Spelling: At the Heart of the Reading Process

During my years of teaching, I saw first hand that poor spellers were poor readers. I also saw, thankfully, how certain types of spelling instruction helped children to become better readers. But I never really connected the spelling and reading dots in a big way. Now, however, after digesting research studies that explore the connections between cognition, brain structure, and literacy, and after reading what writers and researchers like Richard Gentry, Louisa Moats, and Dan Willingham have to say about the importance of spelling for reading, now more than ever, I know that spelling is foundational to reading. You should know it, too.

Brain and cognition research support the idea that effective spelling instruction not only activates reading circuitry but also creates the neural pathways and cognitive "wiring" that lead to higher reading achievement. Over the last ten years, studies have shown that the spelling-reading connection is real, and that it consists of multiple processing systems in the brain that coordinate actions to enable reading (Adams, 2011[i]; Dehaene, S., & Cohen, L, 2011[ii]; Rapp, B., & Lipka, K., 2011[iii]; Norton, Kovelman, & Petitto, 2007[iv]).

Aided by fMRI technology and an increasingly sophisticated understanding of how reading develops, researchers now know that reading is a complex interaction between a number of brain "processors": phonological, orthographic, sound-symbol, and context and meaning. In a student's early years (i.e. elementary school, especially the primary grades), there exists in the brain a greater emphasis on phonological and sound-symbol processing. Later, the orthographic area gains importance, eventually

storing thousands of words in entirety, readying them for later use in reading and spelling.

Creating mental images of correctly spelled words is an act that never ceases. Even as adults we add to our brain-based repository of spelling representations. Why just this year, after writing and revising a series of science articles, I added *camouflage* to my repository. Seeing and spelling *camouflage,* a word I could never before spell correctly, literally dozens of times has permanently etched that word into my grey matter.

It may be helpful to think of the repository of word spellings as a "dictionary in your brain" (Gentry, 2015[v]; Willingham, 2015[vi]). Because your brain activates this repository and draws upon it during fluent reading, it is critical that we help children develop their own dictionaries, for well-developed dictionaries can lead to higher reading achievement.

As I understand it, effective spelling instruction activates the brain circuitry that stores, in the orthographic processing area, the following: letter pairs (such as *ph*, *sh*, and *ch*), morphemes (patterns, such as *ame*, *ight*, and *unk*, as well as affixes and roots), and complete words (such as *chunk*, *shameful*, and *orthographic*). This storing mirrors a child's reading, writing, and spelling development: first words are built up from separate stored sound-letter matches, then chunks, and later whole words. From eye motion studies and cognition studies, we now know that fluent reading is dependent upon the lightning-fast and effortless recognition of *entire words*. Thus, one of our teaching goals should be to help students store thousands of word spellings in their brains.

This storing is a critical component of the reading process, a process that combines the fluent and effortless matching of words a reader sees with word meanings and word spellings. The process is analogous to a walk down a forest path. As you enter the woods, your brain, stocked with literally thousands of concepts, stands ready to match the concepts with whatever you see. As you look around, your constantly thinking brain automatically and accurately matches each seen thing with a concept. That fluffy green stuff? Moss. The jumping grey thing? Squirrel! Each visual image is automatically matched with a name (or names) and a meaning (or meanings). You see and recognize a hemlock, some ferns, a hickory tree, a stream or a bubbling brook, a black-capped chickadee, a woodpecker (is it a downy or a hairy?), a rock with lichen on it, and so on. Of course, the process is more than simple "image calling," just as reading is more than "word calling." As you walk, you also make meaning in a much larger way, and you may notice thoughts arising, such as "I wonder if that woodpecker is finding food for its young," and "Wow, this is a spectacular spring day!"

