

Damage to the Cerebellum

Studies of brain lesions of a particular brain area are often central to understanding the functionality of the brain areas involved. This is true of the cerebellum. Typically, damage to the cerebellum produces cerebellar ataxia, a complex motor disturbance producing difficulty with balance, a wide gait, problems in movement, and eye coordination (Ferrarin et al., 2005). Dysdiadokinesia (difficulty performing rapid alternating movements), dysmetria (overshooting and undershooting a target), dysarthria (motor speech impairment of phoneme pronunciation), and ataxia of stance and gait also result from cerebellar damage (Diener & Dichgans, 1992).

Cerebellar damage creates non-motor difficulties as well. Baillieux et al. (2010) observed significant cognitive and linguistic problems in fifteen of eighteen patients with cerebellar lesions. Schmahmann and Sherman (1998) proposed a "cerebellar cognitive affective syndrome" after observing a variety of symptoms in those patients with cerebellar lesions only. Using bedside mental state examinations, they reported disturbances of executive functioning, impaired spatial cognition, a distinct personality change characterized by flat affect, and linguistic difficulties in patients with cerebellar

lesions. In fact, the motor impairment was generally mild in these twenty patients. Cerebellar damage caused considerably greater impairment than would be suggested by standard cerebellar ataxia.

Cerebellar Involvement in Language Functions

Determining the size of the lateral part of the cerebellum compared to non-humans has proven difficult (Leiner, Leiner, & Dow, 1993). Leiner et al. (1993) suggested that as the cerebral cortex grew in early humans, the lateral portion of the cerebellum also grew. Monkeys, for example, have a smaller frontal cortex and lateral cerebellum than modern humans. Their larger basal ganglia however, an area responsible for initiating and regulating movements, has limited cognitive function. Leiner et al. (1993) propose that the “neural loop” evolved differently in humans than in other primates. In other mammals, the red nucleus sends major projections to the spinal cord, but in humans, the red nucleus projects to the inferior olive. The inferior olive projects to the dentate nucleus in the cerebellum which is connected back in this “neural loop” to the red nucleus. The red nucleus serves a motor function in non-human mammals, but receives input from the language areas of the cerebral cortex in humans, allowing it to take part in both language and motor functions.

PET scans demonstrate that the cerebellum is involved in the cognitive processing of single words (Petersen, Fox, Posner, Mintun, & Raichle, 1988; 1989). Using image subtracting techniques, Petersen et al. (1988; 1989) observed subjects performing a series of increasingly difficult linguistic tasks. This allowed the researchers to subtract PET

scan activation from the previous task for both motor and cognitive tasks, progressively revealing those areas recruited as tasks become more complex tasks. Cerebellar motor activity activated the anterior lobe of the cerebellum, but adding cognitive tasks activated the right inferior lateral cerebellum as well. Leiner et al. (1989) interprets this right cerebellar activity to be related to the projections of the right cerebellum to the left cerebral hemisphere, which is presumably involved in language in these particular patients. Because Broca's area 44 was simultaneously activated (Petersen et al., 1988), Leiner et al. (1989) suggests that the right inferior lateral cerebellum is responsible for word association.

Deficits in cerebellar activation have been demonstrated in dyslexia as well. Nicolson et al. (1999) compared dyslexic and control subjects as they memorized a series of taps on a keyboard. Brain activation levels were measured with PET scans. Dyslexic individuals had less cerebellar activation than controls when performing prelearned motor sequences and learning new sequences. In new learning, dyslexics also activated their frontal lobe significantly more than controls, an area not normally involved in such simple tasks.

Automatization

Lang and Bastian (2002) define automaticity as the ability to focus less of your attention on individual movements. The cerebellum is responsible for this ability. Damage to the cerebellum compromises the ability to learn automatic movements requiring increased attentional demands to control movement (Lang & Bastian, 2002).

When the cerebellum is damaged, these attentional demands are sent to the frontal lobe, which is now required to expend more effort for automatization tasks that are meant to be completed by the cerebellum (Lang & Bastian, 2002; Leiner et al., 1995).

Leiner et al. (1989) provide an anatomical explanation of the cerebellum's role in automatization. When new information comes into the neural loops of the cerebellum, synapses are modified. In the development of that organism, these modified synapses are continually enhanced and “produce incremental improvements in the performance of procedural skills” (Leiner et al., 1989). Nicolson and Fawcett (2008) proposed that problems with automaticity may be critical in developmental dyslexia (p. 29). When the cerebellum is mildly damaged, as seen in some dyslexics, readers have difficulty developing fluency, the ability to quickly recall words (Shaywitz, 2003).

Cerebellar signs

Dyslexics also display impaired articulation speed during reading (Nicolson & Fawcett, 2008; Shaywitz, 2003). Being able to speak memorized phrases, such as the national anthem or the days of the week, quickly and fluently requires both cognitive and cerebellar involvement. Dyslexics exhibited slower articulation time than either control or ADHD groups, for example (Kasselimis, Margarity, and Vlachos, 2008). Kasselimis et al. (2008) observed differences between controls and dyslexics in a cerebellar task of balance and cognitive tasks such as word-naming speed and nonword repetition.

Stoodley, Fawcett, Nicolson, and Stein (2006) compared dyslexic and non-dyslexic adults on a battery of balancing and pointing tasks. On individual tasks, both groups performed similarly. When aggregated, though, the dyslexic group showed global impairments. Stoodley et al. (2006) suggest that, by adulthood, it is likely that dyslexics have found other ways to compensate for their cerebellar deficits, explaining the lack of significance in the individual tasks in adults. As hypothesized, Fawcett and Nicolson (1999) observed differences between control and dyslexic children on a similar battery of cerebellar tests of balance.

Nicolson, Daum, Schugens, Fawcett, and Schulz (2002) compared eyeblink conditioning in dyslexic and control participants. Eyeblink conditioning requires cerebellar input. As predicted, 75% of the dyslexic individuals showed either no or extremely poor conditioning to corneal air puff, measured as the response of eyeblink incidence and timing.

A Continuous Distribution

Brookes and Stirling (2005) examined the relationship between cerebellar soft signs and cognitive skills associated with dyslexia. Reading ability was significantly related to cerebellar soft signs. Cerebellar soft signs include things like balance, coordination, and muscle tone. In fact, they found no bimodality between the correlations of their construct of cerebellar soft signs and other dyslexic tendencies. That is, dyslexia was not a binary diagnosis. Rather, an individual can be “more dyslexic” than another.

Nicolson et al. (2002) demonstrated a similar distribution in the results from their eyeblink study. Twenty-five percent of the dyslexic participants showed no conditioning to the tone at all, and an additional 50% showed abnormally low conditioning levels distributed along a continuum. Reading abilities were similarly continuous with reading ages ranging from 8.3 to 17.0 (mean RA was 17.5 in controls). Spelling ages of the dyslexic participants ranged from 8.0 to 15.6 (mean SA was 17.5 in controls).

Stoodley et al. (2006) also found a continuum of results in their pointing tasks. Adult dyslexics with literacy scores less than one standard deviation below the mean were significantly slower and less accurate in pointing tasks than less impaired dyslexic readers. Like most cognitive abilities, dyslexia appears to fall on a continuum.

Stoodley and Stein (2011) address this heterogeneity as a criticism in their review of the cerebellar deficit hypothesis, stating that “the fact that some cases of dyslexia are not associated with cerebellar abnormality does not mean that no cases of dyslexia are associated with cerebellar dysfunction.”

The anatomical and functional organization of the cerebellum suggests one would find a continuous distribution of deficits. Each region of the cerebellum contains different inputs and outputs (Stoodley & Stein, 2011), many of which are located within the cerebrocerebellum. Graded impairment of activity in these areas would produce a continuum of cognitive and motor impairments, not a discrete, binary classification of dyslexic and non-dyslexic populations.

