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Research Digest

The Science of Reading and Where It Stands in Adult Education

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The science of reading refers to the extensive body of research on how we learn to read and the most effective methods for teaching reading. Our knowledge of what works in reading instruction is based on decades of rigorous, scientifically based research in the fields of education, cognitive psychology, and neuroscience. This research digest provides an overview of the science of reading, followed by a brief summary of research-based frameworks that explain the reading process, and concludes with a discussion of reading research in adult education.

The Evolution of the Science of Reading

The science of reading is best understood in the context of the Reading Wars, a contentious historic debate about the most effective methods for teaching children to read. This debate centered on two opposing schools of thought: phonics-based instruction and whole language instruction. Instruction based on phonics focuses on the relationships between letters and sounds, teaching readers to sound out words and recognize common letter combinations (Mesmer & Griffith, 2005). This instructional approach is typically explicit and sequential, designed to provide children with the necessary tools to "crack the alphabetic code" and become skilled, independent readers (Castles et al., 2018; Ehri, 2020). Conversely, the whole language movement posited that children learn to read through exposure to authentic texts and characterized reading as a "psycholinguistic guessing game" (Goodman, 1967), in which readers must use contextual cues to predict or recognize words. Whole language teaching methods focus on the meaning of connected text, eschew a systematic approach to teaching phonics, and may limit explicit phonics instruction to short lessons delivered in response to student errors (Dahl & Scharer, 2000; Rayner et al., 2001; Stahl et al., 1994).

The pendulum has swung back and forth between phonics-based instruction and whole language instruction in the United States (Chall, 1967; Hempenstall, 1997). In an effort to "end" the Reading Wars, an instructional philosophy known as balanced literacy emerged as a middle ground between these two approaches in the 1990s (Pressley, 1998; Wharton-McDonald et al., 1997). Balanced literacy ostensibly incorporates elements of skills-based and meaning-based methods for teaching children to read (Frey et al., 2005). Critics contend that balanced literacy instruction includes scientifically unsupported practices, such as using picture clues to guess unknown words, and avoids systematic phonics instruction to the detriment of struggling readers (Moats, 2007; Winter, 2022).

In the late 1990s, a federal initiative to use research evidence to inform reading instruction took hold, when Congress convened the National Reading Panel with a mandate to evaluate all available reading research and identify the most effective evidence-based methods of teaching reading. This panel of nationally recognized reading experts included scientists, teachers, administrators, and teacher educators selected by the National Institute of Child Health and Human Development, part of the National Institutes of Health (NIH), in collaboration with the U.S. Department of Education (Shanahan, 2005). The National Reading Panel's landmark report, based on a review of hundreds of research studies, identified five key components of effective reading instruction: phonemic awareness,

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which refers to the ability to identify and manipulate the individual sounds in spoken words; phonics, which, as discussed previously, refers to teaching the relationships between letters or letter combinations and their sounds; vocabulary, which refers to the ability to understand the meanings of words and use words to convey their meaning accurately; fluency, which refers to the ability to read text with accuracy, ease, and appropriate expression; and comprehension, which refers to the ability to read text and understand its meaning (National Reading Panel, 2000). Some of these findings were echoed in similar comprehensive reviews conducted in the United Kingdom and Australia (Rose, 2006; Rowe, 2005).

Since the publication of the National Reading Panel's report, the science of reading has gained traction in the 21st century, as policymakers in the United States have moved toward evidence-based methods of teaching reading. The Institute of Education Sciences (IES), the research arm of the U.S. Department of Education, has published practice guides in the past two decades that highlight evidence-based recommendations for teaching reading in the K-12 system, focusing on the five components of effective reading instruction identified by the National Reading Panel (e.g., Foorman et al., 2016; Vaughn et al., 2022). As of October 2024, 40 states and the District of Columbia have passed legislation or implemented state policies that require evidence-based reading instruction (Schwartz, 2024).

