The Reading Brain –
Understanding the Science of Reading

Fall ASDN Webinar Series - 1

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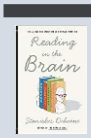
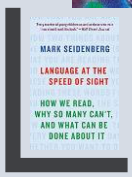
Learning Intentions

- Deepen understanding of the Science of Reading.
- Deepen understanding of the brain regions involved in reading.

2

Resources





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Take a Moment

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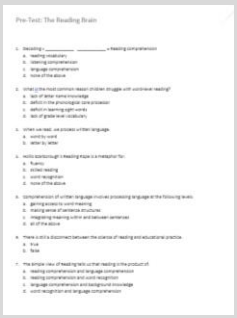

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Quick Write

What comes to mind when you think about the phrase *"Science of Reading"*?

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Research

Learning to read and write is not a natural act—this undertaking requires explicit, systematic, and cumulative instruction.

Castles, Rastle, & Nation, 2018; Gough & Hillinger, 1980; National Institute of Child Health and Human Development [NICHD], 2000; Seidenberg, 2017

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The Scientific Fields

- Cognitive Psychology
- Neuroscience
- Linguistics
- Education Research

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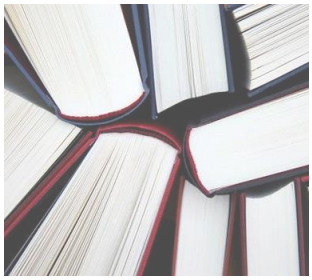
What is the Science of Reading?

It is evidence.



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The 5 Components

- Phonological Awareness
- Phonics
- Fluency
- Vocabulary
- Comprehension

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Poll

- Which component do you feel most confident teaching?
- Which component might you want to increase your understanding of?

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Phonological awareness is...

- the best predictor of reading difficulty in kindergarten through third grade and even beyond (Good, Simmons, & Kame'enui, 2001; Lyon, 1995; Torgesen, 1998, 2004)
- the primary difference between good and poor beginning readers (Liberman, Shankweiler, & Liberman, 1989)
- something that makes a difference when we teach it: children who are provided instruction in phonological awareness show greater improvements in learning than those who are not
- necessary for strong beginning reading skills including decoding and word recognition (Ball & Blachman, 1991; O'Connor, Jenkins, Leicester, & Slocum, 1993; Smith, Simmons, & Kame'enui, 1998)

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Phonics

- An understanding of the alphabetic principle and the ability to apply this knowledge in decoding unfamiliar words.
- Grapheme is the symbol for a phoneme.
  - 26 letters
  - 44 phonemes
  - 250 graphemes

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Fluency is…

The ability to read with automatic word recognition, expression and meaning while reading at a sufficient pace.

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Vocabulary

The words we need to know in order to communicate with others.

Four Types of Vocabulary	
Listening: words we understand when others talk to us	**Speaking:** words we use when we talk to others
Reading: words we know when we see them in print (sight words and words we can decode)	**Writing:** words we use when we write

15

Comprehension

- Comprehension involves constructing meaning that is reasonable and accurate by connecting **what has been read** to **what the reader already knows.**
- Comprehension is the ultimate goal of reading instruction.

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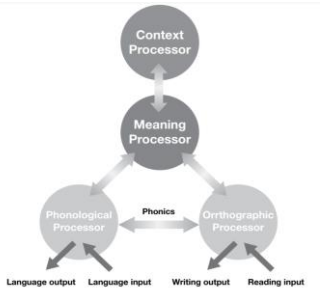
How does an instructional focus on the 5 components support the processors in the brain?



Seidenberg and McClelland (1989)

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Breakout Rooms

- Identify 2 *points of most significance* for you so far in this session.
- Share with your colleagues.

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The *What* of Instruction?

