Brain-Based Strategies for Struggling Readers

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Abstract

Through the advances of fMRI, PET, and EEG brain imaging, neuroscientists have begun to learn about how the brain processes new information, and transfers the new learning from short term to long-term memory. Current brain research can be used as a guideline when creating a preliminary brain-based reading instructional framework. Effective brain-based instruction requires different instructional strategies for individuals based on such variables as prior learning, experience, and a select set of cognitive neuroscience principles. This paper outlines some of the most important information we currently possess on how the brain learns and in particular how the brain learns to read.

Keywords: *Reading, brain-based research, neuroscience, reading strategies, struggling readers, dyslexia;*

Introduction

The ability to read well is a prerequisite skill that every student needs to succeed in school and every adult needs to be successful in their everyday life. Dehaene (2006), a leading cognitive scientist maintains, "Neuroscience today sheds indispensable light on how a reader's brain works and what makes it more or less receptive to different teaching methods" (p, 326). The question of how to best teach students to read has been the source of heated debate for over 100 years amongst educators. Unfortunately, not all students learn to read easily, in fact, many struggle to acquire the skills to become fluent readers throughout the course of their years in school.

Regardless of which instructional method is used, most educators agree that learning to read is a multi-step process. Learning to read can be compared to learning to play a musical instrument. We learn to read at increasingly higher levels of skill development or achievement with training and practice. To decode or sound out words is just a first step in the acquisition of reading proficiency. After obtaining a familiarity with the letter-sound relationships in reading, students must then learn to use this process at an automatic level, to read with fluency.

Sprenger (2013) suggests that "reading is a complete cognitive process that has five essential components built on brain development and experience" (p.75). Reading experts have identified the five major categories of skills which are developed and used as children learn to become skilled readers as: 1) phonemic awareness, 2) phonics instruction, 3) vocabulary, 4) fluency, and 5) comprehension. Two key ideas from neuroscience pertaining to learning and reading instruction were consistently found in the literature: 1) the brain's need for novelty, and 2) the repetition of skills builds and strengthens neurons, multisensory instruction is effective. This paper offers brain specific instructional strategies targeted at teaching the components of reading instruction

The Brain's Need for Novelty

The Reticular Activating System (RAS) is a structure of the brain that performs the first screening of all sensory input before it enters the brain is especially responsive to novelty. Understanding that novel or different instructional activities will be allowed through the RAS allowing your students to attend and receive these activities has important implications for teachers. Changes in the classroom, activities and strategies will catch the RAS's need for novelty. Willis (2010) recommends that teachers use this information about the brain to inform their teaching by incorporating novelty into their daily instructional activities. Neuroscientists believe that concrete vivid images are an important way to convey learning. According to Jensen (2008) the brain has an attentional bias for high contract and novelty and 90 percent of the brain's sensory input is from visual sources. (p. 56). What does that mean for reading teachers? Teachers should incorporate project-based assignments, computers, videos, books, cameras, art supplies, visual aids, and posters, and graphic organizers into their reading and literature lessons.

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The Repetition of Skills

Learning involves the activation of thousands of neurons, which make connections in order to make networks of neurons. As reading skills are practiced, neurons send dendrites to other neurons, creating denser neural connections and possibly increasing myelination. The repetition of correctly performed skills building dendrites has implications for all the components of reading. Regular practice of skills will improve phonemic awareness skills, phonics skills, vocabulary development, fluency, and comprehension by changing the architecture of your students' brains.

Review of the Literature

Reading is a relatively recent cultural creation, and the alphabet itself is thirty- eight hundred years old. When viewed through a neuroscience lens, reading is the development of the brain making connections between thousands of neurons through the process of rehearsal. Neuroscientists have identified the regions of the brain devoted to hearing, vision, speech, as well as the recognition of faces and places. Situated between the regions of the brain, which enable us to recognize faces and the portion, which we use to recognize places, is an area, termed the visual word form. Deheane (2009) explains "an amazing recent discovery shows that there is a specific cortical area for written words, much like the primary auditory area or the motor cortex that exist in all our brains" (p. 51). Deheane (2009) and others have labeled the left occipital-temporal area of the brain the *visual word form area* or the *"brain's letterbox" (*p. 62).

Neuroscientists believe that reading involves the integration of two systems, our ability to speak with that of recognizing objects and faces. According to Dehaene (2009), "Learning to read involves connecting two sets of brain regions that are already present in infancy; the object recognition system and the language circuit" (p. 195). Dehaene (2009) proposes that when a student reads a word, activation begins in the occipital or visual processing portion of the brain followed by neural activity in the left occipital temporal region (Brain's Letter-Box) that extracts the visual word form. Neuroscientists believe that as we learn to read, after numerous times of sounding out a word, the brain stores the word in the visual word form area in the form of a picture.