Research-Based Frameworks for Reading

The science of reading can be further unpacked by examining two prominent frameworks that are aligned with the research evidence on how we learn to read and identify the key skills involved in the process of reading. The first framework is the Simple View of Reading, proposed by Gough and Tunmer (1986), which states that reading comprehension is influenced by two components: decoding and linguistic comprehension. Decoding refers to the ability to quickly sound out words using letter-sound correspondence rules and, eventually, recognize familiar letter patterns, while linguistic comprehension refers to the ability to understand the meaning of spoken language. Importantly, the Simple View of Reading is expressed as an equation, simplified as *Reading Comprehension = Decoding* x *Linguistic Comprehension*, which indicates that proficient reading comprehension is achieved through the multiplication (or interaction) of decoding and linguistic comprehension. This interaction implies that insufficient mastery of either component can hinder overall reading performance.

The second framework is the Reading Rope, formulated by Scarborough (2001), which vividly portrays the process of reading as a finely woven rope, with the strands of the rope representing the diverse array of skills essential for proficient reading. The Reading Rope recognizes two broad categories – word recognition and language comprehension – that map onto the components of the Simple View of Reading and can be deconstructed to identify specific skills involved in reading. Word recognition is broken down into phonological awareness, which refers to recognizing and manipulating the spoken parts of words (e.g., syllables); decoding; and sight recognition, which refers to the ability to quickly recognize and read words at sight, without needing to sound them out (Ehri, 2005; Perfetti, 2007). Language comprehension is broken down into more complex skills, including background knowledge, which refers to the prior experiences and information that a reader brings to the text; vocabulary; language structures, which refer to the understanding of how words are organized within sentences and paragraphs to covey meaning; verbal reasoning, which refers to the ability to make inferences and understand nonliteral aspects of the text (e.g., metaphors); and literacy knowledge, which refers to the understanding of writing goals and conventions (Duke & Cartwright, 2021). All of these skills interweave to form that rope that represents reading proficiency, which improves as the reader becomes more efficient in word recognition and more strategic with language comprehension.

Together, the Simple View of Reading and the Reading Rope explain that readers must be able to (a) quickly process written words, translating them from text to language (decoding or word recognition) and (b) accurately understand the meanings of those words and how those meanings come together to form sentences and a larger discourse (linguistic comprehension or language comprehension). Indeed, a significant body of research shows that both word recognition and language comprehension are correlated with reading achievement

in the K-12 system (Carver, 1998; Chen & Vellutino, 1997; Foorman et al., 2015; Johnston & Kirby, 2006). While word recognition is critical in early grades, its importance gradually diminishes as students progress through grade levels, with language comprehension exerting a greater influence on reading comprehension in high school (Hoover & Gough, 1990; Kendeou et al., 2009; Lonigan et al., 2018; Tilstra et al., 2009; Vellutino et al., 2007). Additionally, researchers have documented that reading difficulties can be traced to poor performance in one or both of these areas (Aaron et al., 2008; Brasseur-Hock et al., 2011; Catts et al., 2006) and that systematic instruction focused on phonics and decoding can improve reading outcomes for elementary school students with dyslexia (Shanahan, 2023).

Reading Research in Adult Education

What we know about effective reading instruction in the K-12 system may not directly translate to the adult education context. Individuals who participate in adult education programs comprise a heterogenous population, with diverse cultural, language, and educational backgrounds (Lesgold & Welch-Ross, 2012). Unlike school-going youth, adult learners must manage their classes alongside work and family responsibilities (Greenberg, 2008). With respect to the science of reading, child-based research findings need to be evaluated separately for adults who are improving their literacy skills (Greenberg et al., 2017; Mellard et al., 2010). Therefore, it is important to consider the evidence and limitations presented by reading research involving adult learners.

First, robust evidence on effective reading instruction in adult education settings is limited. The strongest evidence in educational research comes from randomized controlled trials, which systematically assign learners to separate groups to compare the effects of different instructional approaches, ensuring unbiased results. Only a small number of randomized controlled trials involving reading instruction have been conducted with adult learners (Kindl & Lenhard, 2023). Some of these studies were funded through a 2001 grant competition for research on adult and family literacy that was jointly sponsored by the NIH, the U.S. Department of Education, and the National Institute for Literacy, reflecting a key federal investment in adult education research (Miller et al., 2011). Overall, the evidence suggests that implementing an instructional program that includes a systematic phonics component can support adult learners in improving their decoding skills, particularly those who are nonnative speakers of English (Alamprese et al., 2011; Condelli et al., 2010). In the context of individual tutoring, vocabulary instruction focused on analyzing the structure of meaning within words also shows promise for boosting decoding performance (Gray et al., 2018). However, the burden of managing multiple responsibilities and stressors often disrupts adult learners' participation in instructional programs, which can impact the success of reading interventions in adult education (Greenberg et al., 2013; Miller et al., 2011).