Why Would Cerebellar Deficit Increase Later Achievement in Life?

Logan (2009) explored the difference in dyslexia frequency in entrepreneurs and corporate managers against the general population on the anecdotal accounts of successful entrepreneurs, like Charles Schwab, claiming that their dyslexia helped them succeed in business. This is found to be true in both the United States and the United Kingdom; there was a significantly higher incidence of dyslexia among entrepreneurs in both the US and the UK than among the general population.

Logan (2009) raises an interesting question: Could a cerebellar deficit increase later achievement in life? Nicolson and Fawcett (2008) address that question. Their cerebellar deficit hypothesis proposes that dyslexics may have problems with the automated learning by the cerebellum but not with reasoning. Fluency—an ability impaired in dyslexics—is mediated by the cerebellum, but reasoning is mediated by the frontal and temporal lobes. They suggest that because dyslexic individuals have problems with their cerebellum, they are more likely to depend on their frontal lobes. The PET study conducted by Nicolson et al. (1999) demonstrated this; dyslexics activated their cerebellums less than controls and their frontal lobes more than controls when engaging in simple tasks. However, this over-dependence on the frontal lobes will fail for automated tasks like reading and writing. Their reliance on frontal lobe processing may allow them to think more creatively. Nicolson and Fawcett (2008) place fluency and creativity as antagonists of one another. The ability to solve new problems requires approaching the problem differently while fluency requires repeating previous approaches more quickly. Tafti, Hameedy, and Baghal (2009) demonstrated increased

creativity—that is, a subtest of originality—and increased pictorial (nonverbal) memory of a small number of dyslexic individuals in Iran compared to controls. Further study is required before one can link decreased fluency with increased creativity in dyslexics, but this may provide support for Logan's (2009) anecdotal reports of dyslexics who thrive as successful entrepreneurs.

Dyslexics' ability to compete under difficult conditions in childhood provides a distinctive benefit when later circumstances test their abilities rather than their weaknesses.

What Other Evidence is Needed?

While some scholars remain convinced of the cerebellar deficit hypothesis (Nicolson & Fawcett, 2008), most want more evidence. From a brain perspective, a good place to start would be to look for which specific parts of the cerebellum are involved. While the dentate nucleus of the cerebrocerebellum is a good candidate structure, there is not certain evidence available that points to this area. In fact, this area of research is relatively quiet in terms of a cerebellar deficit. The cerebellum may be to blame, but how it is guilty remains a mystery.

Stoodley and Stein (2011) recommend demonstrating that the cerebellar deficit is specific to dyslexia. Because dyslexia is highly comorbid with others impairments like ADHD and developmental coordination disorder (Germanó et al., 2010), it is necessary to demonstrate that dyslexia is the root cause of these cerebellar deficits and not these other disorders.

Finally, further evidence must explain why different dyslexics are affected differently. While a continuous range of dyslexia could explain this problem, different areas of the cerebellum being affected is also a possible justification. Another is that there are subtypes of dyslexia, one of which produces a deficit in the cerebellum.

CHAPTER FOUR

A Second Opinion

A Hole in the Literature

One concern in the dyslexia literature is the relative lack of input from those educators actually working with dyslexics.

I conducted interviews with two teachers from two different large, public school districts in Texas. As with case studies, there are some severe limitations in attempting to learn about the entire field of education from the opinions of just two teachers. For instance, their opinions are strictly based on their own experiences which may differ significantly between schools and districts. Their opinions are likely to differ based on their jobs and their experiences with other teachers. Also, the generalizability of this information must be considered because not all teachers will necessarily agree with the data represented here. To protect the identities of these teachers, I refer to them throughout my paper by their initials.

Most, but not all, schools have teachers who work specifically with dyslexic students. One of my interviews was conducted with one of these teachers. The other is a teacher for poor first grade readers, working with at-risk children before they have an opportunity to be classified as dyslexic. These two teachers provide a broader sampling of the classroom environment for most teachers.

Finally, the application of this information may not be relevant under all circumstances. While a poll of hundreds of teachers may have been more applicable, this approach allows for more thorough investigation of the problems between science and

education. This format allows for follow-up questions and case-specific questions based on previous answers that would not have been plausible if hundreds of teachers were simply polled.

The Teachers

N.E. is a 26-year teacher who earned a bachelor's degree in elementary education and a master's degree in curriculum and instruction. She currently holds the position of district dyslexia teacher in a school within an academically recognized public school district in Texas (Texas Education Agency, 2011). Her job entails “delivering small group dyslexia intervention to students identified by [the] district dyslexia evaluators” to have characteristics of dyslexia (N. E., personal communication, January 23, 2013). She works with students from first to fifth grade. Prior to her work as a district dyslexia teacher, she also worked as a first and third grade classroom teacher and as a general reading intervention teacher.

N.E. has extensive training in dyslexia. She was trained at the district level about dyslexia in general and to administer the Dyslexia Intervention Program used in her school district. She was also trained at Neuhaus Education Center through their Reading Readiness Program, Basic Language Skills, and Advanced Basic Language Skills courses, all at her own personal expense. Neuhaus Education Center is a Houston-based non-profit organization “dedicated to the prevention of reading failures [by] providing research-based training and support to educators” (Neuhaus Education Center, n.d.). Finally, she attends regular professional development meetings with other teachers in her

school district in similar positions. She has undergone a total of 300 hours of continuous education workshops over the past four and a half years.

M.M. is a 39-year teacher who earned a bachelor's degree in elementary education and a master's degree, also in curriculum and instruction. She has taught in the classroom in first, third, fourth, fifth, and sixth grade. She currently teaches Reading Recovery half the day and first grade English and Language Arts half the day in an exemplary school within an academically acceptable Texas public school district (Texas Education Agency, 2011). Reading Recovery is a non-profit organization which trains teachers to work individually with children who initially struggle in learning to read and write in first grade (Reading Recovery Council of North America, 2012). As a Reading Recovery teacher, she tests low-performing first graders to identify the four lowest-performing students in reading and writing at the start of first grade. Through daily individually tailored lessons, she records each child's daily performance and helps these students accelerate their learning (M.M., personal communication, January 22, 2013). She, however, has not been trained in dyslexia. As dyslexia screening does not usually occur until after the start of first grade, the students with whom she works have not had the opportunity to be classified as dyslexic.

Both of these teachers explained that they are unable to keep up with the professional literature on reading and literacy as much as they would like. M.M. said she has "too many other school-related demands on [her] time," (M.M., personal communication, January 22, 2013), and N.E. explained that there is so much information

available but she does not get the opportunity to read books or studies for new information except in the summer (N.E., personal communication, January 23, 2013).

Experience with Dyslexic Students

N.E. has worked with over 100 students who were identified as dyslexic, primarily through the Dyslexia Intervention Program. She also has experience working with students in a general classroom setting; she estimates that she had two or three students per year in a class of around twenty that were dyslexic (N.E., personal communication, February 8, 2013).

In the school district for which M.M. works, dyslexia is generally not identified in students “until they have had a chance to [receive help from] Reading Recovery” (M.M., personal communication, February 6, 2013). Screening for dyslexia usually is not even recommended until the end of first grade.

Training for Dyslexia

N.E. received extensive dyslexia training. Totalling over 300 hours in the course of four and a half years, N.E. has been trained at the school district level in how to deliver the Dyslexia Intervention Program used by her district, through Neuhaus Education Center which provided training in their Reading Readiness Program, Basic Language Skills, and Advanced Basic Language Skills courses, and through ongoing professional learning meetings with other district dyslexia teachers. The Neuhaus training was completed at personal expense. Her school district did not pay for her continuing

education for two reasons. First, the cost of such training was too much for the training of a single teacher. Furthermore, the district believes the intervention programs used by the district differ from those developed by Neuhaus Center (N.E., personal communication, February 19, 2013).

