

# Recent Advances in Understanding Word-Level Reading Problems: Implications for Instruction and Effective Intervention

Ohio Literacy Academy  
March 18, 2019

David A. Kilpatrick, PhD  
*State University of New York,  
College at Cortland*  
*kilpatrickd@cortland.edu*

# Today's Three Objectives

- 1 Understand “sight vocabulary” development & fluency
  - 2 Understand why some students struggle
  - 3 Learn the “elusive” research based reading interventions
- ▶ My real goal is to “whet your appetite” to embark on a course of self-study so you can become a “conduit” of empirical reading research to your schools.

# Key Terms to Understand this Presentation

- ▶ Auditory vs. phonological
- ▶ Phonological vs. phonemic
- ▶ Orthography and orthographic
- ▶ Phonological awareness vs. phonics
- ▶ Decoding
  - Phonic decoding and word-level reading
- ▶ Sight word and sight word vocabulary
  - Also called orthographic lexicon

# An Important Note About Dyslexia

- ▶ Multiple definitions – organizations and popular
- ▶ Researcher Definition:
  - Word-level reading difficulty despite adequate opportunity and effort  
(all else is popular lore that's been with us for over 100 years)
  - In October 2017 it got a boost from the chair of the UK Reading Panel

*A problem translating research to practice: where to draw the line*

- ▶ Relationship to SLD in IDEA
- ▶ Relationship to IDEA in general
  - Cuts across many disability categories

# The Phonological–Core Deficit of Dyslexia

- ▶ From the “most common cause” to the “universal cause”
- ▶ Weakness in one or more of the following:
  - Phonemic awareness/analysis
  - Phonemic blending/synthesis
  - Rapid automatized naming
  - Phonological working memory
  - Nonsense word reading, letter–sound knowledge acquisition
- ▶ Typically more than one of these, sometimes all
- ▶ Very well established with no substantive alternatives
  - 1) *Kids who are average or better in all of these do not have dyslexia! (so long as the PA assessments are sensitive)*
  - 2) *We don't find poor word readers without one or more of these characteristics*

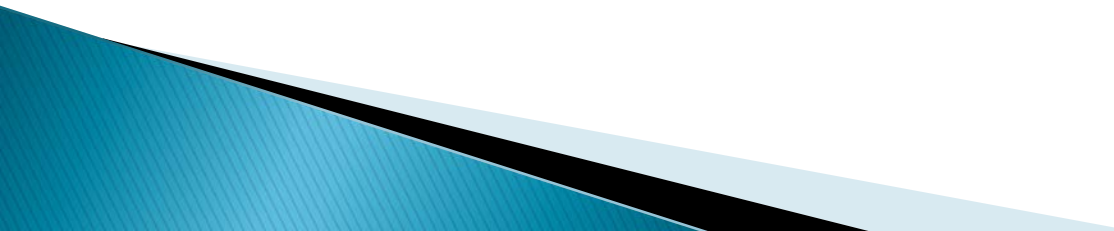
To understand highly effective  
prevention and intervention,  
we need a

# **CRASH COURSE ON HOW WORDS ARE LEARNED**

# What is YOUR Theory About How We Remember the Words We Read?

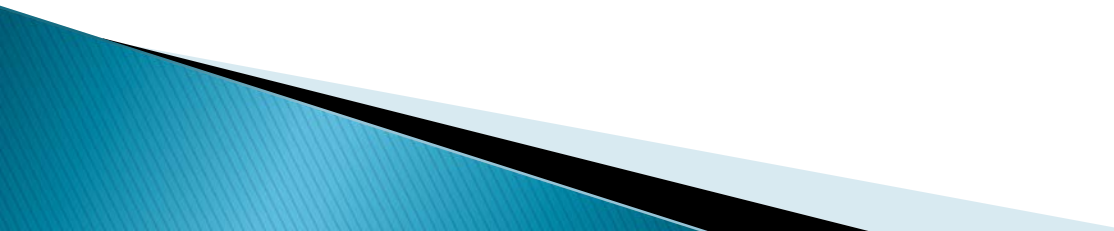
- We all have a theory, but you may not know yours
  - If you can't think of yours, just work backward from any interventions you use or recommend
- Our instruction focuses on on READING words, not on LEARNING words

# Two Levels of Word-level Reading Skill Deficits

- What distinguishes skilled word readers from poor word readers?
    - 1) The ability to identifying unfamiliar words by sounding them out
    - 2) The ability to remember the words they read
- 



# The Alphabetic Principle

- Chinese writing vs. alphabetic writing
  - We do not write words!
    - We write sequences of characters designed to represent sequences of phonemes in spoken words
  - Poor access to the phonemes makes reading alphabetic languages very difficult
  - Phoneme skills are needed for BOTH sounding out new words AND remembering the words we read
- 

# Theories of Word-Level Reading

## Fundamental assumption:

*We all do the best we can with what we know*

- My first 9 years as a school psychologist & first 4 years teaching courses in learning disabilities and educational psychology

