

Implications of the Evolving Reading Brain for Intervention with Struggling Readers



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Metaphor for Personal-Intellectual Dimension in Reading: Proust

We feel quite truly that our wisdom begins with that of the author...By a law which perhaps signifies that we can receive the truth from nobody, that which is the end of their wisdom appears to us as but the beginning of ours.

-Marcel Proust



Principles of Brain Design Underpinning Cultural Inventions

- Ability to form new **connections**
- Capacity for “working groups” of neurons to **specialize** (e.g., pattern recognition)
- Capacity for **automatization**



Greek Writing and the Alphabetic Principle



The insight that words are made up of sounds and each sound can be signified by a symbol.

Universal Reading Brain

English

Chinese

Japanese



Brain can rearrange itself in multiple ways to read.

Bulger, Perfetti, & Schneider

Cognitive Development: Concepts Matter

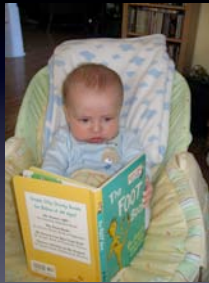
Concepts in first language
are essential platform for
concepts and vocabulary
in second language



Reading never just happens.

Everything matters:

- Visual and auditory development
- Cognitive development
- Language development
- Social development
- Emotional development



Everything Matters

Phonemes (smallest sounds)

Orthographic Parts: Letters
Letter patterns
Common Words

Semantic Meanings of Words

Syntactic Uses of Words

Morphemes

Phonemes Matter

- Phoneme Awareness
- Explicit emphases on decoding



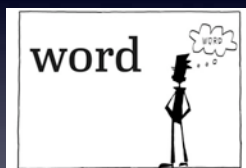
Orthography Matters

- Letters
 - Letter Patterns
 - Conventions of Print
- Left to right scanning

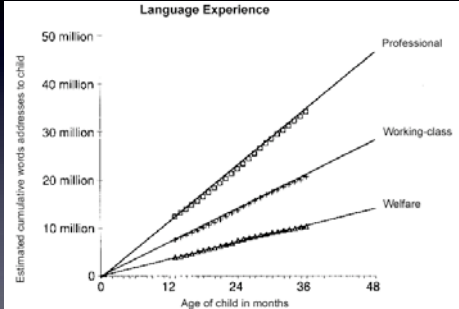


Semantics Matters

- Vocabulary development
- Semantic breadth and depth
- Polysemy (multiple meanings) and Semantic Flexibility



Semantic Development: Words Matter 32 million word gap



Syntax Matters

“The only thing Harry liked about his own appearance was a very thin scar on his forehead that was shaped like a bolt of lightning.”
- J.K. Rowling

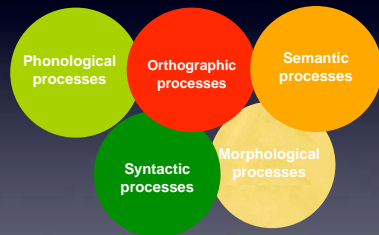


Morphemes Matter

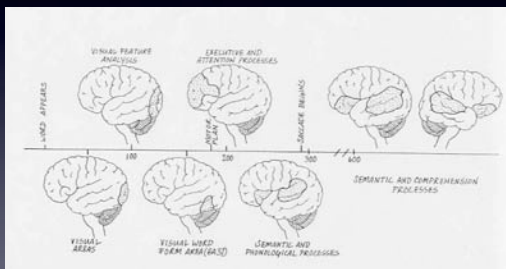
- Orthographic, semantic, and syntactic information

jam jams jamming unjammed

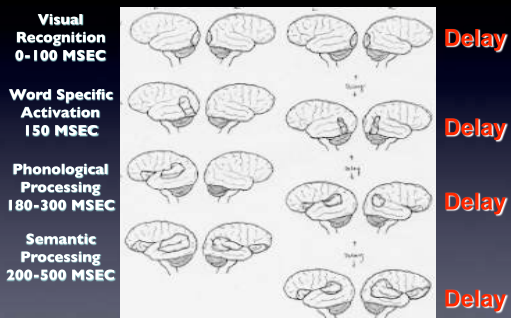
The more you know about a word
...the faster you will read and comprehend
that word.



Timeline of Expert Reading



Normal Readers **Dyslexic Readers**



Subtypes of Dyslexia: Double Deficit Hypothesis

Average Readers

- Intact Naming Speed
- Intact Phonology
- Intact Comprehension

Naming Speed Impairment

- Impaired Naming Speed
- Intact Phonology
- Impaired Comprehension

Phonological Impairment Double-Deficit

- Intact Naming Speed
- Impaired Phonology
- Impaired Comprehension
- Impaired Naming Speed
- Impaired Phonology
- Impaired Comprehension

Wolf & Bowers, 1999

Implications of Evolutionary View For Reading Intervention

Intervention must address:

- Development of each recruited structure
- System Connections
- Automaticity
- Time to comprehend and think new thoughts

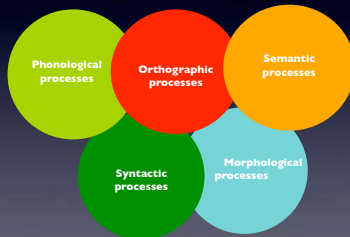
Principles Underlying Developmental, Component-based Fluency Intervention

1. Explicit teaching in each **component** area.
2. Explicit teaching of component **connections** (e.g., between phonology and orthography, semantic and retrieval-processes, morphology and syntax).
3. Systematic attention to move from **accuracy** to **rapid rates** in each process.
4. Systematic attention to sublexical, lexical, and connected text **levels**.
5. Integration of component parts in **comprehension**.