However, N.E. said that her school district provides three-day training for teachers new to dyslexia intervention, supplemented by several half-day seminars throughout the year. This is considered adequate to be able to teach dyslexic students. She estimates that most first year dyslexia teachers have between 24 and 30 hours of training (N.E., personal communication, February 20, 2013).

M.M. has not been trained in dyslexia. She does, however, work in a school district where there are dyslexia teachers on campus. The teachers in her school district, she explained, receive three weeks of training from Neuhaus. In fact, she believes that this training does not provide an “understanding of what reading is and of how people learn” (M.M., personal communication, February 6, 2013). For comparison, teachers in the Reading Recovery Program undergo “a full academic year of professional development with graduate credit under the guidance of a registered Reading Recovery teacher leader,” weekly classes in which they must participate, and quarterly evaluations by teacher leaders to observe teacher-in-training lessons and to consult about implementation in the school (Reading Recovery Council of North America, 2012).

These two individuals demonstrate a very different picture of how dyslexia intervention is applied in a school setting. While N.E. herself underwent over 300 hours of training in dyslexia, dyslexia teachers in M.M.’s district receive simply three weeks of

training. N.E. may be an exception herself since she admitted that she personally decided that she “needed more education to fully address the needs of [her] students;” this was her prompt for paying for her own continued education (N.E., personal communication, February 8, 2013).

What is Dyslexia to a Teacher?

I asked M.M. to explain to me what she understood dyslexia to be. Despite no formal training, she has an accurate understanding of dyslexia. She was aware that it manifests itself differently in different people, is a spectrum disorder, is hereditary, affects students of normal or high intelligence, and, as both Nicholson and Fawcett (2008) and Shaywitz (2003) explain, M.M. said that students often “develop their own ways of coping with their dyslexia.” She also explained that dyslexics have difficulty working with print, which manifests itself as problems with reading and spelling, orthographic memory, seeing patterns in words, and rapid naming (M.M., personal communication, February 6, 2013).

Although M.M. had little formal dyslexia training, her conceptualization of dyslexia was consistent with current scientific knowledge. This suggests that the information is available for the classroom teacher. While some of her knowledge of dyslexia comes from a particular reading specialist at her own school who regularly held in-services on dyslexia for the faculty of the school, most of her knowledge of dyslexia has come from her correspondence with other reading specialists in her school district (M.M., personal communication, February 18, 2013).

In N.E.'s school district, parents and educators are supplied with information resources such as a brochure entitled "Dyslexia Program Awareness for Educators and Parents." This document explains dyslexia and lists common signs a classroom teacher or a parent may observe in developing readers. However, N.E. admits that, because of time constraints, even easy-to-read information like as in brochures are likely not to be read carefully by most teachers (N.E., personal communication, February 15, 2013). So while the information may be available, it is likely not reaching the teacher.

Identification of Dyslexia

Both N.E. and M.M. agree that "an experienced classroom teacher is probably the person who could most quickly see that a struggling student might need to be screened for dyslexia" (M.M., personal communication, February 6, 2013). However, M.M. gave a specific example of a kindergarten student who was mis-identified as dyslexic by her classroom teacher—despite the fact that this teacher has no dyslexia training—when the child progresses more slowly than others in the class. After successfully completing the Reading Recovery program with M.M. by the end of first grade (the student had caught up with her grade reading level), the child's parents requested that the child be screened for dyslexia. When screened, the child turned out not to be dyslexic. While a classroom teacher may recognize a struggling student might be at risk for dyslexia, most cannot identify a student as dyslexic. Even a fully-certified dyslexia teacher cannot always correctly identify a student as dyslexic.

In both school districts, students can be screened for dyslexia by either parental request or classroom teacher recommendation.

First and second grade are the most common years for dyslexia screening and identification of students. However, N.E. and M.M. disagree as to when students should be identified. M.M. believes that “students need a chance to have good first teaching to see if that will resolve those [reading problems] before being labeled as dyslexic” (M.M., personal communication, February 6, 2013). However, if dyslexia is truly a difference in brain morphology, identifying dyslexics early would likely contribute to a child’s reading success (N.E., personal communication, February 8, 2013). This is particularly true if students can receive help before they begin to fail. N.E.’s opinions are consistent with the current literature. In M.M.’s experience though, this has not been the case.

Clearly, a key component to identification of dyslexia is the quality of dyslexia intervention among schools. The discrepancies between the training of dyslexia teachers across districts are severe. As mentioned previously, while N.E. has earned over 300 hours of training over the course of four and a half years as a dyslexia teacher, her district considers adequate training to be the three-day training provided by the district. This training is not to teach the science of dyslexia but to implement the program chosen by the district (N.E., personal communication, February 8, 2013). Dyslexia teachers in M.M.’s school district receive only three weeks of training.

Current Dyslexia Intervention

The current dyslexia intervention in N.E.'s school district uses specific programs that focus on different tools for dyslexic students including: phonological processing, multisensory activities to teach systematic vowel functions, and strategies for decoding and reading multi-syllable words for older students (N.E., personal communication, February 8, 2013).

The school district evaluates success by assessing the student's yearly improvement and relative performance in three areas: silent reading fluency (and comprehension), spelling, and decoding analysis. The program is supposed to require two years of instruction. The ultimate goal of the program is to have the student achieving success in his or her grade-level of reading. N.E. admits, however, that the program often takes longer than just two years. Though students are normally identified in first or second grade, they often move on to junior high without completing this program (N.E., personal communication, February 8, 2013).

Since the goal of the program is to allow a child to read at grade level (as well as to teach them to cope with their dyslexia so they can be successful on their own), the lack of an overall successful intervention rate is alarming. In the words of M.M., "if the students [in the dyslexia program] do well, great. But if they don't, well, they are dyslexic" (M.M., personal communication, February 6, 2013). If a student becomes dependent on help, will that child begin to struggle again when, for instance, they go to junior high?

In M.M.'s school district, there is also no overall intervention success rate for the dyslexia program. If this is common across districts, this is a concern that must be addressed. If a program does not work, alternatives need to be developed. Without outcome assessment, utility of an intervention cannot be determined.

The Breakdown between Dyslexia Science and Intervention

N.E. explained the dissemination of new dyslexia research through her district using the flowchart in Figure 1. The district makes the decisions as to what to do with new research: whether to use it, how to implement and integrate it. New research findings are not presented to teachers; teachers are not even given the information until the district personnel decide that it will be implemented. N.E. believes that teachers should be involved in this decision making from the start (N.E., personal communication, February 15, 2013). In fact, even though district personnel are aware of conferences that are offered, they often do not have the resources to finance all district dyslexia teachers to attend. M.M. agreed that money is one of the main limitations for teachers to have access to research and literature by attending literacy conferences. The district office of interventions in N.E.'s district does occasionally inform teachers of current literature through professional learning meetings and books but not of scientific literature. Utilizing free webinars is something that N.E. cites as helpful for continued learning of dyslexia research (N.E., personal communication, February 15, 2013).