Second, correlational research focused on adult learners' reading skills lends support to the Simple View of Reading and the Reading Rope. Adult learners' performance on reading comprehension assessments is associated with both word recognition and language comprehension (Barnes et al., 2017; Mellard et al., 2010; Sabatini et al., 2010; Talwar et al., 2021). Multiple studies have highlighted the importance of the specific skills recognized in the Reading Rope framework, including phonological awareness, decoding, vocabulary, and background knowledge (see Tighe & Schatschneider, 2016 for a meta-analysis). Additionally, researchers have identified different reading profiles based on adult learners' performance across these areas, including two notable groups: (a) readers who are relatively proficient decoders but struggle with understanding the meaning of what they are reading and (b) readers who have difficulty with sounding out words but have a stronger grasp on oral language (Binder & Lee, 2012; MacArthur et al., 2012; Mellard et al., 2009; Talwar et al., 2020).

Third, readers' prior knowledge may hold particular importance in the context of adult education. Adults carry a wealth of experiences and skills, which shape the vocabulary and background knowledge that they bring to a reading activity. Depending on their unique lived experiences, adult learners may have mastered vocabulary used in authentic, everyday situations but might encounter knowledge gaps in academic vocabulary (Pae et al., 2012; Strucker, 2013). Overall, adult learners with more extensive vocabulary and background knowledge are more likely to be successful at making inferences while reading (Tighe et al., 2023). Their prior knowledge of the

world influences how well they understand text, especially the type of longer passages one might encounter on high school equivalency assessments (Strucker, 2013).

Lastly, promising research is underway that could further strengthen the evidence base for effective reading instruction in adult education. As a notable example, IES funded the Center for the Study of Adult Literacy, a national research and development center that operated from 2012 to 2022 and piloted a multicomponent reading curriculum in adult education settings (National Center for Education Research, 2022). The curriculum included instruction on decoding, vocabulary, and reading comprehension, supported by self-paced reading comprehension practice in an interactive online program (Einarson et al., 2021). The research findings could provide insight into whether this curriculum supports adult learners in building the skills that are important for reading, such as those identified by the Simple View of Reading and the Reading Rope frameworks. Another example of innovative reading research in progress is the AutoTutor for Adult Reading Comprehension project, which is part of the Collaborative Research for Educating Adults with Technology Enhancements (CREATE) Adult Skills Network funded by IES in 2021 (CREATE Adult Skills Network, n.d.). The goal of this project is to develop, refine, and pilot a standalone intelligent tutoring system that supports adult learners in learning reading comprehension strategies and basic digital literacy skills. The research findings could shed light on whether this online instruction system helps adult learners in improving their reading proficiency. Once this technology is developed, it could potentially serve as a personalized learning tool for adult learners in different locations and provide instructors with data-driven insights into learners' progress.

Conclusion

Despite its profound impact on our understanding of effective reading instruction, the science of reading has not been immune to critique. Critics argue that it overly emphasizes phonics and decoding, which is widely considered a mischaracterization of the evidence generated by decades of reading research (Seidenberg, 2019; Shanahan, 2003; Wexler, 2023; Wilkins & McNamara, 2023). With respect to phonics, the evidence demonstrates that systematic phonics instruction is more advantageous than teaching approaches in which phonics is taught unsystematically or not taught at all (Ehri et al., 2001; Stuebing et al., 2008). Additionally, the research also shows that fluency, vocabulary, and comprehension are critical components of effective reading instruction (Castles et al., 2018; National Reading Panel, 2000). For readers in the early stages of acquiring literacy, instructional practices informed by the science of reading include building vocabulary knowledge, teaching phonics-based word reading strategies, and playing games to identify and fix comprehension errors (Foorman et al., 2016). For more advanced readers, evidence-based practices include teaching how to analyze prefixes and suffixes to derive the meanings of complex words and facilitating partner work that encourages readers to summarize their understanding of a connected text to a peer (Vaughn et al., 2022).

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