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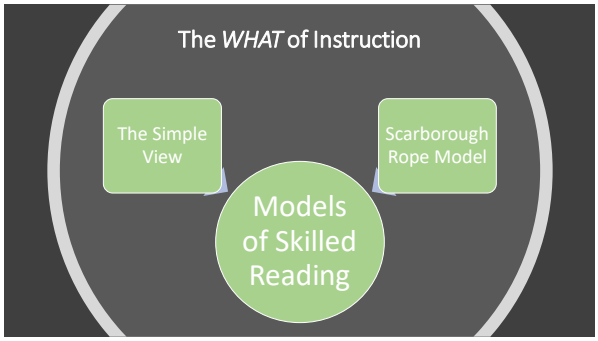
The *WHAT* of Instruction
The Simple View
Scarborough Rope Model
Models of Skilled Reading

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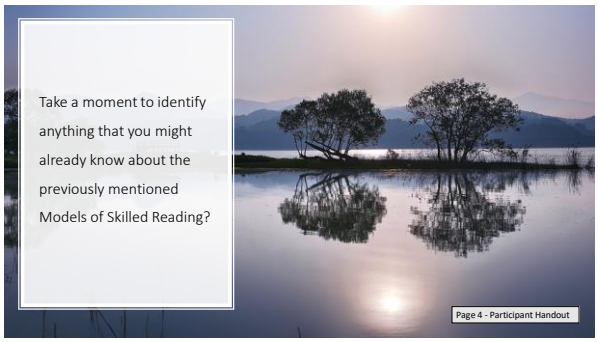
Take a moment to identify anything that you might already know about the previously mentioned Models of Skilled Reading?
Page 4 - Participant Handout

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D x LC = RC

The Simple View of Reading (Gough & Tunmer, 1986)

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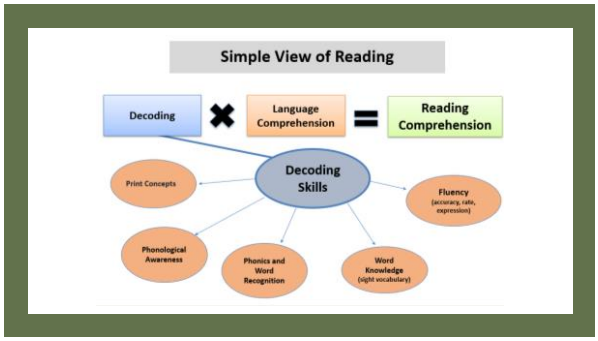

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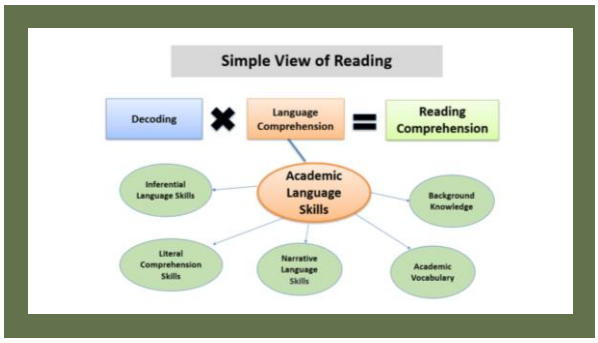

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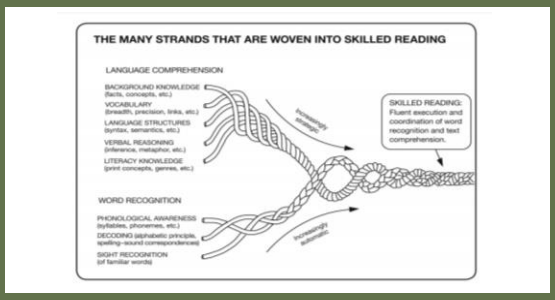

(Scarborough, 2001)

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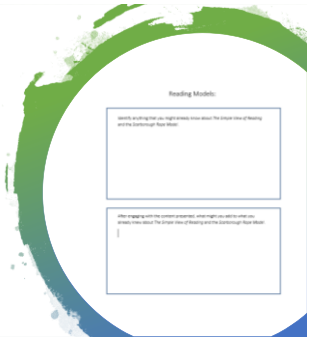
After engaging with the content presented on the Models of Skilled Reading, what might you add to what you already knew about *The Simple View of Reading* and the *Scarborough Rope Model?*