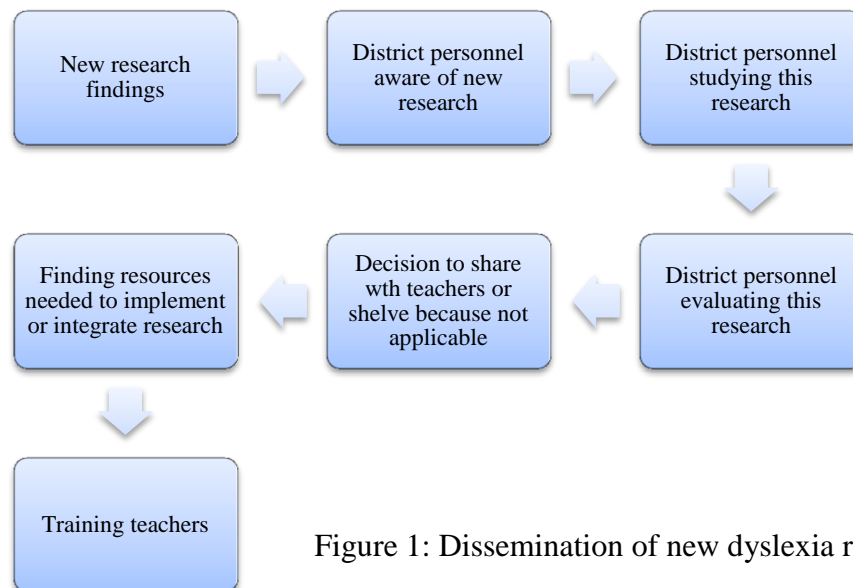


Figure 1: Dissemination of new dyslexia research

Besides the lack of funding and poor dissemination of information to teachers, both N.E. and M.M. cite limited time as one of the fundamental issues preventing teachers from keeping up with the most current scientific literature. N.E. is required to provide intervention to each identified dyslexic students (three percent of the school's population) for at least 90 minutes a week. In addition, she must plan for each scheduled time with students or groups of students (N.E., personal communication, February 15, 2013). Likewise, M.M. must plan for her classroom and the four individual students to whom she delivers Reading Recovery intervention (see transcript for full list of responsibilities; M.M., personal communication, January 22, 2013). Taking extra time to study the current literature is not always possible with so many other responsibilities.

Although providing easy-to-read information to read is an option, anecdotal evidence suggests it may not be read. N.E. recommends that some sort of follow-up to individual study of this work be presented to allow teachers to actually learn more.

Again, if teachers were involved in the process of dissemination of new research, perhaps regular study could occur between teachers and district personnel that would benefit the quality of the dyslexia programs offered. M.M. states that teachers in her school are required to attend in-services on current scientific research and told to use it.

Unfortunately, most teachers don't take advantage of this information, and no one check to see if they have used it. Often, no further support is provided for teachers to help them put the information in practice (M.M., personal communication, February 18, 2013).

CHAPTER FIVE

Moving Forward

Disagreements notwithstanding, researchers agree on three things. First, the cerebellum is involved in at least some cases of dyslexia (Brookes & Stirling, 2005; Fawcett & Nicolson, 1999; Stoodley et al., 2006). This could be due to the occurrence of subtypes of dyslexia where different areas of the cerebellum (and perhaps other brain regions). Secondly, dyslexia manifests itself differently in different individuals. That is, dyslexia is not binary but exists along a continuum. Some individuals may be “more dyslexic” than other individuals (Brookes & Stirling, 2005; Nicolson et al., 2002), and different dyslexic individuals may exhibit different symptoms, consistent with the literature (Nicolson and Fawcett, 2008; Shaywitz, 2003; Yap and van der Leij, 1994). Finally, many dyslexics find ways to cope with their dyslexia. At a young age, this might mean relying heavily on pictures to determine what a text says (Shaywitz, 2003). As they get older, their “coping” may be visible as their success as an entrepreneur or corporate manager, allowing them to thrive in the workplace (Logan, 2009; Nicolson & Fawcett, 2008).

Likewise, based on my interviews with N.E. and M.M. I can draw three conclusions concerning the educational system. First, teachers across school districts are not trained consistently to work with dyslexic students. Initially, education is limited; three weeks was the maximum time spent training new teachers in the districts I studied. Continued education is equally limited. Though some correspondence occurs between teachers at different schools within the same district, attendance at conferences for further

learning is not stressed, and such opportunities are rare due to limited funding.

Second, the quality of dyslexia intervention differs. Teachers often try whatever they believe might work without much direction from the school district. While this is a positive for well-trained, most are likely to struggle. Finally, neither of the two districts I studied tracked intervention success rates. This is disconcerting because we do not know if our intervention is actually helping dyslexic students.

One of the most important applications that both the classroom teacher and the dyslexia interventionist must understand is that dyslexia presents itself differently in each individual. Teachers working with dyslexic students will need to have a large “bag of tricks” in order to help different dyslexic students. Though we don’t know if this is due to dyslexia subtypes or just the generalized continuum of dyslexia, any generalized intervention strategy must contain teaching strategies that will assist a large variety of dyslexic students.

A reorganization of dyslexia intervention is warranted, and outcome data must be collected. If dyslexic students receive as much help from Reading Recovery programs as they do from a specialized intervention, for instance, there is no need for specific dyslexia intervention. Dyslexia intervention often changes depending on the amount of training that an individual teacher has received. Though this may be helpful for specific students, we have no way to measure whether a single dyslexia teacher or the program being used is effective.

While it is important for a child to learn to read, dyslexia interventions for older dyslexic students (in upper elementary grades) need to focus on helping students acquire

strategies to cope with their dyslexia. When students leave elementary school, most will not receive individual help. As such, when they leave elementary school, they must be able to function on their own despite their dyslexia.

Students would benefit from cross-district consistency. The two school districts sampled here have two different training programs for dyslexia intervention specialists, one taking three days and the other taking three weeks. If we want a teacher to be able to work with a range of dyslexic students each having their own needs, teachers will need more specific training in order to serve these individual students.

A disconnect between science and education exists in that, while science is busy figuring out how the brain works, education is still responsible for teaching students, including dyslexics. The gap between the two creates a learning dissonance in the classroom when teachers struggle to mold a mind they do not fully understand. In conclusion, dyslexia research needs how the cerebellum is involved in dyslexia, whether through subtypes or different cerebellar or brain regions. Meanwhile, education must focus on reorganizing dyslexia intervention to measure its effectiveness. With these goals in mind, we can make a lasting impact on the learning goals of dyslexic students in their classroom environments.

APPENDICES

APPENDIX A

Transcript of Interview with N.E.

January 23, 2013

What is your name? N.E.

How long have you worked in education? 26 years **What degree(s) do you have?** BS in Elementary Education; MEd in Curriculum & Instruction

What teaching positions have you held in this field? 7 years as a first grade classroom teacher; 15 years as a third grade classroom teacher; 2 years as a reading intervention and dyslexia teacher; 3 years as a dyslexia only intervention teacher. **What position do you currently hold?** district dyslexia teacher **What does your job**

entail? delivering small group dyslexia intervention to students identified by our district dyslexia evaluators and 504 committee as a student with characteristics of dyslexia; grades 1 - 5

What professional organizations are you a member of? KATYTSTA/TSTA/NEA

Are you able to keep up with the professional literature on reading and literacy as much as you'd like? No. **Why or why not?** There is so-o-o much information on

reputable internet sites, and in recommended books on dyslexia, those are the types of reading I do. I read books mostly in the summer or when offered a book study by our Office of Interventions. Trying to keep up with current dyslexia information prevents the opportunity to read other professional literature on reading and literacy. I've even begun to feel "out-of-the-loop" regarding current district language arts curriculum and instruction, because my focus is on dyslexia intervention.

Have you been trained in dyslexia at any point in your career? Yes - training by KatyISD and training by Neuhaus Education Center.

What was the training?

- 1) District training: Instruction including basic information about dyslexia, as well as training in how to deliver the Dyslexia Intervention Program used by Katy ISD (3-days)
- 2) Neuhaus Education Center: A) Reading Readiness Program (online at personal expense); B) Basic Language Skills (60 hours at personal expense); C) Advanced Basic Language Skills (60 hours at personal expense)
- 3) Ongoing professional learning meetings with other District Dyslexia teachers; 1/2 day trainings, webinars

I have a total of 300 hours in training or workshops (this includes the Neuhaus hours mentioned above) over the past 4-1/2 years relating to dyslexia

February 18, 2013

Follow-up: How did you decide that you wanted to teach dyslexia? As a 3rd grade classroom teacher, I had encountered several students identified with dyslexia, and had read some about it and had discussions with the dyslexia intervention teacher at my campus (a different elementary at the time than the current campus). Administration began clustering the dyslexia students in my class each year, and I became more familiar with dyslexia classroom interventions and accommodations. The dyslexia teacher and I collaborated as needed concerning individual students, thus I learned even more from her about dyslexia characteristics. I decided that this might be a challenge and growth-step

for me in my career to change my focus from whole class to small group and more intensive teaching. So, I transferred to another school as a 3rd grade teacher, where I might have a greater opportunity to move into this type of reading intervention position. After my first year here at my present campus, an opening occurred, and I requested the reading intervention teacher position. At that time the reading intervention teachers worked with small groups of students needing reading intervention, and small groups of students identified with dyslexia.

