

How children learn to read: An overview

**The wars are over—
the science is settled**



BY **COREY BORGMAN**
AND **ANGELINE LILLARD**

A compelling and growing body of evidence supports Montessori as an educational approach that improves students' social, emotional, and academic outcomes while functioning as a lever for equity and educational justice.

Montessori outcomes have been particularly compelling and consistent for reading and literacy. For those who may wonder about the secret in the Montessori sauce, we can point to the fact that Montessori education has always been based on careful scientific observations of how children learn. For over a century, as mainstream educational practice and policy has vacillated between phonics-based, whole-language, and balanced literacy approaches (to name a few), Montessorians have continued to base curricular and instructional decisions on empirical evidence.

It is no wonder, then, that as the volume rises on our national conversation around the science of reading, practitioners, researchers, and advocates are moving to highlight the longstanding alignment between Montessori literacy instruction and current understandings from cognitive psychology, developmental psychology, and neuroscience.



A literacy-rich environment

This article provides a brief overview of those understandings, offering the appropriate background knowledge to approach other contributions to this issue.

While definitive claims are rare in education research, findings related to reading science are an exception: four decades of research in both laboratory and field have been marked by widespread agreement amongst scientists and literacy experts as they work to build a model of reading acquisition.

A major takeaway from those forty years of scientific inquiry? That neither phonemic awareness (the recognition of isolated speech sounds) nor decoding (the mapping of those sounds onto written symbols) are innate functions of the human brain. Alphabetic writing was invented a mere 3,800 years ago—nowhere near the scale of time required for the human brain to evolve

in response. This means that, whereas related brain functions like spoken language will develop fairly spontaneously within the context of an enriched environment, this is not the case with reading.

Instead, the neural networks relevant to reading develop in response to explicit instruction and deliberate practice. In short, approaches that emphasize direct instruction in phonemic awareness and phonetic decoding are known to optimize the ease and speed with which all children learn to read, and are particularly crucial for children at risk for reading challenges. Whole-language strategies, on the other hand, which encourage children to recognize words via their overall shape or through context clues, are not.

Via explicit instruction in

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letter-sound correspondence, a region in the learner's left temporal lobe, previously dedicated to facial recognition, is gradually repurposed for the task of reading. This area, referred to as the "visual word form area," will henceforth serve as a switchboard between visual networks at the rear of the brain (which process the image of written marks on paper) and two regions nearer the front of the brain dedicated to speech and meaning, respectively.

In a pre-literate brain, this visual word form area does not activate in response to the image of letters or words—there is no neural pathway connecting the visual stimulus of these strange marks on paper to the processes of speaking or retrieving meaning from words. Fascinatingly, though, brain imaging studies show this neural connection beginning to develop after just five hours of explicit decoding instruction! According to Stanislas Dehaene in his book *Reading in the Brain: The New Science of How We Read*, with evidence-based instruction and deliberate practice, the typical learner will progress through three phases of reading acquisition as their brain works to develop the pathways described above.

In the first, "logographic," phase, children memorize a handful of key words (often their own name and perhaps some frequently encountered brand logos) by sight alone, as if they were pictures. This is a key development, marking the child's dawning realization of the connection between marks on paper and spoken language. At the same time, the logographic approach is not a sustainable one, as the child cannot possibly memorize the holistic "picture" of every word in the English language. Neither can a teacher realistically introduce them all.

A new strategy is required for continued growth, and the learner transitions into the "phonological" phase. Here a child begins to grasp the alphabetic principle—that each grapheme (a

letter or grouping of letters) maps directly onto a corresponding phoneme (a basic unit of speech sound) and furthermore, that mastery of this one-to-one code will enable independent decoding of unlimited new words.

Meaning is not accessed directly at this point; rather, written symbols are first processed by the visual region of the brain, passed from there to the visual word form area, then the speech

from word length, and reading strategies more closely resemble those proposed by whole-language advocates. Importantly, this is only achieved once one has attained fluent and accurate decoding skill. In other words, whole language reading is a result of instruction and practice, and not a strategy for it.

So we see that a child's literacy development is supported from birth by

Neural networks develop in response to explicit instruction and deliberate practice

area, and lastly to the region responsible for retrieval of meaning. During the phonological phase, there is a significant relationship between word length and reading speed, demonstrating that emerging readers decode grapheme by grapheme, a learning strategy inadequately supported by whole-language approaches.

As a phonological reader gains increasing fluency and accuracy, they reach the third and final "orthographic" phase of reading development. This phase is marked by the gradual development of dual, parallel neural routes connecting visual processing to meaning. While the existing phonological route is reinforced through practice, the visual word form "switchboard" begins to build a second pathway (the "lexical route") which bypasses spoken language and connects visual information directly to the vast catalog of definitions and lexical relationships stored in the brain's "meaning" region.