# Theories of Word-Level Reading

## 1) Three-cueing systems approach

- Actually a theory about getting meaning from print
  - But has a lot to say about identifying words
- Developed in the 1930s–1940s updated in the 1960s
  - No real change since the 1960s despite over 40 years of research
- Previously called the *psycholinguistic guessing game*
- Central to whole language, balanced instruction, MSV, literacy-based approach; the foundation for LLI & Reading Recovery

## 2) Visual Memory Hypothesis

- Whole word approach, flash card approach, repeated readings; even incorporated into the phonic approach
  - It's the phonic approach to irregular words and word memory

## 3) Phonics

- Also called the “code-based approach” & “structured literacy approach”

# Poor Readers, not skilled readers read based on the “Three-Cueing Systems” Approach

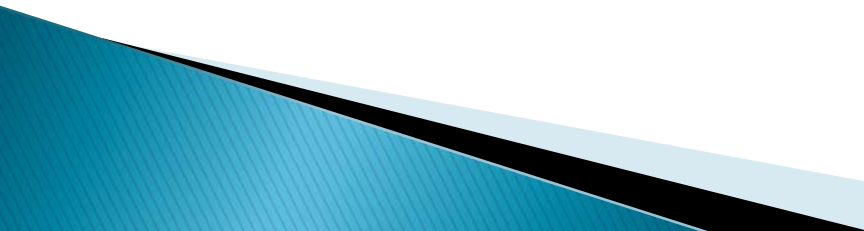
## Contextual

- Skilled readers recognize most of the words they read. Context is not required to recognize familiar words.
- Poor readers know fewer words so they rely on context.

## Syntactic/Grammatical

- These skills are virtually uncorrelated with word reading.

## Grapho-phonetic

- Skilled readers effectively sound out unfamiliar words with help from set for variability (80% accuracy rate)
  - Poor readers are weak in phonic decoding and have to rely on contextual guessing (25% accuracy).
- 

# Sight Word Vocabulary is NOT Based on Visual Memory/Visual Skills

- Our intuitions fail us here
- Input and storage are not the same thing
  - Input is visual, storage is orthographic, phonological, & semantic
- Cattell's findings in 1886
- Findings from the 1970s
  - Correlation between word reading & visual memory: zero to weak
  - RD (only) kids have equivalent visual memory to non-RD
- 1960s to 1980s miXeD cAsE sTuDiEs
  - Adams' comment about debating with students
  - Kevin reading Calvin & Hobbes
  - If a first grader learns "bear" he can instantly identify "BEAR"
  - Consider all the fonts and personal handwriting we read
  - Our "abstract representation" of every letter

# Sight Word Vocabulary is NOT Based on Visual Memory/Visual Skills

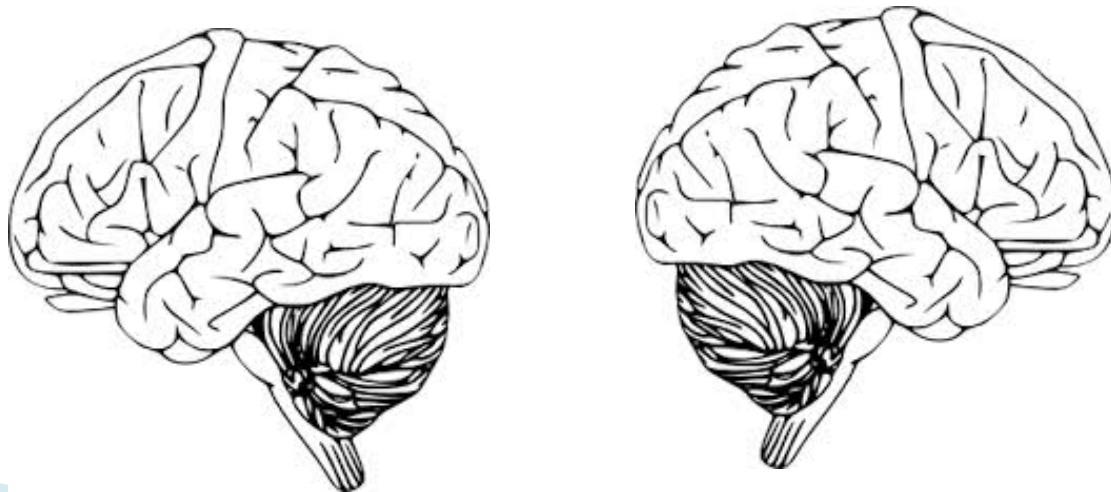
- Word reading correlates strongly with phonological skills
  - *Phonological awareness & Word Reading:  $r = .30$  to  $.85$ ;*
    - Usually  $.5$  to  $.7$  depending on which PA test (more later)
  - *Visual Memory & Word Reading:  $r = .1$  to  $.2$*
- Note how we sometimes “block” on names of people and things (visual memory), but never written words
- Most students who are deaf struggle tremendously with word level reading
  - This should not be such a problem if word reading was based on visual memory

