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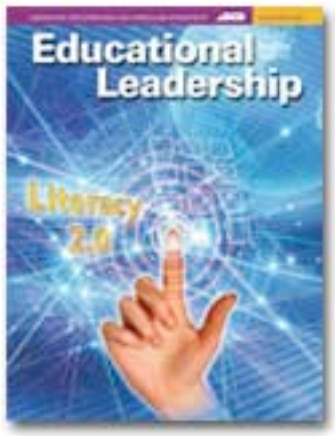

The Importance of Deep Reading

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What will it take for the next generation to read thoughtfully—both in print and online?

Of the three lives Aristotle speaks of, the life of action, the life of contemplation, and the life of enjoyment, we have the two, action and enjoyment, but we lack the other, contemplation. That, I thought, is why ours is a violent city.

A culture can be judged, in Aristotle's view, according to how it pursues three lives: the life of activity and productivity, the life of enjoyment, and the life of contemplation. As our society ineluctably transitions from a print-based to a digital culture, it is important to examine how this transition influences these three lives.

The digital learner seems particularly well-suited for a life of activity and a life of enjoyment. The emphases of digital media on efficient, massive information processing; flexible multitasking; quick and interactive modes of communication; and seemingly endless forms of digitally based entertainment encourage such lives. These emphases, however, can be less suited for the slower, more time-consuming cognitive processes that are vital for contemplative life and that are at the heart of what we call *deep reading*.

By *deep reading*, we mean the array of sophisticated processes that propel comprehension and that include inferential and deductive reasoning, analogical skills, critical analysis, reflection, and insight. The expert reader needs milliseconds to execute these processes; the young brain needs years to develop them. Both of these pivotal dimensions of time are potentially endangered by the digital culture's pervasive emphases on immediacy, information loading, and a media-driven cognitive set that embraces speed and can discourage deliberation in both our reading and our thinking.

Such a perspective presents a Gordian knot of cognitive advantages and challenges for the present and upcoming generations, which, if unaddressed, could affect the already diminishing role of contemplation in our society. Moreover, these emphases of the digital culture may radically change how we learn to read and acquire information. And they may well change how we think.

There is some historical irony here. The ancient Greeks raised similar concerns during a related historical shift—the transition from an oral to a written culture. As reported by Plato, Socrates cautioned his society *against* learning to read. He believed that literacy could alter the kind of memory and probative processes required for the young to deeply pursue and internalize knowledge. He worried that the seeming permanence of writing would delude young people into thinking that they had learned the "truth," when they had just begun the search for it.

Will factors inherent in the digital medium produce similar issues for today's young learners? Will the digital culture produce changes in the more cognitively demanding deep-reading processes? And could these changes have unintended effects on the intellectual development of generations to come? We can gain insights into these questions by examining how the brain learned to read.

The Brain—Rewired

Human beings were never born to read (Wolf, 2007). We were born to see, move, speak, and think. Genetic programs unfold for each of these functions as the organism interacts with the environment.

Not so with reading. Reading is a new cognitive function, invented only 5,500 years ago, which translates into about a minute before midnight on the clock of human evolution. Understanding how humans learned to read helps illumine one of the brain's great, semi-miraculous design features—its plasticity. This aspect of the brain enables us to make whole new circuits and connections among our older, genetically programmed structures. In the case of reading, plasticity enables the brain to form new connections among the structures underlying vision, hearing, cognition, and language. This design feature means that the very organization of the human brain enables it to go beyond itself.

This view has fascinating implications for the history and future of literacy. If the brain has no one programmed reading circuit, then circuitries for different languages and writing systems will not all look the same. An increasing amount of cross-linguistic imaging data demonstrates exactly that. All writing systems share some universal structures, but some orthographies use different structural regions and activation patterns (Bolger, Perfetti, & Schneider, 2005).

For example, the brain of a reader of Chinese requires extensive activation of visual regions in the occipital areas, a physiological correlative of the cortical "space" needed for acquiring thousands of Chinese characters (Tan, Spinks, Eden, Perfetti, & Siok, 2005). By contrast, alphabetic reading brains require more processing in the temporal and parietal regions to accommodate the alphabet's early emphases on sounds (phonemes) and the rules of correspondence to visual (letter) symbols. In such a way, the requirements of individual writing systems shape reading circuits in the brain.