This act of cognition is similar to how the reading brain works. Scientists have shown that upon seeing a word (essentially a set of squiggles) on a page or screen, in roughly a quarter of a second or less, the brain's reading circuitry coordinates various storage and processing areas. All this storage, processing, and coordination ensure that when a reader looks at a word, the reader knows the sound of the word, the meaning of the word, and the conventional spelling of the word. In the end, brain action enables a fluent reader to read this sentence - *The tired man fill asleep on the bead* – identify any errors, and quickly swap in the correct words for the incorrect.

When, through effective spelling instruction, children encounter dozens of spelling patterns and hundreds (if not thousands) of words, their brain dictionaries

expand and deepen. Put another way, over months and years of practice, children develop word permanency. Willingham specifically puts it in terms of spelling, saying that children "develop an increasing number of mental representations that allow them to identify words by their appearance, i.e., by their spelling." (Willingham, 2014[vii])

One fascinating literacy and cognition study, authored in 2015 by Bruce McCandliss[viii] and his colleagues at Stanford University, seems to give strong support to these important points:

- Reading instruction that emphasizes decoding (phonics) and encoding (spelling) is more effective than instruction that doesn't;
- The way in which words and word parts are taught effects how efficiently brains call up words a day later, as well as learn new words;
- Certain methods of direct and explicit instruction, in the areas of letter-sound correspondences and spelling patterns (phonics), increase the likelihood that readers will develop efficient decoding skills; and most amazingly,
- Certain methods of instruction actually promote the left-lateralization of the brain, strengthening the left hemisphere brain circuits that are most needed for the decoding of sub-lexical units. In other words, specific types of instruction set up positive feedback loops for reading word chunks, allowing poor readers to simultaneously activate *and* build brain circuitry that is both underutilized in their current state of reading development and critical for future fluent reading.

All of this is tremendously exciting. By emphasizing best practice spelling instruction, you stand ready to not only accelerate the achievement of your typical students, but also to help students with dyslexia and other reading difficulties begin to

build better functioning neural pathways, thereby making reading easier for them, both now and later in life.

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[i] Adams, M.J. (2011). The relation between alphabetic basics, word recognition, and reading. In S.J. Samuels & A.E. Farstrup (Eds.), *What research has to say about reading instruction* (4th ed., pp. 4–24). Newark, DE: International Reading Association.

[ii] Dehaene, S., & Cohen, L. (2011) The unique role of the visual word form area in reading. *Trends in Cognitive Science,* 15(6), 254–262.

[iii] Rapp, B., & Lipka, K. (2011). The Literate Brain: The Relationship between Spelling and Reading. *Journal of Cognitive Neuroscience*. 23(5): 1180–1197. doi:10.1162/jocn.2010.21507.

[iv] Norton, E.S., Kovelman, I., & Petitto, L.A. (2007). Are There Separate Neural Systems for Spelling? New Insights into the Role of Rules and Memory in Spelling from Functional Magnetic Resonance Imaging. *Mind Brain Education*. 1(1): 48–59. doi:10.1111/j.1751-228X.2007.00005.x.

[v] Gentry, R. (2015) *Current Research on Spelling Instruction*. Retrieved 2/15/2016 from https://www.zaner-bloser.com/sites/default/files/public/S2731J_Current_Research_on_Spelling_Instruction.pdf

[vi] Willingham, D.T. (2015). *Raising kids who read.* San Francisco, CA: Jossey-Bass.

[vii] Willingham, D.T. (2014). *How Did We Learn To Read? Studies Reveal Best Teaching Methods for Kids*. Retrieved from RealClearEducation.com. http://www.realcleareducation.com/articles/2014/04/29/how_did_we_learn_to_read_956.html

[viii] McCandliss, B., Wise, J., & Yoncheva, Y. (2015). Hemispheric specialization for visual words is shaped by attention to sub-lexical units during initial learning. *Brain & Language*. 145–146 (2015) 23–33

[viii] Gentry, J.R., & Graham, S. (2010). *Creating better readers and writers: The importance of direct, systematic spelling and handwriting instruction in improving academic performance*. Columbus, OH: Saperstein.