You said that you paid for the training at Neuhaus of personal expense. What prompted this training? I was provided with a brief 3-day dyslexia intervention program training by our district in order to work with dyslexic students. It was mostly a training in how to implement the program chosen by our district for dyslexia intervention (as required by the State). The information touched generally about dyslexia characteristics, but not inclusively. For the years at Katy Elementary that I had taught dyslexia students in the general education setting, I had heard many references and praises of the Neuhaus Center and its Basic Language Skills program. I had also participated in International Dyslexia Association seminars in which there were Neuhaus presentations. After a year or two into working with the dyslexia program and students, I knew I need more education to fully address the needs of my students. I requested the opportunity to attend Neuhaus training at district expense and was denied. In my opinion, and that of many others, the Neuhaus Center is one of the best, so I still wanted to attend, and if paying for it myself was the only way I could attend, then I did.

In your career, have you worked with dyslexic students? If so, how many have you administered training to and how many have you had the opportunity to observe in a general class setting?

I am currently working with 20 students identified with dyslexia (3 second graders, 4 third graders, 4 fourth graders and 9 fifth graders) for the 2012-2013 school year. I work with them 3-4 times a week, 30-45 minutes per session. I do not observe them in the general ed classroom, but I have access to their test scores and nine-week grade reports, so I do monitor how they are performing in the general class setting.

I have provided or am providing dyslexia intervention to:

2012-2013: 20 students

2011-12: 28 students

2010-2011: 27 students

2009-2010: 22 students

2008-2009: 8 students

During the 2008-2009 and 2009-2010 school years I had non-dyslexic reading intervention groups, as well as groups of identified dyslexic students (and there was another teacher who had the same, so she had some dyslexic students, too).

I have worked with dyslexic students in the general ed classroom as a 3rd grade teacher. My estimate is I had about 2-3 dyslexic students in my general ed classroom per year for a total of around 20 students.

So - my total number of students for whom I have provided actual intervention since being trained in the Dyslexia Intervention Program would be about 105 students. If we

include those I taught who were seen by a dyslexic teacher and I was the general ed teacher, the total would be about 125.

How would you describe dyslexia?

I would describe it using the words from the current definition provided by the International Dyslexia Association (and can be found in the TEA Dyslexia Handbook):

"Dyslexia is a specific learning disability that is neurological in origin. It is characterized by difficulties with accurate and/or fluent word recognition and by poor spelling and decoding abilities. These difficulties typically result from a deficit in the phonological component of language that is often unexpected in relation to other cognitive abilities and the provision of effective classroom instruction. Secondary consequences may include problems in reading comprehension and reduced reading experience that can impede growth of vocabulary and background knowledge. (Adopted by the International Dyslexia Association Board of Directors, Nov. 12, 2002) and The Texas Education Code (TEC) §38.003 defines dyslexia in the following way: (1) Dyslexia means a disorder of constitutional origin manifested by a difficulty in learning to read, write, or spell, despite conventional instruction, adequate intelligence, and sociocultural opportunity. (2) Related disorders includes disorders similar to or related to dyslexia such as developmental auditory imperception, dysphasia, specific developmental dyslexia, developmental dysgraphia, and developmental spelling disability.

What characteristics do dyslexic students face?

Again, I would defer to the compiled lists in the Handbook: "The primary difficulties of a student identified as having dyslexia occur in phonemic awareness and manipulation,

single-word decoding, reading fluency, and spelling. Secondary consequences of dyslexia may include difficulties in reading comprehension and/or written expression. These difficulties are unexpected for the student's age, educational level, or cognitive abilities. Additionally, there is often a family history of similar difficulties.

The following are the primary reading/spelling characteristics of dyslexia:

- Difficulty reading real words in isolation
- Difficulty accurately decoding nonsense words
- Slow, inaccurate, or labored oral reading (lack of reading fluency)
- Difficulty with learning to spell

The reading/spelling characteristics are the result of difficulty with the following:

- The development of phonological awareness, including segmenting, blending, and manipulating sounds in words
- Learning the names of letters and their associated sounds
- Phonological memory (holding information about sounds and words in memory)
- Rapid naming of familiar objects, colors, or letters of the alphabet

Secondary consequences of dyslexia may include the following:

- Variable difficulty with aspects of reading comprehension
- Variable difficulty with aspects of written composition
- A limited amount of time spent in reading activities

Common Evidence of Dyslexia

The following may be associated with dyslexia if they are unexpected for the individual's

age, educational level, or cognitive abilities.

Pre-school

- May talk later than most children
- May have difficulty with rhyming
- May have difficulty pronouncing words (i.e., busgetti for spaghetti, mawn lower for lawn mower)
- May have poor auditory memory for nursery rhymes and chants
- May be slow to add new vocabulary words
- May be unable to recall the right word
- May have trouble learning numbers, days of the week, colors, shapes, and how to spell and write his or her name

Kindergarten through Third Grade

- Fails to understand that words come apart; for example, that snowman can be pulled apart into snow and man and, later on, that the word man can be broken down still further and sounded out as /m/ /ă/ /n/
- Has difficulty learning the letter names and their corresponding sounds
- Has difficulty decoding single words (reading single words in isolation)—lacks a strategy
- Has difficulty spelling phonetically
- Reads dysfluently (choppy and labored)
- Relies on context to recognize a word

Fourth Grade through High School

- Has a history of reading and spelling difficulties
- Avoids reading aloud
- Reads most materials slowly; oral reading is labored, not fluent
- Avoids reading for pleasure
- May have an inadequate vocabulary
- Has difficulty spelling; may resort to using less complicated words in writing that are easier to spell"

How can a classroom teacher recognize dyslexia?

Classroom teachers can be made aware of the characteristics of dyslexia at the various grade levels through training, videos, PowerPoints, etc. Teachers are given a brochure titled "Dyslexia Program Awareness for Educators and Parents", which includes a definition of dyslexia and common signs of dyslexia. Those signs are: K-3rd: 1) Failure to understand that words are made up of parts or individual sounds, 2) Difficulty learning the letter names and their corresponding sounds, 3) Difficulty reading single words in isolation, 4) Choppy and labored reading, 5) Difficulty spelling phonetically and 4th-12th: 1) History of reading and spelling difficulties, 2) Avoids reading aloud, 3) Reads most materials slowly; oral reading is labored, not fluent, 4) Avoids reading for pleasure, 5) Difficulty with spelling.

What is the rate of dyslexia in the general population according to your training? If you do not know, what would you estimate it to be?

I have seen estimates from 5-20% of the population are affected by dyslexia. At our

school the percentage of identified dyslexic students is about 3%.

In your experience, when are dyslexic students identified?

It has changed - initially many were being identified around the 3rd grade. But with more knowledge about assessments and dyslexia identification, more and more students are being identified in the first and second grades. Currently, our district does not have the expertise or diagnostic instruments to evaluate Kindergarten students and first semester first graders. Although from my reading, there are several instruments available by which to evaluate the 5 and 6-year old students for dyslexia identification.