The amount and quality of experiences with written language also shape reading circuits. Fascinating differences exist between expert readers and novice readers, who are just learning to set up their reading circuits. Novice readers in English must learn a great many things—from the not-so-simple alphabetic principle, to the varied sound-symbol correspondence rules in English's

orthography, to decoding hundreds of new words. As a result, in the beginning, young reading brains need to activate far more expansive brain regions than adult brains do. Gradually, as the expert reading brain emerges over time, the original reading route changes to a set of pathways that are streamlined for decoding and that can now incorporate ever more sophisticated semantic and syntactic processes (Sandak, Mencl, Frost, & Pugh, 2004).

The properties of print itself also play a role in shaping the reading circuit. For instance, the stability and linearity of printed text as well as the layers of thought and composition that it represents invoke the reader's complete attention to understanding the thoughts on the page. Thus, becoming fluent in the decoding processes enables readers to allocate the time and attention necessary to process the ideas, information, story, and intellectual arguments and assumptions presented. To be sure, such comprehension is not simple, nor does it develop overnight in terms of clues to aid understanding. Little is given to the reader outside the text. For that reason, readers must engage in an active construction of meaning, in which they grapple with the text and apply their earlier knowledge as they question, analyze, and probe. In the process, they learn to build knowledge and go beyond the wisdom of the author to think their own thoughts.

This latter capacity, which we refer to as the Proustian principle (Wolf, 2007), requires great amounts of attention, effort, motivation, active imagination, and time—time for the reader and time for the brain, a few hundred milliseconds to be exact. Depicted in imaging research on comprehension, these milliseconds involved in deep reading require extensive activation of both hemispheres (Keller, Carpenter, & Just, 2001). By the time the expert reader has comprehended a text at a deep level, all four lobes and both hemispheres of the brain have contributed significantly to this extraordinary act—a neural reflection of the many processes involved. What we read and how deeply we read shape both the brain and the thinker.

Physiologically and intellectually, human beings are substantively changed by the evolving richness of the neural networks that we add through our reading over time. That said, the expert reading brain is not a given. Any reading circuit can emerge, including one that uses only part of its potential.

The Distracted Reader

With digital text, the potential for creativity, learning, and discovery that encourage deep thought is immense. For example, interest in a Shakespearian play can drive a discovery process that links the reader not only to the text of the play and various comprehension supports, but also to relevant historical information, videos of the play, discussion groups, articles from noted literary critics, and artistic interpretations that may drive deeper reflection.

However, this great gift of easily accessible, readily available, rich information has the potential to form a more passive and, as Socrates put it, an even more easily "deluded" learner. Although this is possible within any medium, online reading presents an extreme of sorts with its uncensored, unedited maelstrom of anything and everything that is always available and capable of diverting one's attention.

As the medium itself offers little in the way of clear boundaries, standards, and organization, the ability to discern these features is a necessary skill for the online reader—in particular, the ability to read critically when considering the quality of text and the reliability of online sources. As Nick Carr opined in his article, "Is Google Making Us Stupid?" (2008), sources are often prioritized on the basis of the number of hits rather than on the quality of information or whether the information comes from an adjudicated source.

Taking advantage, then, of the wealth of information that is always just a click away demands the use of executive, organizational, critical, and self-monitoring skills to navigate and make sense of the information. Thus, even as this hyperlinked environment offers seemingly endless opportunities to enhance comprehension through easy access to information such as vocabulary and background knowledge, students typically underuse such opportunities (Dalton, Pisha, Eagleton, Coyne, & Deysher, 2002; MacArthur & Haynes, 1995). This behavior suggests that readers have not yet developed the comprehension-monitoring skills and self-awareness necessary to fully avail themselves of the supports of the Web. Students are often unable to evaluate whether links will be useful or simply distracting (Kamil & Lane, 1998). Without this knowledge, they may find themselves mired in irrelevant and unrelated information.

As opposed to the relative linearity of printed text, the very appearance of digital information at once presents both new richness and new challenges for the online reader. The fluid, multimodal nature of digital information enables online readers to become immersed in a subject, both visually and verbally. Even as this presentation of material in several different modes provides the reader with multiple points of entry into a subject, it also opens the door to great distraction. It further requires that the reader understand how to evaluate visual information and make meaning in and across several different modalities. Indeed, some research indicates that elementary-age students are less likely to recall information from a source when it is filled with many pictures and animations in addition to the text (Eastin, Yang, & Nathanson, 2006).

What We Stand to Gain—and Lose

Online reading has the potential to mold a mind adept at effectively finding, analyzing, and critically evaluating and responding to information across several modalities. The participatory nature of the Web may help foster young minds skilled in communicating, collaborating, and creating in new ways. And the deictic nature of technology (Leu, Kinzer, Coiro, & Cammack, 2004)— that is, the almost momentary creation of new modes of representing information and connecting digitally—may promote problem solving and lifelong learning for many.