Page 4 - Participant Handout



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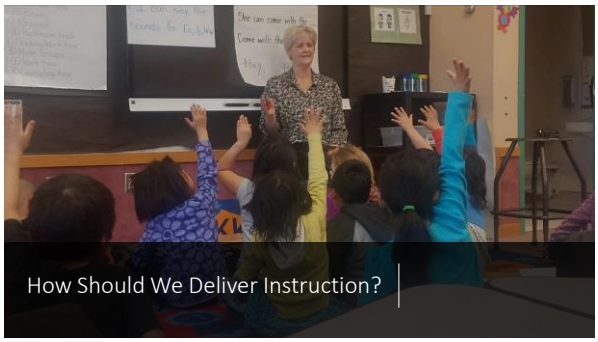

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How We Teach

Explicit	Systematic	Sequential
New skills are directly modeled Students are guided to the correct response Error response includes immediate corrective feedback Skills are practiced to mastery and automaticity	Consistent instructional routines are used to guide students to correct responses Instructional time is carefully allocated to maximize time on task Cumulative review	Skills are taught in order from easier to harder; Pre-requisites are taught first Component or foundational skills are taught directly to support higher-order skills Intentional sequence within and across lessons; within and across grades

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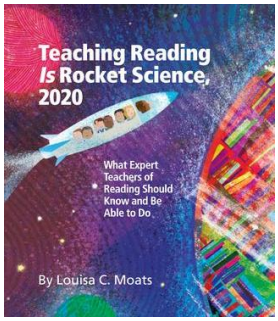
Teaching Reading *Is* Rocket Science

Use Page 5 in your Participant Handout as you review two sections of *Teaching Reading Is Rocket Science.*



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the mapping of speech to print includes recognition of letter sequences, including syllable patterns and meaningful units (morphemes). The reading brain gradually builds neural networks that facilitate rapid processing of symbol-sound and sound-symbol connections. Once these networks for mapping speech to print are developed, the brain can recognize and store images of new printed words with little conscious effort.

Superficial visual characteristics of printed words, such as their outline or configuration, have no bearing on this process. That is why we can read many fonts and many kinds of handwriting. Printed words are not learned as wholes but rather as letter sequences that represent speech sounds and other aspects of language. What appears to be whole-word learning or whole-word retrieval is, under the surface, dependent on a rapid, letter-by-letter and sound-by-sound assembly of linguistic elements.

Skilled reading happens too fast and is too automatic to detect its underlying processes through simple introspection. We read, but we cannot watch (or intuit or deduce) how our minds make sense out of print. Once we can read, the linkage of sounds and symbols occurs rapidly and unconsciously. The linguistic units that compose words—the single speech sounds (phonemes), syllables, and meaningful parts (morphemes)—are automatically matched with writing symbols (graphemes and their combinations) so that attention is available for comprehension. Because our attention is on meaning,

a class of children who are learning how to read symbols that represent speech sounds and word parts, we may never have analyzed language at the level required for explaining and teaching it. Similarly, we may not know how a paragraph is organized or how a story is put together until we teach writing to students who do not know how to organize their thoughts. Thus, to understand printed language well enough to teach it explicitly requires disciplined study of its system and forms, both spoken and written.

Few Teachers Have Been Taught the Structure of Language

When adults are evaluated on knowledge of language, even those who are well educated typically demonstrate major gaps in understanding. This should not be surprising—most adults have not had the opportunity to study the structure of language.[2] Surveys measuring experienced teachers' abilities to identify speech sounds, spelling patterns, word structures, and sentence structures also reveal gaps in understanding. For example, the concept that a letter combination can represent one unique speech sound (*ch, wh, sh, th, ng*) is unclear to a substantial number of elementary school teachers. Many identify these units by rote but are unable to differentiate conceptually between these spelling units (digraphs) and two letters that stand for two distinct sounds (consonant blends such as *cl, st,*

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"This we know: reading failure can be prevented in all but a small percentage of children with serious learning disorders. It is possible to teach most students how to read if we start early and follow the significant body of research showing which practices are most effective.... It is our nation's dedicated teachers and their excellent teaching that will bring the rocket science that is research-based reading instruction to schools and classrooms across the country and will unlock the power and joy of reading for our children."