Program Components

- **PHAB/DI** -Phonological Analysis and Blending/Direct Instruction
- **PHAST**- Phonological and Strategy Training (now called Empower Reading)
- **RAVE-O**-Retrieval, Accuracy, Vocabulary, Engagement, Orthography: Systematic intervention designed to explicitly address; the development of representations in all and each process that contributes to reading; the connections among these processes; the automatic access, retrieval, and integration of the processes; the power of the affective systems.
- **CSS**- Classroom Survival Skill
- **MATH**- Math/Direct Instruction

The more you know about a word...
...the faster you will read and comprehend that word.

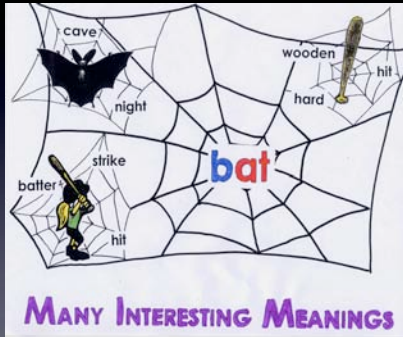


Important DESIGN Features

- ▶ **Systematicity**
- ▶ Attention to **accuracy** and **speed of retrieval**
- ▶ Emphases on **letter patterns, words, and connected text**

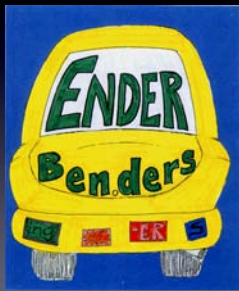


MIMs



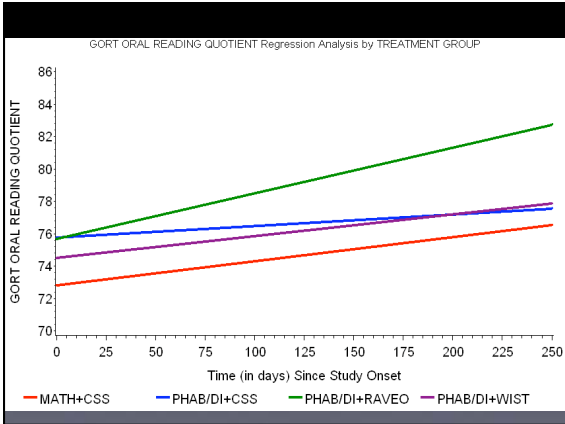
MANY INTERESTING MEANINGS

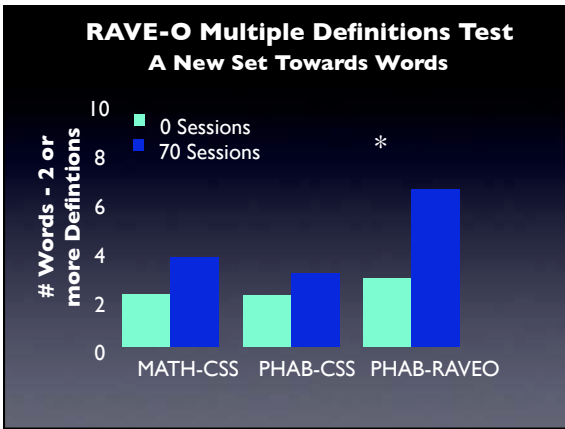
Ender Benders



Program Results

- ▶ All interventions performed better than control
- ▶ Multi-dimensional programs performed better than phonological programs alone.





From a Literate Culture to a Digital Culture

What are the deeper implications of an **evolving reading brain** for the children of a **digital culture**?

From Socrates to Tenner

- Socrates feared that print would give the illusion of truth and create no ambition in the young beyond the superfluity of knowledge.
- Tenner "It would be a shame if brilliant technology were to end up threatening the kind of intellect that produced it."

Digital Reading Brain emphasizes:

- massive information processing and production
- speed and efficiency
- multi-tasking and interactive communication



“Digital Reading”
Brain: Life of **Activity**
Life of **Enjoyment**



Characteristics of on-line reading in the young reading brain

- Continuous partial attention
- Distractibility
- Demand for immediate information
- Efficient multi-tasking and integration across diverse sets of information



Cognitive Effects: Brain Imaging Studies

“Even if we can learn while distracted, it changes **how** you learn, making the learning **less efficient and useful**”

“Multitasking hinders learning”
Russ Poldrack (2006)

Proceedings from National Academy of Science

Cognitive Effects: Task Switching Effects

- Increases amount of time needed to learn
- Changes learning style qualitatively by use of less flexible memory system
- Loss of attention and time used to switch tasks adversely affects ability to learn more complex facts and concepts.

• Gasser & Palfrey, 2009

“Deep Reading” Brain

- Slower, deep reading processes.
 - Inference
 - Analogical Thinking
 - Critical Analysis and Deliberation
 - Insight and Epiphany
 - Contemplation
- The Underpinnings of Wisdom and Virtue

Evolving Conclusions

*We are both
what we read
and **how** we read*

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