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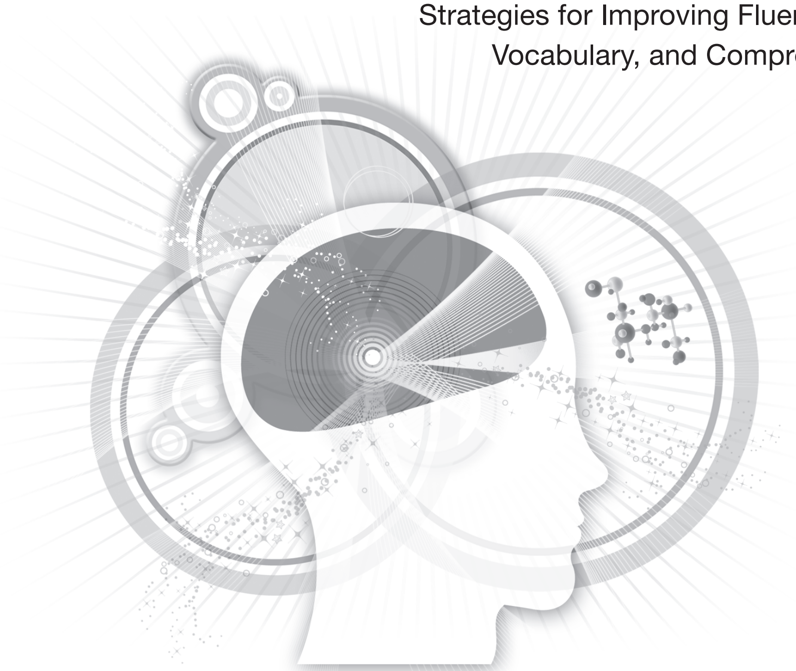
Teaching the Brain to READ

Strategies for Improving Fluency, Vocabulary, and Comprehension



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Introduction

On a hot day, after a climb up a few hundred steps in a historic lighthouse on the Oregon coast, I was weary but ready for the next adventure. I was motivated because I knew it was worth climbing those stairs for the view from the top. In the parking lot I heard a boy of about 5 complain to his parents in the overtired and frustrated whine any parent or teacher recognizes. He didn't want to go to any more lighthouses. They were "stupid and boring," so why should he have to go? As the child became more angry and resistant, his parents suggested that he could sit in the car and calm down and then they could continue the discussion. This boy knew what that meant. He knew there would be no discussion and he would have no say in the outcome, so he just snapped and said, "Sitting isn't leaving!"

The emotions he was feeling are much like those of children who struggle with learning to read and later learning to understand complex text. The frustration, the anxiety about making mistakes, and the impatience build and build as teachers and parents try to coerce the child to climb the lighthouse steps that are the "must-know spelling words."

Reading comes easily to some children, but most struggle with some part of the complex process that begins with phonemes and continues to comprehension of complex text. When students are asked to face stressful reading challenges, they don't feel good about the reading equivalent of a hot day and a daunting staircase.

They will be resistant when the task they are asked to do is either not at their skill level or so unmotivating that they can't or won't persevere. They also don't necessarily value the reward, be it the view from the lighthouse or the reading of a book. They may not think that there is any purpose in struggling to read when they can enjoy stories and even acquire information from videos, movies, television, and being read to. Asking a child to just suck up reading frustration won't work.

Reading is not a natural part of human development. Unlike spoken language, reading does not follow from observation and imitation of other people (Jacobs, Schall, & Scheibel, 1993). Specific regions of the brain are devoted to processing oral communication, but there are no specific regions of the brain dedicated to reading. The complexity of reading requires multiple areas of the brain to operate together through networks of neurons. This means there are many potential brain dysfunctions that can interfere with reading.

Considering all the cognitive tasks required to go from connecting symbols to sounds, sounds to words, words to meaning, meaning to memory, and memory to thoughtful information processing, it is not surprising that an estimated 20 percent to 35 percent of American elementary through high school students experience significant reading difficulties (Schneider & Chein, 2003).

I am filled with awe and respect for every teacher who has helped a student climb the lighthouse stairs by using successful strategies and motivators. Without these teachers, children would never discover that the view from the top is so wonderful.

The Development of Brain-Based Research

The two most important advances in brain-based research are positron emission tomography (PET) and functional magnetic resonance imaging (fMRI). The PET scan relies on one of the brain's properties; it is extremely hungry for glucose and oxygen. PET

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From Syllable to Synapse: Prereading Through Decoding

To understand how students learn to read, we must first understand how the brain processes written information. The process of reading with comprehension appears to involve several essential and interrelated phases:

1. Information intake—focusing and attending to the pertinent environmental stimuli.
2. Fluency and vocabulary—associating the words on the page with stored knowledge to bring meaning to the text.
3. Patterning and networking—recognizing familiar patterns and encoding new information by linking it with prior knowledge.

Comprehension, retention, and use of information obtained through reading appear to be associated with prefrontal lobe activation and storage in neurons of the neocortex. The ultimate site where information gained from reading appears to be processed is in the frontal lobe's executive function centers. When comprehension and retention are successful, executive functioning appears to allow the information to be used to prioritize, plan, analyze, judge, and use the knowledge to make decisions that guide future actions.

After a discussion of mirror neuron research and prereading, there will follow my interpretation of the voluminous data accumulated through neuroimaging and EEG studies about the proposed brain reading systems. The purpose of this research summary and interpretation is not to artificially divide the brain's reading processing into discrete, independent reading pathways. Individual variation is very significant in reading, as it is in most neural activities. Data that has accumulated from neuroimaging studies while subjects are engaged in specific parts of the reading process are difficult to isolate. How do we know the subject is not using some internal visualization recognition rather than auditory recognition when they hear a sound not printed? We don't. Similarly, when subjects see a word, some may be internally verbalizing it while other subjects being scanned are automatically recognizing it as a familiar visual pattern. Given these uncontrollable factors, what I have tried to do with the reading pathway research is provide a general map of the most common brain pathways that appear to be activated in the complex, multistep process of reading. These pathways are generalizations and should not be interpreted as precise roadmaps.

Prereading

Even before children develop the ability to talk or read, their developing brains may be experiencing *imitation learning* through the activation of *mirror neurons*.

Giaccamo Rizzollati's 1996 discovery of what he named mirror neurons was part of his group's study of a cluster of neurons in the premotor cortex of the frontal lobes of monkeys (the region that corresponds to *Broca's area* in the cortex of the frontal lobe of humans—the brain center associated with the expressive and syntactic aspects of language). Rizzollati found that these brain cells fired when the monkeys performed specific actions with their hands such as picking up peanuts and putting them in their mouths. At first it was assumed that these neurons fired because they were sending messages to the hands to perform these motor activities (Rizzolatti, Fogassi, & Gallese, 2001). The researchers were surprised to discover that the mirror neurons that fired in the