—Louisa C. Moats,
Teaching Reading *Is* Rocket Science, 2020

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Chat Box

What ideas were confirmed for you ***OR*** what insights have you gained about The Science of Reading and the nature of proficient reading?

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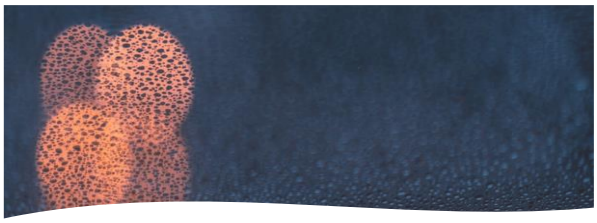

"Within his brain, the child is literally building the neural circuitry that links the sounds of spoken words, the phonemes, to the print code, the letters that represent those sounds."

--Shaywitz, 2003

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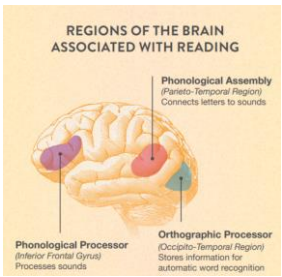

(Sandak, Mencl, Frost, & Pugh, 2004; Houde, Rossi, Lubin, & Joliot, 2010).

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Reading is **not a natural task**, and children are not **biologically prepared to it by evolution** (unlike spoken language acquisition). Thus, teachers must be aware that many of the **reading steps** that they take for granted, because they are expert readers and have a fully automated and non-conscious reading system, **are not at all obvious for young children.** Massive changes are needed, **at the phonological and at the visual level**, before children master **the skill of reading.**

- Dehaene, 2011

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When We Read…

- We recognize the letters, combining them into graphemes.
- We connect these to speech sounds to decode the word.
- We connect to meaning processors to recognize the words.
- The areas for speech sounds and meaning already exist for spoken language.
- We use the same parts of the brain for spoken language and written language when it comes to speech and meaning.

Dehaene, 2012

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Growing the Brain

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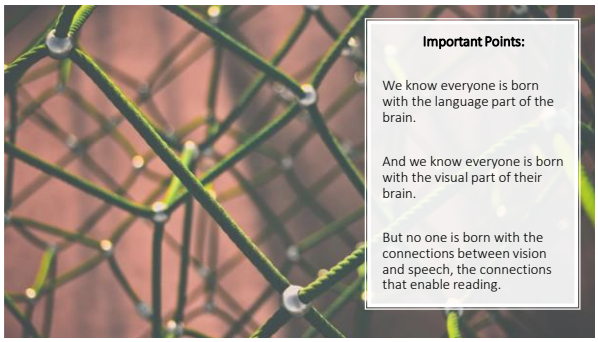

Important Points:

We know everyone is born with the language part of the brain.

And we know everyone is born with the visual part of their brain.

But no one is born with the connections between vision and speech, the connections that enable reading.

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Viewing Recommendations:

Video Viewing Guide – The Reading Brain

Directions: After watching the video segments, use this document to record responses to the questions below.

- Stanislas Dehaene - https://youtu.be/wh72lk_07vk
- Stanislas Dehaene - https://youtu.be/GxvMyoic4kU
  - Watch: 3:02 -9:22
  - Watch: 12:24-15:45

In your own words, summarize what happens in the brain when it reads?

What implications should this information have for how reading should be taught?

Page 7 - Participant Handout

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Chat Box

- Identify ideas confirmed for you that support the need to provide instruction based on the Science of Reading.
- Considering the content of this session and conversations with colleagues across Alaska; how might this information impact your instructional practice?

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Wrap-Up

1. Decoding x _____ _____ = Reading comprehension

c. language comprehension

2. What is the most common reason children struggle with word-level reading?

b. deficit in the phonological core processor

3. When we read, we process written language:

b. letter by letter

4. Hollis Scarborough's Reading Rope is a metaphor for:

b. skilled reading

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Wrap-Up

5. Comprehension of written language involves processing language at the following levels:

d. all of the above

6. There is still a disconnect between the science of reading and educational practice.

a. true

7. The Simple View of Reading tells us that reading is the product of:

d. word recognition and language comprehension

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