

WATERFORD.ORG & THE SCIENCE OF READING

WHAT DOES NEUROSCIENCE TELL US ABOUT HOW THE BRAIN LEARNS TO READ?

In the brain of a proficient reader, neural pathways connect the areas of the “reading network” in the left hemisphere. In the brain of a developing reader, these connections are still being formed. Learning to read literally changes the brain.

Developing readers decode words, relying on the area of the brain that links the sounds and symbols of language (1). Decoding reveals a word’s pronunciation (2), which then triggers its meaning (3). The student is beginning to read, but not fluently.

Proficient readers recognize words instantly, eliminating the need for decoding. This is possible because the process of learning to read causes a specialized area to develop within the brain’s visual system—the visual word form area, named the “letterbox” by neuroscientist Stanislas Dehaene (2009). The letterbox supports orthographic mapping, the process that permanently stores words in long-term memory. When a student sees words that have been mapped to long-term memory, neurons fire in the letterbox (1), then the oral language (2) and meaning (3) areas of the brain (Dehaene 2009). The student is now reading fluently.



WHAT DOES SCIENCE-ALIGNED EDUCATIONAL RESEARCH TELL US ABOUT EFFECTIVE READING INSTRUCTION?

Word recognition skills, detailed at the bottom of the graphic, are woven together to support increasingly *automatic* reading. Language comprehension skills, shown at the top, work together so that reading can become increasingly *strategic*. These two groups of skills are woven together to make proficient reading possible. Waterford’s six instructional strands for literacy align with Scarborough’s Reading Rope.

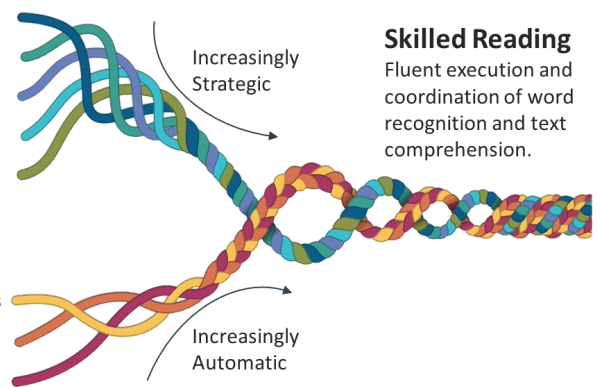
Waterford’s Instructional Strands for Literacy



Scarborough’s Reading Rope

Language Comprehension

- Background Knowledge
- Vocabulary Knowledge
- Language Structures
- Verbal Reasoning
- Literacy Knowledge



Word Recognition

- Phonological Awareness
- Decoding (and Spelling)
- Sight Recognition

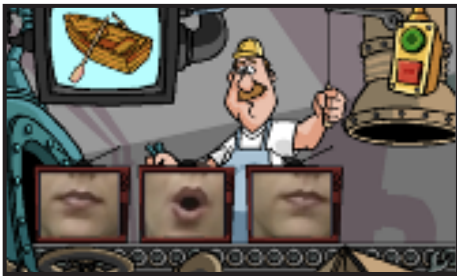
Scarborough, H. 2001. Connecting early language and literacy to later reading (dis)abilities: Evidence, theory, and practice. Pp. 97-110 in S. B. Neuman & D. K. Dickinson (Eds.) *Handbook of Early Literacy*. NY: Guilford Press.

HOW IS THE SCIENCE OF READING INTEGRATED INTO THE WATERFORD READING ACADEMY JOURNEY?

The human brain is wired for speech but must be deliberately trained to read. Waterford’s curriculum is built on a foundation of research from the neuroscience and education fields that sheds light on the key elements of effective reading instruction.



PHONOLOGICAL AWARENESS



Phonemic awareness is the best predictor of students’ ability to identify words quickly and accurately (Shaywitz & Shaywitz, 2020). Because oral language is experienced as a continuous stream of speech, breaking it into smaller units of sound is not intuitive—phonological awareness skills must be taught explicitly (Castles et al., 2018; Willingham, 2017; Moats, 2010).



PHONICS



Proficient readers do not identify words based on their visual appearance. Instead, the brain processes individual phonemes and graphemes within words (Kilpatrick, 2015). Knowledge of the 64 most common letter-sound correspondences along with the ability to identify the 100 most common words allows readers to identify 90% of words they tend to see in texts (Solity and Vousden, 2009).



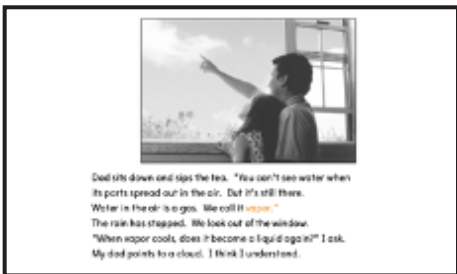
FLUENCY



Students build a large bank of sight words through the process of orthographic mapping that links sounds and letters to store words in long-term memory (Ehri, 2005). A large sight word bank makes fluent reading possible. And fluent reading frees up the cognitive load required for decoding to support reading comprehension.



COMPREHENSION & VOCABULARY



Vocabulary and background knowledge are the foundation for reading comprehension (Snow, 2017). Instruction should engage students in purposeful conversation about text, build background knowledge, increase fluency so students can focus on meaning, and foster critical thinking skills through rich experiences with narrative and informational text.



LANGUAGE CONCEPTS



It is important for students to understand how written language is organized, including print concepts, punctuation, spelling, and grammar. Early on, students must develop print awareness (Adams, 1990). An understanding of grammar and punctuation supports comprehension (Silva & Cain, 2015). Decoding for reading and encoding for spelling are mutually supportive (Ehri, 2000).



COMMUNICATION



The Communication strand supports the development of speaking, listening, and writing skills. Early oral language skills are a strong predictor of later outcomes in reading comprehension (Hart & Risley, 1995; NELP, 2008). Experiences with listening support reading comprehension. Reading and writing require many of the same cognitive processes and types of knowledge (Shanahan, 2016).