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Research Article

Reading Disability: Current Practices for Learning

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Description

In typical learners, reading is the basis of learning. Most of us learn to recognize letters prior to pre-school, and the majority of us learn to read single words and simple sentences in kindergarten and first grade. Evidence is not wholly conclusive as to what part of the brain we use to read. This can be attributed to many factors ranging from how the reader views the activity, such as work and a non-leisure activity versus an enjoyable activity, to biological factors that may make reading more difficult, and in effect less enjoyable for some children. There are also distractors to take into consideration that present to young readers such as technology and socialization. According to the Diagnostic and Statistical Manual of Mental Disorders-Fifth Edition, Reading Disability is classified as a neurodevelopmental disorder, within the more general category "specific learning disorders," qualified by the description "with impairment in reading" [1]. To be diagnosed with specific learning disorder, a person must have difficulties in at least one of the following areas, and the symptoms also must have continued for at least six months despite interventions: difficulty reading (e.g., inaccurate, slow and only with much effort); difficulty understanding the meaning of what is read; difficulty with spelling; difficulty with written expression (e.g., problems with grammar, punctuation or organization); difficulty understanding number concepts, number facts or calculation; or difficulty with mathematical reasoning (e.g., applying math concepts or solving math problems) [1]. In 2015-16, the number of students ages 3-21 receiving special education services in the United States was 6.7 million, or 13 percent of all public school students. Among students receiving special education services, 34 percent had specific learning disabilities [2]. The challenge presented to researchers and educators is to mesh the research-proven methods for reading with classroom practices. Although reading is a fundamental skill that is required throughout one's lifetime, many children lose interest in reading by a very young age. Perhaps the occurrence of this can be diminished by focusing on incorporating solid research into classroom practices of teaching reading.

The general approach for assessing reading disability is Response to Intervention (RTI). RTI screening is based on the research of Satz, Taylor, Friel, and Fletcher (1978) [3]. Initial screening is generally performed in kindergarten and includes "equations for predicting the risk of a reading problem in Grade 2. Now this technology has continued to develop, with many approaches to screening in kindergarten and Grade 1 requiring 3-5 min per child and embedded in service delivery systems described as Response to Intervention models" [4]. RTI allows implementers to assess and identify reading difficulties. It is a tiered model where students receive universal screening and are placed within tiers of support where intensity of the lessons match their responsiveness to the interventions [4]. As educational neuroscience emerges and develops as a valid field of study, the possibility and likelihood that reading disabilities will be identified and diagnosed through neuroscience will be a more typical practice. Reading involves many areas of the brain, including cognitive and non-cognitive functions. Research points to a spectrum of areas that adjusts as our brain ages. The areas of the brain involved in reading are: The Broca's and Wernicke's areas [which are] involved in language functions, six more areas are involved and are active at the same time: the anterior cingulate gyrus, the prefrontal cortex, the basal temporal language area or fusiform gyrus, the cerebellum, the right hemisphere, and the elements of the limbic system" [5].

The process ranges from recognition of letters and word forms to processing the words at a comprehension level. The process is in effect, not limited to these areas of the brain, as each area of the brain does not exist in a vacuum. We must consider that each neural pathway within the brain is a contributing factor as well to reading. It is a connected function of cognition, emotion and physiology [5]. Christodoulou et al studied the structural makeup of white matter compared to typical readers and those with reading disability. Their study indicates that there are differences in white matter development during early reading stages of typical readers than with readers with a reading disability [6]. The white matter serves as a connector. When a child is deficient in a physical part of

the brain that lends to reading, that ability to learn is compromised. When the learning is compromised, the child loses interest in continuing to learn because of the difficulties encountered in doing so. This causes an emotional response to reading deficit. Because a child needs to pay attention to reading, this attention is activated in the prefrontal cortex which is the area of the brain that helps the child maintain focus [7]. Gabel et al (2016) [8] state that Reading Disability (RD), "is an early-onset neurodevelopmental disorder, therefore early detection and intervention are necessary to improve individual outcomes" (p. 320).

Reading disability is a significant impairment in the development of reading and spelling [9]. Diagnosing reading disorders usually involves a series of tests of a person's memory, spelling abilities, visual perception, and reading skills. Family history, a child's history of response to instruction, IQ tests, and other assessments might also be involved. Kingeil, Nelson, and Van Norman, (2017) [10] examined the accuracy of three diagnostic approaches for identifying Reading Disability: a computer adaptive test, a Curriculum-Based Measure [CBM], and an informal reading inventory. They found that one type of testing is not necessarily suitable for all children and that the characteristics of each child should be taken into consideration. They also recommend continued educator training as well as local consideration of established cut scores.