The brains of expert readers operate according to this "dual pathways" model, in which phonological and lexical routes activate in a simultaneous and mutually supportive fashion. At this point, reading speed decouples

facilitation of phonemic awareness and later, usually in the pre-K and Kindergarten years, through explicit instruction in decoding. But Dan Willingham, in *The Reading Mind: A Cognitive Approach to Understanding How the Mind Reads*, urges educators and parents to remember that "teaching reading is not just a matter of teaching reading" (p. 127). At least two additional factors, namely background knowledge and reading behaviors, are highly influential for fluency and comprehension.

Willingham illustrates that comprehension is significantly impacted by the volume of background knowledge and relevant vocabulary that a reader brings to a piece (a point made famous by E.D. Hirsch and his Core Knowledge curriculum). In fact, studies have shown that a typically developing reader's prior content knowledge contributes far more to their comprehension and recall than do reading or verbal skills. This suggests that many tests, ostensibly serving as targeted measures of reading skill, are in actuality heavily influenced by content familiarity.

In addition to explicit instruction

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in phonemic awareness and decoding, then, children require a broad and carefully sequenced curriculum that is integrated across content areas. Curricular breadth equips learners with the array of background knowledge necessary to comprehend new texts, while mindful sequencing ensures that the volume of newly introduced vocabulary and content is challenging yet attainable.

In addition to cultivating a broad knowledge base, the development of positive reading behaviors is another essential element for successful reading. Motivation is a crucial factor, Willingham argues, because while leisure reading has a strong positive effect on skill level, it is, of course, dependent on a child's voluntary reading behaviors. Those reading behaviors are shaped by three primary factors: one's reading attitudes, motivation, and environmental characteristics impacting one's likelihood of acting on that motivation.

In keeping with these factors, The Reading Mind offers several helpful strategies for supporting the development of positive reading habits. First, because we know that attitudes are driven more by affect than by logic, providing positive, enjoyable early reading experiences will be more influential than will arguments for reading's importance or value.

Motivation, meanwhile, is related to one's perception of both a task's value, and the likelihood of its successful completion. Children may be motivated to read, therefore, by potential outcomes such as learning something new or sharing an interest with peers, but are more likely to act on that motivation when texts are carefully chosen for probable success, and in the context of a mindfully prepared environment. Such an environment, according to Willingham, eschews motivation-eroding external rewards, contains a plethora of books that are visible and within easy reach, and in

which access to distracting alternatives (read: screen/video content) is limited.

Educators and parents, therefore, can support the development of positive reading behaviors by fostering positive associations with reading; selecting interesting, relevant, and appropriately leveled texts; making the choice to read both easy and preferable to available alternatives; and letting the reading be its own reward. Once positive habits are established, the relationship between reading behavior and skill level is reciprocal—children who read will experience more enjoyment and less tedium, increasing motivation and the likelihood of more voluntary reading.

Reading experts estimate that with proper, evidence-based reading instruction, the vast majority of children could be brought to grade-level fluency, freeing teachers' time and effort for further support of struggling readers. Readers familiar with Montessori education will have noticed the clear alignment between reading science and Montessori practice, as detailed by Susan Zoll in this issue (page 1).

Focusing just on the Primary (ages three to six) classroom, we see that Montessori begins with phonemes, exploring sounds, and then connecting them—as early as 30 months of age—to sounds. Thus it taps right into the phonological phase, possibly even before children recognize any words logographically.

We know that active, embodied cognition supports learning best. Montessori has a plethora of other materials supporting children in the phonological phase, from sandpaper letters to the moveable alphabet to phonogram cards and baskets of phonetic objects with labels; ample books of poetry and inviting topics are available in a cozy reading corner.

The materials themselves also motivate children, making reading fun—they learn about parts of speech with

a small farm of animals, and by carrying out commands with command cards—and diagramming sentences is much more interesting with the grammar boxes of symbols. As children are moving into the orthographic phase, their motivation to read increasingly complex texts is supported by the fact that they are reading to learn about things they personally want to learn, and learning for making reports and charts with peers that they will share back with the class.

But does this all work in practice? Studies suggest that yes, the Montessori approach to reading correlates with, even produces, better reading outcomes. Thus, as educators and policymakers are beginning to fully acknowledge the importance of science-based reading instruction, the Montessori approach makes excellent sense.

Dr. Corey Borgman is the Director of Education & Outreach at UVA's Montessori Science Program.

Dr. Angeline Lillard is a Professor of Psychology at UVA, and the Director of UVA's Early Development Lab.

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