When do you think they should be identified? Why? I think the optimal time to identify students with dyslexia, or even with dyslexic characteristics, is in Kindergarten and first grade. I think this because of current information I have heard and read (Overcoming Dyslexia by Sally Shaywitz; Multisensory Teaching of Basic Language Skills edited by Judith R. Birsh; Bright Solutions for Dyslexia website, International Dyslexia Association; Neuhaus Education Center) that share this information. I agree with these experts that identifying and intervening as early as possible in a child's academic career allows a more certain possibility of academic reading success in future years.

How do you help dyslexic students? Specifically, how do you help them to learn to read and write different from how you would help any other low reader?

Programs our district uses to help dyslexic students are:

Reading Readiness: a Neuhaus Education Center program which emphasizes reading readiness strategies with an emphasis on phonological processing (usually with 1st

graders)

Multi-sensory/Systematic Phonics Strategies: multisensory activities to teach systematic vowel functions in order to read decodable text using Imagination Station teacher resources for practice

Dyslexia Intervention Program: a Region 4 program usually used 2nd - 5th grades, but can be used in other grade levels as well depending on student need

Esperanza: intervention used for elementary-aged Spanish-speaking students

REWARDS/Fluency-Building Strategies: later elementary students who have mastered single-syllable words; includes strategies for decoding and reading multi-syllable words.

My 2nd-4th graders are primarily instructed using the Dyslexia Intervention Program.

With my 5th graders I use the REWARDS program integrated with the Dyslexia Intervention Program, as needed.

The "difference" of dyslexia intervention is that the major instructional strategies should utilize individualized, explicit, intensive, and multisensory methods. This instruction is systematic and often needs to be more intensive (in time and frequency) than with other low readers. However, in the public school setting it is difficult to truly maintain the intensity that is optimal for these students due to State testing, benchmarks, scheduling, etc.

How is “successful intervention” measured by the dyslexia program in your district?

Success is measured in yearly growth and proximity to a student's grade level in silent

reading fluency (and comprehension), spelling, and decoding analysis. Dyslexia teachers test at the beginning of the year and the end of the year in these 3 areas. We have mastery checks that are part of our program to periodically monitor progress. I have written "Continuous Progress Monitoring" checks which I give after approximately ten lessons based on the previous lessons taught. We also consider report card grades in identifying if the intervention is carrying over into the students' every day classroom work. Common and State assessment scores are indicators, also. Imagination Station monthly scores are a component in measuring a student's success. Our ultimate goal would be to have the student achieving success with on-grade level in reading.

What is the approximate success rate?

I honestly do not know. Our program is expected to take approximately 2 years of instruction. However, many students go at a slower pace depending on "other" concerns affecting their participation, or depending on the number of minutes I have with each group. On students I work with from year to year, I check for growth throughout the year, as well as compared to prior years. I have had one 5th grade student exit the dyslexia intervention program this year, and I will be re-evaluating another 5th grade as soon as we receive consent to test. Students often move on to junior high or to other schools or districts, limiting our ability to ascertain their success. The district criteria used to re-evaluate a student for exiting the program includes: spelling, silent and oral reading fluency and comprehension, decoding, report card grades, State assessment grades and teacher observations. We do not have specific standards in place to determine the success rate.

Do you keep up with dyslexia research? Have you heard of the phonological deficit hypothesis, the magnocellular deficit hypothesis, or the cerebellar deficit hypothesis for instance? I keep up on the "peripheral", skimming short articles occasionally. I have not heard of phonological deficit hypothesis, the magnocellular deficit hypothesis, or the cerebellar deficit hypothesis. Based on the wording, I could guess at them, but I have not seen those terms in dyslexia material I've read.

February 15, 2013

Do you think it is important for teachers to keep up with the scientific literature on dyslexia? Why or why not?

It is important for teachers to keep up with scientific literature on dyslexia, because what is being researched, learned, and reported has a direct impact on how dyslexia interventionists deliver instruction/intervention. In recent years there has been a relatively significant amount of new discoveries through brain imaging and research to help with the understanding of what dyslexia is and how it affects learners.

Unfortunately, there are significant limitations to teachers to keeping up with the most current scientific literature. Several factors which are to be considered include time, funding and leadership.

I believe most dyslexia teachers recognize the need and the importance for constantly updating their education with the current information. Funding can be a hindrance because, in my experience, the district level offices which supply dyslexia-related teacher training often do not have the budget to finance all district dyslexia teachers to attend

symposiums, conferences and trainings that are offered. These symposiums frequently have speakers with current scientific findings. I usually learn about these conferences, etc. through emails from various organizations which offer them (Houston Branch of the International Dyslexia Association; Neuhaus Education Center, Learning Ally, Region 4 Education Service Center, Region 10 Education Service Center, Bright Solutions, The Council of Educators for Students with Disabilities, Inc., Jensen Learning, etc.). As I have stated previously, I have been denied the request from the district to finance Neuhaus classes I was interested in, and I paid for them myself. (There have been one or two of the lesser expensive classes my campus paid for.)

Free webinars are offered through several organizations, and those can be noteworthy sources of information (and the district will give professional development credit for these).

The district office of interventions occasionally makes teachers aware of current scientific literature through professional learning meetings. For example we are currently having a book study on the 2012 book, *Essentials of Dyslexia Assessment and Intervention* by Nancy Mather and Barbara J. Wendling. However, we are not frequently directed to scientific literature. I get most of my information, as I said earlier, from websites of organizations which contribute current findings and data on dyslexia.

What limitations, from the perspective of a teacher, do you see with being able to keep up with the scientific literature?

Time is definitely a hindrance to teachers seeking more information. In this district there is a minimum of 90 minutes a week to provide intervention to identified dyslexic

students. This intervention time is scheduled in sync with campus and class schedules, and these schedules can make it difficult to find the time to search out and study information on one's own without some guidance as to what is available. It would be helpful to have district office personnel keep abreast of current research and study opportunities, and subsequently to share the ones they have deemed worthwhile and informative for our teachers and our students. Providing easy-to-read information is an option, but there is the chance it won't be read carefully (because of time), thus follow-up to individual study would also be helpful through meeting and actively discussing items that are important; and would be optimal for teachers actually learning more.

Do you think there is a simple solution to this discrepancy between science and education? If so, what? If not, why?

- **Lectures/in-service for teachers; are the in-services that are currently used actually beneficial in helping teachers learn more?**
- **Do teachers need continued education?**
- **Easy to read information, brochures (would something like this actually be read though?)**

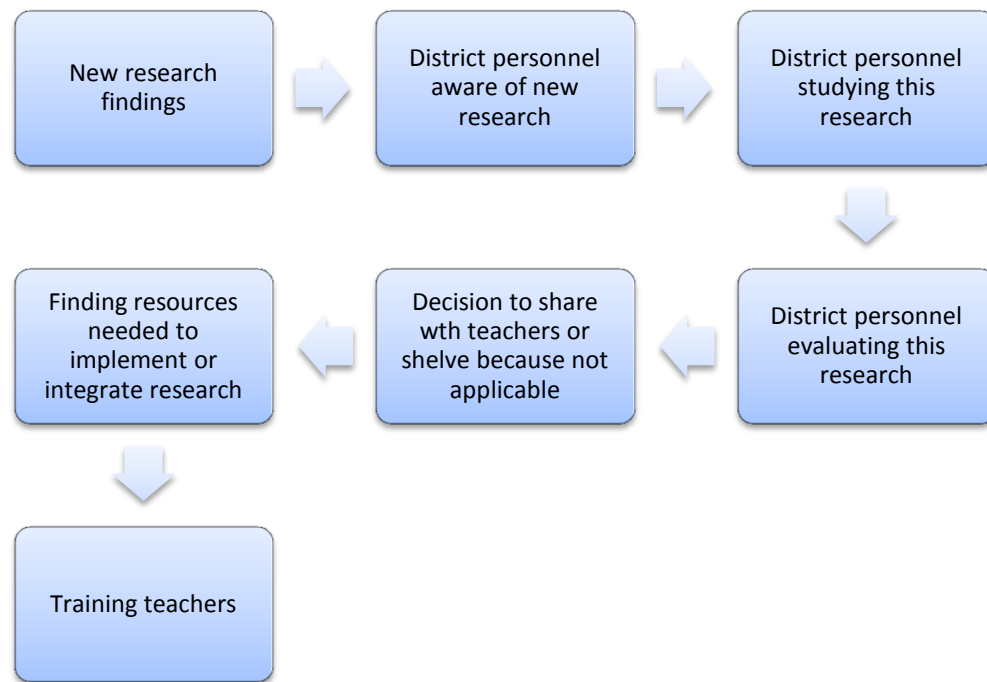
In-services are conducted to help teachers learn more, but frequently procedures and guidelines are the focus of our in-service time, as are teaching tips, but not current scientific information. There is no doubt that teachers need continuing education. Our world is changing daily, our student needs vary daily and it is essential that teachers have access to the information and tools to provide the help they require.