There is no specific phenotype or observable characteristic related to RD, therefore it can be understood that RD, "occurs across a continuum with specific biological components linked to a pattern of disruption(s), all of which lead to a specific learning disorder with impaired reading. Understanding the connection between genes and behavioral impairments associated with RD may facilitate the development of early detection and individualized intervention plans that target specific deficit(s) in an individual with RD" [8]. Early detection of Reading Disability will help to close the gap between children who are typically developing and children who have a deficit in acquiring reading skills. This will enable educators to utilize research-based early intervention measures and strategies with children in order to significantly decrease the delayed acquisition of reading skills.

Phonological processing is when one uses sounds to process language. Phonological processing consists of 3 distinct parts: Phonological Awareness (PA), rapid automatized naming (RAN), and the Phonological Loop (PL) of working memory. Brandenburg et al's 2017 [9] study compared phonological processing in typically developing children and children with RD. Their findings challenge the guideline for diagnosing RD in that their, "results support a dimensional phonological processing [which include] Deficits in PA, RAN, and PL [that] seem to constitute the lower end of an entirely different or less differentiated phonological processing structure" [9]. They determined that all three parts of phonological processing should be instrumental and considered in developing literacy skills and diagnosing RD. The study suggests that perhaps the definition of RD should be more reliant upon multi-dimensional points of RD rather than a categorical checklist which will improve the likelihood of more specific and reliable diagnosis of RD. It is important to diagnose a learning disability as early as possible. Children who are diagnosed early have more capability of managing their disability. Generally, they seek out help more often and spend extra needed time to complete assignments. Diagnosing early is important from a sociological standpoint as well, a child who has dyslexia who does not realize they have a disability could be left behind and constantly feel inferior to their peers. This causes stress, low self-esteem, and can lead to bullying and difficulty making friends. Perhaps considering the incidence and impact of reading disabilities, there should be some directive to screen all children for reading disabilities.

Dyslexia is a neurodevelopmental disorder that is affected by cognition, behavior and genetics [8]. The three systems of the brain that are evident in dyslexia are the inferior frontal gyrus in which articulation and word analysis occurs, the parietotemporal area in which word analysis occurs, and the occipito-temporal region in which word form occurs. In relation to how these three regions behave for dyslexic readers and non-dyslexic readers, Shaywitz & Shaywitz (2003) [11] discuss: In dyslexic readers, converging evidence from many laboratories around the world has demonstrated "a neural signature for dyslexia," that is, a disruption of the two neural systems in the back of the brain observed during reading (shown in the image below).

In nonimpaired readers, three systems are evident, one anterior in the area of the inferior frontal gyrus (shown in green) and two posterior, the top system around the parietotemporal region (shown in red) and the bottom system around the occipito-temporal region (shown in yellow). In dyslexic readers, the anterior system is slightly over activated compared to non-impaired readers; in contrast, the two posterior systems are under activated. This pattern of under activation in left posterior reading systems is referred to as the neural signature for dyslexia. Brain imaging now provides visible evidence of the reality of dyslexia; dyslexia (figure 1) is no longer a hidden disability (pp. 7-9).

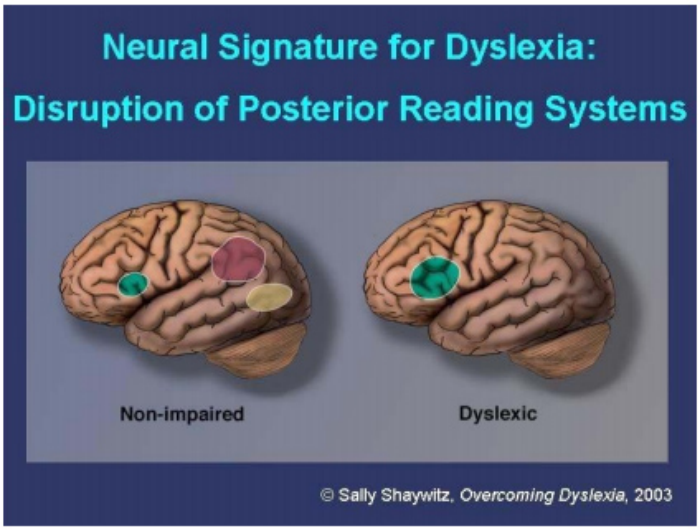

Figure 1: Demonstrates the areas of the brain that are activated during reading.