Deheane hypothesizes that reading hijacks portions of the brain, which were genetically hard-wired for visual recognition. To survive primates needed to have instantaneous face and place recognition to avoid danger and promote survival and that this would account for evolutionary and genetic programming of these highly developed recognition skills.

Phonics

According to Sousa (2005), "Effective programs for phonics instruction help teachers systematically and explicitly instruct students in how to relate sounds and letters, how to break words into sounds, and how to blend sounds to form words" (p. 75). Recent brain research supports an explicit phonetic approach to teaching decoding. Sally Shaywitz, a neuroscientist and professor of pediatrics at Yale University School of Medicine, has studied the brain mechanisms involved in the reading process using magnetic resonance imaging technology. Shaywitz (1999) reported that reading is not a naturally developed skill as is learning to use oral language.

Adams (1990) conducted a meta-analysis of over six hundred reading studies. Two major outcomes of the Adams' report were: (1) explicitly taught phonics resulted in improved reading achievement, and (2) phonics instruction needed to be taught within the context of a balanced program.

The phonetic method of instruction has been used to describe a wide range of techniques, although it is comprised of two main approaches: (1) the synthetic or explicit method, and (2) the analytic or implicit method. Explicit phonics methods teach the letter-sound correspondences in isolation and insist that students blend the individual sounds to pronounce whole words. Anderson et al. (1985) describe what happens in explicit phonics, "In explicit phonics instruction, the sounds associated with letters are identified in isolation and then "blended" together to form words" (p. 39).

Vocabulary

Hart and Risley (2003) in their gold standard research study found that somewhere between eight-six and ninety-eight percent of children's recorded vocabularies matched that of their parents. They also found that by the age of three, children living in professional families had a recorded vocabulary size of 1,116 words whereas children in working class families have a vocabulary size of 749 words. This difference in the vocabulary of children entering schools puts children of working families in a catch-up position as they began to learn to read. However, enriched early childhood programs can help students increase their vocabulary, lessening the existing gap in vocabulary.

Skilled teachers can expand their students' vocabulary by building background knowledge, reading rich literature aloud to their class and inspiring their students to love read. Deheane (2009) reminds us that, "A child must learn the morphology of English prefixes, suffixes, and roots of words, particularly when he comes from an underprivileged background where English is a second language" (p. 328).

Beck and McKeown (1985) suggest that literate people have a vocabulary consisting of three tiers. Tier 1 words are made up of sight words, nouns, verbs, and adjectives such as book, girl, and baby. Tier 1 words include coincidence, masterpiece, industrious, and benevolent. Tier 3 words are domain specific and used during instruction in that content area, Beck advises that teachers concentrate on teaching Tier 1 words to achieve the best vocabulary benefit.

Fluency

Let's turn our attention to reading fluency and look at some of the brain compatible strategies that improve fluency. According to Willis (2008), "Fluent readers can decode, recognize and comprehend the meaning of text at the same time, so their networks fire effectively and efficiently" (p. 47). Using the gradual release of responsibility model, to promote reading fluency is an accepted methodology among reading experts. In step one of this model, the teacher models reading a passage with fluency. During this time, students hear the correct pronunciation and expression for this passage. In step two, students choral read the passage with the teacher. Step three follows when students choral reading without the teacher. Finally, during step four, students read independently after practicing the passage.

Reading Comprehension

Most educators would agree that the ultimate goal of reading is comprehension. When students have mastered the alphabetic principle, and can masterfully decode words and read with fluency, their working memory is freed up for the task of comprehending the text. Students with a strong knowledge about the world and a wide range of things, bring to the reading process prior knowledge. When teachers model comprehension strategies, they show students how to break down the text to extract meaning. When students practice comprehension strategies correctly after teacher modeling, they strengthen their neurological circuitry. Since we know that the brain has a need for novelty, we should vary the stories we use to teach reading comprehension.

Conclusions

Learning to read is not a linear endeavor because the cognitive elements and components of reading support and reinforce each other. Through the advances of fMRI, PET, and EEG brain imaging, neuroscientists have begun to understand how the brain processes new information. This new information regarding how the brain learns to read can help teachers to create effective, research-based lessons and activities.

Currently, brain research can be used as a guideline when creating a brain-based instructional framework. Two of the key ideas from neuroscience pertaining to reading instruction are: 1) the brain's need for novelty, and 2) the repetition of skills builds and strengthens neurons and their connections. Interesting and varied activities appeal to the brain's interest in novel stimuli. Focused practice over time of key reading skills builds dendrites, and increases the density of neural connections which allows students to become fluent readers with a deep understanding of text. Most importantly, the ability to read well often results in the desire to read independently which reinforces the reading components. Good readers very often become avid readers with a passion for reading that lasts a lifetime.

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