Bureaucracy can also be an issue interfering with teacher access to training and technology. One area where this is evident is in translating the science knowledge into practice, especially regarding technology available to make learning more enjoyable and even a bit less demanding for our struggling learners. For example, a teacher learned through email of a website called Learning Ally, and its purpose is to provide free access to audiobooks for children with reading difficulties like dyslexia. It is free to all public schools through a grant from TEA, and with permission from the administrator, an account was set up for the school. Months were spent trying to get the technology office to approve the software needed to access audio books for the dyslexia students.

Throughout this process there was no support from the district, even though an interest was expressed at the district level. (And it is likely that due to lack of adequate funding and personnel resources, the district office did not have the time to pursue this.)

Regarding a simple solution to the discrepancy between science and education...in public schools I believe the breakdown from scientific research and information to the application in the classroom is related to bureaucratic, communication and personnel issues. It appears to me there is not enough time and money at the district level to integrate scientific research on dyslexia with its application to education. Teachers are not involved in that process, unfortunately. The district personnel have procedures they have to follow, budget duties, meetings, an overabundance of responsibilities, and their time is limited to conduct the research needed in both understanding new advances, and evaluating which ones are worth investing in for our students.

Here is a short flowchart:



As I currently perceive it, this is not happening in reality, and I would optimally suggest that teachers be included from the beginning.

I use district personnel throughout the above flowchart because it is from this level that leadership in the application of scientific research to education flows. Teachers often do not have a say in this; decisions are made by those in these leadership positions, not at the teacher level. Communication to teachers and training comes after decisions are made at the district level. A teacher with the resources of time and money, of course, can pursue learning and study of current research on his/her own. However, application to the intervention lessons must be within district and state guidelines for dyslexia intervention and/or use of technology, if applicable.

February 19, 2013

Follow-up: Were you given a reason by the district or by your school as to why they turned down your request for furthered education through Neuhaus? Was it simply that they didn't have the funding, like you mentioned, or some other reason?

The first request was turned down by the campus with the reasons given: 1) limited funding 2) Neuhaus's dyslexia intervention program did not coordinate with the dyslexia program our district uses (which was not accurate - these two programs are almost identical). The reason was given to our then campus principal by an "acting administrator" in the district dyslexia office.

The request for funding of the 2nd part of the Neuhaus program was turned down due to the fact that the sum of over \$1,000 could not be justified for training of only one individual teacher from the campus (especially due to the fact that I am an employee of the district office and not the campus).

February 20, 2013

Follow-up: If the district didn't approve of the Neuhaus training because the intervention programs did not coordinate (according to them), did they recommend another dyslexia program that would be acceptable? A less expensive program perhaps? Or did they just singularly turn down your requests for further education?

The program that is acceptable in our district is the Dyslexia Intervention Program, based on Orton-Gillingham concepts and published by Region 4 Education Service Center.

This is a far less expensive program, and the district has been using it since around 1997 or 1998. I had received 3 days of district training in that program, and that is considered adequate by the district for a teacher to then provide dyslexia intervention. I felt I needed more education and training about dyslexia.

Our district is in favor of further education, but appears reluctant to allocate funds for out-of-district continuing education. We can receive credit for the hours, if approved out-of-district, but are not reimbursed on a regular basis. The district was OK with me attending the Neuhaus training, just not paying for it. It is so similar, and updated, that I integrate parts of the Neuhaus program with ours as appropriate. It was well worth the money spent, but many of the others attending the two intensive Neuhaus trainings (two weeks each), were funded by their district.

Is the amount of training that you've received in dyslexia (300+ hours) typical among most dyslexia teachers in your district? Is the amount of training that you've received above average, below average, or about normal?

The training I have received is definitely above the average.

As I have mentioned previously, the district provides a 3-day training for teachers new to dyslexia intervention. We usually have a few more days of 1/2 day trainings throughout the year provided by the district specific to dyslexia.

My estimate would be that an average beginning dyslexia teacher in our district will have received a minimum of 24 hours up to 30 hours of district training the first year.

APPENDIX B

Transcript of Interview with M.M.

January 22, 2013

What is your name? M.M.

How long have you worked in education? 39 years

What degree(s) do you have? I have a bachelor's degree in elementary education and a master's in curriculum & instruction.

What teaching positions have you held in this field? I have taught: first grade self-contained; first grade language arts; Reading Recovery; 4th grade self-contained; 6th grade self-contained; 6th grade language arts; 5th grade self-contained. One year I was the ELA helping teacher for Fort Bend ISD. As part of my job duties, I was sent out to teach in 3rd grade ELA classes in low-performing schools.

What position do you currently hold? I currently teach Reading Recovery half day and first grade ELA half day.

What does your job entail? In Reading Recovery, I have to test low-performing first graders to determine which are the 4 lowest in reading and writing. Those are the 4 I will work with one-on-one for highly individualized lessons (reading and writing) daily. I am expected to keep extensive records on each child's daily performance, and I am responsible for helping each of these students accelerate his/her own learning so he/she can (hopefully) catch up to the average of his/her class. It is my job to know what the child is able to do on his/her own in reading and writing, and then to use this to scaffold the child's learning. I am also expected to attend regular Reading Recovery professional

development and to do assigned professional reading in preparation for these sessions. I also have to teach one of my students for my fellow Reading Recovery teachers to watch. I have to do this at least once a year. During the other half of my day, I teach ELA in first grade. I am responsible for teaching writing workshop, guided reading or reading workshop, word study, and reading comprehension. I am also responsible for administering regular assessments of my students, including our district writing benchmark twice a year, the DRA2 three times a year (individually administered), and a phonemic awareness inventory. I also must participate with my teammates in "data teams" which is part of SMART goals. I have to grade papers, keep a grade book, and use the district curriculum to write lesson plans. I write the weekly newsletter (goes home to parents) for our team. I have to participate in staff development as dictated by the district and/or my principal.

What professional organizations are you a member of? Delta Kappa Gamma. ATPE, and the Reading Recovery Council of North America.

Are you able to keep up with the professional literature on reading and literacy as much as you'd like? No. **Why or why not?** I have too many other school-related demands on my time.

Have you been trained in dyslexia at any point in your career? I have not had dyslexia training.

February 6, 2013

In your career, have you worked with dyslexic students? Have there been students that you have worked with that were identified as dyslexic but received Reading Recovery help and/or students that you have observed in the classroom that were identified as dyslexic?

I have worked with students who were not identified as dyslexic to start with, but were later identified as dyslexic. In Fort Bend ISD, very few first graders get identified as dyslexic, especially until they have had a chance to be in Reading Recovery. Those few don't get identified as dyslexic until later in their first grade year.