Gabel et al (2016) [8] performed a cross-species study of humans and mice to determine any correlation between the species and spatial relation and to make further predictions regarding dyslexia. The study involved visual cues combined with working and reference memory abilities, which are the same skills used in reading. Gabel et al concluded in their research that they could, "translate behavioral deficits observed in genetic animal models of dyslexia to humans with reading impairment" [8]. This correlation will assist in further research possibilities, as studies that can be performed on mice can be correlated to virtual studies for human research in the future.

Werfel and Krimm (2017) [12] studied the patterns of how reading subtypes differ among children with Speech Language Impairment (SLI) and children with typical language. They found that word-level and text-level skills in reading impairment studies should be simultaneously but separately considered [12]. In other words, the children with SLI had more difficulty reading over children who were typically developing and also that they demonstrated a different pattern of reading impairment, for which, the children should be considered separately. The study suggests, "Measuring only the reading skill of interest in a particular study (e.g., decoding) may contribute to the disparate estimates of reading subtypes seen in the literature" [12]. We can't categorically evaluate typically developing children and compare them with those who demonstrate a reading impairment because it would not be a similar comparison because their patterns of reading are differentiated. This study also underlined the importance of early detection and intervention. Inner speech, which is also known as covert speech or verbal thinking has been utilized across populations of readers to address reading concerns for many years. Traditionally, it has been utilized as a strategy in psychiatric dysfunction and developmental disorders where a person demonstrates a language deficiency [13]. Inner speech derived from Vygotsky's (1987) [14] theory of cognitive development. Alderson-Day and Fernyhough (2015) [13] state that, "When children are asked to learn a set of pictures, those aged 7 and over tend to exhibit a phonological similarity effect, suggesting that visual material is being recoded into a verbal form via sub vocal rehearsal (i.e., inner speech)" (p. 936).

This practice serves to be a reinforcer for the new learned information. In addition to a visual cue, the child has a mental inner-speech cue to recall. Children under seven were not observed practicing this inner speech. Alderson-Day and Fernyhough suggest that, "inner speech represents a functional system whereby initially independent neural systems are "wired together" in new ways by social experience" [13]. Therefore by utilizing inner speech by recalling someone else's speech in place of one's own, this transcends the private experience to one that is social. The study indicates that, "inner speech appears to perform significant functions in human cognition, which in some cases reflect its developmental origins and its sharing of resources with other cognitive processes" [13].

The instructional strategy recommended for the most effective learning response is direct explicit instructions of the material. Direct explicit instruction is teacher‐centered instruction that is focused on clear behavioral and cognitive goals and outcomes. These in turn are made 'explicit' or transparent to learners. In direct explicit instruction, teachers follow a step‐by‐step, lesson‐by‐lesson approach to instruction that follows a pre‐determined skill acquisition sequence administered to students placed in ability/achievement groups. Shaywitz studied second and third grade students who were struggling in reading. During a time span of eight months, the students received 50 minutes daily of individual systematic and explicit tutoring. The tutoring was performed by certified teachers who were intensively trained. The results indicated that the, "students in the experiment made significant gains in reading fluency and demonstrated increased activation in left hemisphere regions, including the inferior frontal gyrus and the parietotemporal region" [11]. Direct explicit instruction is a foundational element to learning in most public schools and according to this study continues to be an effective means of teaching and learning. While many models tend to be moving away from direct instruction in favor of more student-centered learning, direct instruction continues to be an effective form of delivering information to children.

It is not only important to research and prove these best practices, but it is also important to implement them in a successful manner. One important element of research is that when it is complete, it is necessary to successfully marry the researched-based practices and procedures with real life situations and

integrate them with genuine classroom experiences. This is not always an easy task to perform. One study discusses educational neuroscience through the economic lens and how linking neuroscience to education can prove to be a big business in itself [15]. Busso and Pollack discuss the implications of incorporating neuroscience into education and how it will inevitably inspire "brain-based" products and opportunities that will inevitably insert themselves into the classroom via lessons, curriculum and professional development. While this exposure is magnificent for the field, it leaves a path wide open for misinterpretation of studies. It also leaves room for misappropriation and misunderstanding of implications from the field. As important as it is to implement research-based practices in the classroom, it is equally important to implement these practices in a manner that is respectful to the field and not allow exploitation in the form of neuroscience-based consumer goods [15]. Neurocognitive reading models and neuroscientific research connections point to the benefits of rapid multisensory attentional shifting [16]. Krause (2015) [16] found that not only did the children's reading speed improve for the group who participated in playing action video games but results demonstrated an improvement equivalent to or more than 1 year of typical reading development and more than 1 year of specific and intensive traditional reading interventions. This underscores the implications that spatial and temporal attentional engagement opportunities potentially have for the improvement of reading abilities (p. 298).