However, many of the skills involved in maximizing the potential of digital reading, such as choosing the right search words and locating and evaluating information, require a host of decision-making, attention-monitoring, and executive skills. Many of these skills are known to develop later in life. For example, young children, who are concrete in their thinking and who are just learning to discern fact from fiction, are less likely to successfully navigate the online world and understand all it has to offer.

An early immersion in reading that is largely online tends to reward certain cognitive skills, such as multitasking, and habituate the learner to immediate information gathering and quick attention

shifts, rather than to deep reflection and original thought. The immediacy and volume of available information may well delude new learners into thinking they have what they need to know. From a pedagogical perspective, when information seems so complete, what motivation is there to go beneath and beyond it? From a cognitive neuroscience perspective, the digital culture's reinforcement of rapid attentional shifts and multiple sources of distraction can short-circuit the development of the slower, more cognitively demanding comprehension processes that go into the formation of deep reading and deep thinking. If such a truncated development occurs, we may be spawning a culture so inured to sound bites and thought bites that it fosters neither critical analysis nor contemplative processes in its members. As technology visionary Edward Tenner (2006) remarked, it would be a shame if the very intellect that created this new technology was threatened by it.

Encouraging Deep Reading Online

Here lies the crucial role of education. Most aspects of reading—from basic decoding skills to higher-level comprehension skills—need to be explicitly taught. The expert reading brain rarely emerges without guidance and instruction. Years of literacy research have equipped teachers with many tools to facilitate its growth (see Foorman & Al Otaiba, in press). For example, our research curriculum, RAVE-O (Wolf, Miller, & Donnelly, 2000), uses digital games to foster the multiple exposures that children need to all the common letter patterns necessary for decoding. Nevertheless, too little attention has been paid to the important task of facilitating successful deep reading online.

The medium itself may provide us with new ways of teaching and encouraging young readers to be purposeful, critical, and analytical about the information they encounter. The development of tools—such as online reading tutors and programs that embed strategy prompts, models, think-alouds, and feedback into the text or browser— may enhance the kind of strategic thinking that is vital for online reading comprehension.

For example, programs like the Center for Applied Special Technology's (CAST) "thinking reader" (Rose & Dalton, 2008) embed within the text different levels of strategic supports that students may call on as needed, such as models that guide them in summarizing what they read. In this way, technology can help scaffold understanding (Dalton & Proctor, 2008). Such prompts help readers pause and monitor their comprehension, resist the pull of superficial reading, and seek out a deeper meaning. For example, in the CAST Universal Design Learning edition of Edgar Allan Poe's "The Tell-Tale Heart" (http://udleditions.cast.org/INTRO,telltale_heart.html), questions accompanying the text ask readers to highlight words that provide foreshadowing in a given passage; to ponder clues about the narrator as a character in the story; and to use a specific reading strategy (such as visualize, summarize, predict, or question) to better understand a passage.

Well-designed WebQuests can also help students learn to effectively process information online within a support framework that contains explicit instruction. Even practices as simple as walking a class through a Web search and exploring how Web pages may be biased or may use images to sway readers help students become careful, thoughtful consumers of online

information. Instruction like this can help young minds develop some of the key aspects of deep reading online.

The Best of Both Worlds

No one has real evidence about the formation of the reading circuit in the young, online, literacy-immersed brain. We *do* have evidence about the young reading brain exposed to print literacy. Until sufficient proof enlarges the discussion, we believe that nothing replaces the unique contributions of print literacy for the development of the full panoply of the slower, constructive, cognitive processes that invite children to create their own whole worlds in what Proust called the "reading sanctuary."

Thus, in addition to encouraging explicit instruction of deeper comprehension processes in online reading, we must not neglect the formation of the deep-reading processes in the medium of human's first literacy. There are fascinating precedents in the history of writing: The Sumerian writing system, in use 3,000 years ago, was preserved alongside the Akkadian system for many centuries. Along the way, Akkadian writing gradually incorporated, and in so doing preserved, much of what was most valuable about the Sumerian system.

Such a thoughtful transition is the optimal means of ensuring that the unique contributions of both online and print literacies will meet the needs of different individuals within a culture and foster all three dimensions of Aristotle's good society. Rich, intensive, parallel development of multiple literacies can help shape the development of an analytical, probative approach to knowledge in which students view the information they acquire not as an end point, but as the beginning of deeper questions and new, never-before-articulated thoughts.

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