I haven't ever worked with any students in Reading Recovery who were truly identified as dyslexic before coming into Reading Recovery. We have one kinder teacher who does not like to make much effort (can't think of a way to say this nicer), and she is infamous for "identifying" kinder students who don't catch on quickly as dyslexic. She has no training in dyslexia whatsoever, although she was a not-very-effective Reading Recovery teacher for 2 years about 8 years ago. One child she "diagnosed" as dyslexic in kinder was in my first grade class and I had the child in Reading Recovery. The child successfully completed Reading Recovery (in 20 weeks, a full program) and tested on a level 16 nonfiction on the DRA2 at the end of first grade. (Level 16 nonfiction on the DRA2 is considered end of first grade level.) This child is in 2nd grade now and has had some struggles with reading. The child's mother took the child to an optometrist specializing in perceptual difficulties, and that has helped the child. This child was screened for dyslexia after successfully completing Reading Recovery (at parent request),

but was definitely not dyslexic.

To your understanding, how would you describe dyslexia? What characteristics do dyslexic students face? In your opinion, can a classroom teacher recognize dyslexia?

I would describe dyslexia as something that causes a person to have difficulty working with print. This is a broad definition, but from what I know about dyslexia, it doesn't manifest itself exactly the same in each person, and it's more of a spectrum disorder.

Also, from what I have been told, dyslexia tends to be (or can be) hereditary. Also, in first graders, letter reversals are not a definitive indication of dyslexia, despite conventional wisdom among non-educators!

I think dyslexic students tend to struggle with reading and spelling, but not math. I think some dyslexic students struggle with things like orthographic memory (like learning high frequency words in reading and writing). I think some dyslexic students have a hard time seeing patterns in words, and some of them have trouble with rapid naming. Also, from what I understand, dyslexic students tend to be of normal or above intelligence. Also many of them develop their own ways of coping with their dyslexia. I think an experienced classroom teacher is probably the person who could most quickly see that a struggling student might need to be screened for dyslexia, especially if that teacher has already tried a number of different ways to help the student and has given that student a good bit of one-on-one and extra small group work/attention.

What would you estimate the rate of dyslexia in the general population to be? In your experience, do you believe it to be over- or under-identified?

And, from the information I have been given, a very small percent of the general population is truly dyslexic (4 to 5 per cent, or something like that). I think dyslexia tends to be over-identified because classroom teachers tend to like for struggling kids to be identified as dyslexic. Then the teachers seem to feel that the dyslexia specialist is responsible for that child learning to read.

In your experience, when are dyslexic students identified? When do you think they should be identified? Why?

In my experience, students get identified as dyslexic later in first grade (3rd or 4th 9 weeks) or early in 2nd grade. I don't think students should be identified any earlier than 3rd 9 weeks of first grade because there can be developmental issues that cause a student to struggle with reading and writing in kinder and first grade. Students need a chance to have good first teaching to see if that will resolve those things before being labeled as dyslexic. Also, sometimes kinder and first grade students struggle because they have developed confusions about the way print works. They aren't dyslexic; they just need a good teacher to help them untangle those confusions. Also, some young learners have the wrong theory about what reading is, and, again, they need good first teaching to resolve these confusions.

Do you know how is “successful intervention” measured by the dyslexia program in your district? What is the approximate success rate?

From my understanding, the dyslexia program in our district is not held accountable for how the students in the program perform. If the students do well, great. But if they don't, well, they ARE dyslexic! I have never heard anyone in our district talk about the success

rate of the dyslexia program. Sometimes, it has seemed like to me that students were classified as dyslexic when no one knew what else to do with them.

This isn't one of your questions, but I have a very low opinion of the training our dyslexia teachers receive. They get 3 weeks of Neuhaus training. This seems to me to be a very "one size fits all" program. I know a number of the dyslexia teachers, and to be very honest, they have very little (if any) understanding of what reading is and of how people learn. In other words, they have a very small bag of tricks. They tend to be very worksheet oriented teachers. And, to be totally honest, a good many of them want the reading specialist job (a misnomer if ever there was one!!) because it is much easier than being in the classroom, and there's no accountability to speak of.

February 18, 2013

Your knowledge of dyslexia is really impressive to me, especially for somebody who has never “had to” learn about it since you don’t typically work with dyslexic students. Do you believe that your knowledge is average among your fellow teachers or above average? I know that in at least one other school district teachers are given information brochures about dyslexia. Is this the case in your district? How do you think you came to that knowledge about dyslexia—from your personal experiences, from your personal study, information given to you by the district, etc.?

I don't think most classroom teachers understand much, if anything, about dyslexia. The reading specialist we used to have used to do an Inservice on dyslexia that our faculty had to attend, but since she believed that a high percentage of people are dyslexic (and I

don't) I never found her Inservice very helpful---more opinion (hers) than research-based information. I think what I have learned has come from working with Reading Recovery teachers who have also been "reading specialists" in [my school district]. None of them have had a very high opinion of the dyslexia program in our district.

Do you think it is important for teachers to keep up with the scientific literature on dyslexia or whatever they teach? Why or why not?

I think it's important for teachers to keep up with current research on learning, including brain research that has to do with learning. Not sure if keeping up with current research on dyslexia is important. I think keeping up with current research on learning is important because teachers need to know how people learn. (Don't get me started on this! I have to work with some teachers who have no clue about how learning takes place.)

What limitations, from the perspective of a teacher, do you see with being able to keep up with the scientific literature?

I don't think teachers recognize the need for understanding how learning takes place. I don't think this is a very big part of teacher education in undergrad programs, and most teachers seem to think teaching is a matter of presenting the material---and if the kids don't get it, well, it's because the kids aren't trying hard enough or are ADD or ADHD & need meds.

Honestly, I don't think some teachers are smart enough to understand the scientific literature, or they don't want to make the effort. Most of them don't have the schema & they don't want to acquire it.

Lots of teachers don't have access to this research/literature. We used to get to go to high-quality literacy conferences, but because of \$\$\$\$ issues, that has changed.

I think many teachers don't have time to try to put the research into practice, because we have so many ridiculous things to do that have nothing to do with best practices. And, from my observations, even when we are inserviced on current scientific research & told we have to use it, teachers don't use the information & no one checks to see if they are. And often no further support is provided to help teachers put the scientific information into practice.

Since you teach all range of low readers, as an outsider looking in, what pros and cons of the current dyslexia teaching do you see? Do most students advance out of the need for help? As dyslexia can affect somebody their entire life, are most of these students able to eventually not need this help?

Most of the kids I work with are never classified as dyslexic. It seems like to me that the ones who are continue to need support as they go through the grades since true dyslexia doesn't go away. However, this is based in anecdotal evidence, not scientific evidence.

If you were to change the current dyslexia teaching, how would you change it?

Would you incorporate different strategies into Reading Recovery? Would you have identified dyslexic students taught individually and separate but with more effective teachers? What would you recommend?

If I were to change current dyslexia teaching, I would change dyslexia teaching. I would find something besides Neuhaus training for dyslexia teachers, and I would require them to have on-going training like Continuing Contact training that Reading Recovery

teachers go through. I wouldn't add any dyslexia things to Reading Recovery because very few of our Reading Recovery kids get diagnosed as being dyslexic, and because the dyslexia teaching seems to be based more on opinion than research.

Do you think there is a simple solution to this discrepancy between science and education? If so, what? If not, why?

- **Lectures/in-service for teachers; are the in-services that are currently used actually beneficial in helping teachers learn more?**
- **Easy to read information, brochures (would something like this actually be read though?)**

I don't think there is an easy answer to getting teachers to use current scientific information to better their teaching. See answers above for why. I don't think informational brochures will help. I have seen too many instances where teachers had the necessary information but refused to put it into practice, for whatever reason.

What I have seen is that most teachers don't want to have to understand how learning takes place. They want someone to tell them what to do, a "one size fits all" if you will, and they want someone else (like a Reading Recovery teacher or reading specialist) to be totally responsible for "fixing" ALL problems (home issues, behavior problems, etc.) that kids have when the "one size fits all" doesn't work.

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