Research suggests the use of action video games for remediation and musical entrainment. Although with a warning of caution about overuse, this element can be seamlessly incorporated into a classroom lesson on reading. Game-based learning is already a function of the classroom and it is a benefit to the kinesthetic learner as well. Incorporating multisensory aspects into learning will benefit most learners anyway. The appeal of gaming in learning seems to be that there is a sense of accomplishment that perhaps isn't present in typical classroom learning. Although this sense of accomplishment may be based on virtual, or something that is not real, the feeling of accomplishment is still present and can be a powerful driving force for learning. While it has been determined best practices are based on proven research, there is research that questions the integrity of the implementation of this research in the general education classroom for students with disabilities. Maheady, Rafferty, Patti and Budin (2016) [17] discuss evidence-based practice and its roots, how it is defined, and its importance. They discuss how students with disabilities are among those who are adversely affected by evidence-based practices, not because of lack of training of special education teachers, but because of lack of research-based training for general education teachers. Implementation of research based practices for special education need to be executed more often in the inclusion general education classrooms as more general education classrooms contain students with disabilities.

While we can't change the disability status of children, we can change the way we teach them and provide an education that is based on proven strategies and learning experiences regardless of the classroom setting and regardless of the teacher's training. It is imperative that researched based practices are incorporated into general education teacher training at the same rigorous level they are incorporated in special education teacher training. In order to advance research in the field of Reading Disability, the National Institute of Health (NIH) funds multidisciplinary Learning Disability Research Centers to undertake studies on defining, classifying and understanding learning disabilities and related disorders including Reading Disabilities. Additionally, these centers examine the effectiveness of Response to Intervention (RTI) as a means of identifying and teaching students with reading difficulties as well as other scientifically tested learning techniques. Besides interventions, advances in brain imaging technology such as Functional Magnetic Resonance Imaging, allow investigators to inspect activity that occurs in different areas of the brain that are associated with reading. Genetics also play a role in reading ability and researchers continue to investigate that front. And finally, often there are comorbidities with Reading Disabilities such as ADHD, and the NIH continues to study Reading Disabilities in conjunction with other factors [18].

Another concern about educating students with disabilities involves external factors that aim to profit from educating them. Dennis (2017) [19] discusses the opportunity that Every Student Succeeds Act (ESSA) has to move away from the No Child Left Behind (NCLB) model and gear toward a model that supports teacher development and expertise. The article discusses the problems associated with the NCLB and the opportunity that is now available to correct those problems with the ESSA especially around literacy education. Dennis states that, "too much credence was given to the results on end-of- year state assessments, resulting in punitive action against both children and teachers. Publishers earn billions of dollars per year selling their no-fail core curriculum and supplemental materials to school districts. The problem, which is no surprise to educators and literacy researchers, is that no one program can meet the needs of all children" (p. 397). Dennis reveals several problematic areas with the education system. First the concern of the assessments, which is universally understood to be an enemy of special education. Children with disabilities traditionally do not do well on standardized tests, and as noted, often the student and or the teacher is punished with low scores or high opt-out rates. Another concern raised which is directly related to employing research based practices is the misuse of the research brand by publishers. A one size fits all curriculum is not effective in delivering a quality education to all children, especially children with disabilities. The winners in these cases are the corporations that get to brand their product in the name of research, and sell

exclusively to education institutions that are pressed to teach a research based curriculum. This big box curriculum is a win for the educational institution because they are given everything needed to meet criteria for teaching research based curriculum. It's a win for the corporations distributing them because they sell exclusively and have immense financial gain [20].

The impact of having a Reading Disability is lifelong. A child's environment shares an important role in reading disability as well as their exposure to learning and it continues to be felt into adulthood. There is negative connotation in labeling a person for any reason and it is no different with labeling someone with a reading disability. As adults, those with RD often have low wages, they end up living in low-rent areas. They are therefore usually exposed to more crime and drugs. They are also more apt to be a victim of a crime, or commit more crimes because of the socio-economic situation he or she is in. Because of their living arrangements and their socio-economic status, the person who has RD is more apt to be subject to negative peer influences and substance abuse. Regardless of their living conditions or their socio-economic status, one who has a Reading Disability may also experience alienation and emotional complications due to the lifestyle they are forced in to. While family history is an important risk factor for Reading Disability, it is still a neurological/biological based disability. Regardless of the traditional practices of reading interventions, it is important to take the time to implement new research-based interventions into the classroom as well as promote a family and community environment that encourages reading, and to prepare a person with a reading disability to be vigilant his or her entire life. Those who have a reading disability never outgrow the disability and will always need to continue to work on their reading and language skills.

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