# Sight Word Vocabulary is NOT Based on Visual Memory/Visual Skills

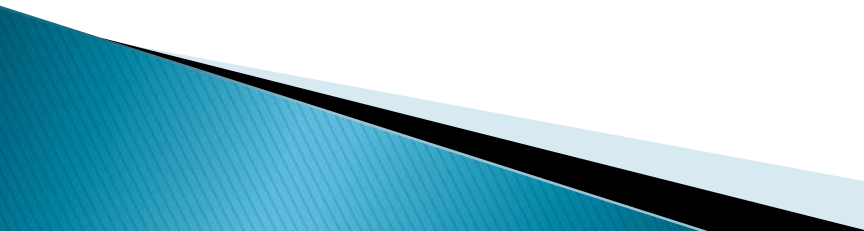
- Neuroimaging studies since 2000 show that
  - 1) phonic decoding;
  - 2) instant word recognition;
  - 3) memory for faces; and
  - 4) object naming

*are all processed in different areas/sub-systems of the brain!*

(Cattell's findings from 1886 now make sense)



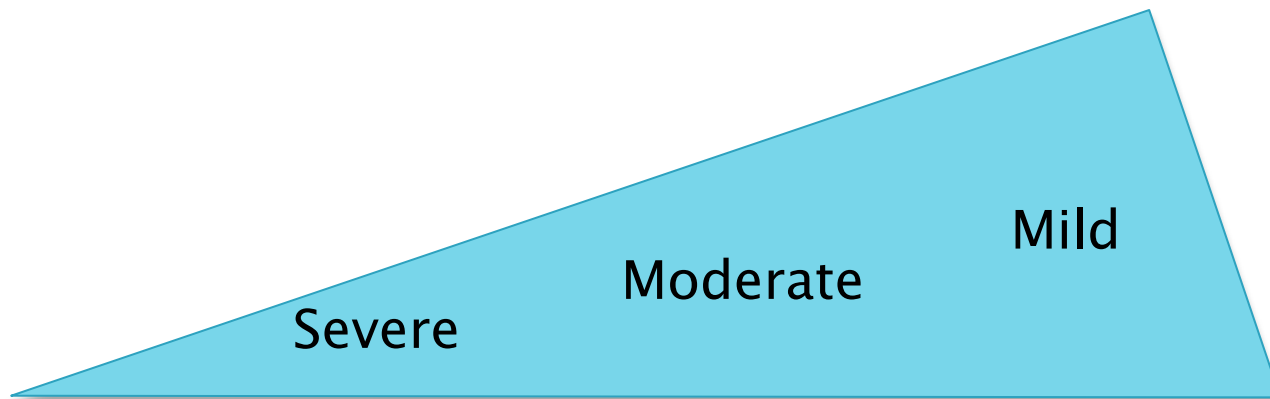
# Concerns About the Efficacy of Phonics

- Explicit and systematic phonics instruction displays superior results than whole word or whole language (three cueing, guided reading, balanced instruction)
    - This is true for all children but results “wash out” in the top half to two thirds of students by 3<sup>rd</sup> to 4<sup>th</sup> grade
    - Bottom third show ongoing benefit over time
  - Too many, however, never “catch up”
  - A small percentage cannot seem to learn via phonics
  - No built-in mechanism or theory about fluency and building a sight vocabulary
- 



# Concerns About the Efficacy of Phonics

- Three levels of response to phonics based upon the severity of the phonological–core deficit
  - (And you know all these students!)



Level of Severity of the Phonological–Core Deficit

# Comments on All Three Approaches

- They form the basis of today's instruction and intervention
- All have equally enthusiastic advocates
- All have too high a “failure rate”
  - Phonics has the lowest failure rate, but still too high
- Remediation is more intense version of the same
  - As if something that doesn't work will work better if delivered more intensively
- None can accurately describe why students struggle
- None addresses “memory” for words
- Why these issues?

Because all were developed long before the last 40 years of scientific findings about reading

# How Sight Vocabulary is Developed

An Introduction to Orthographic Mapping



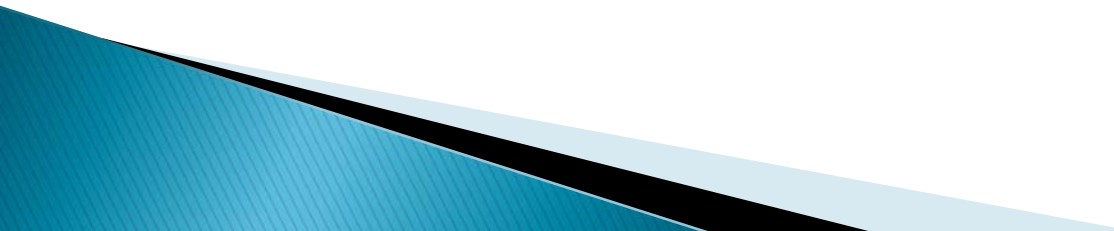
# The Science of Remembering Written Words

- ▶ Orthographic learning
  - How we remember the words we read
  - Instant effortless access to words
  - Building the orthographic lexicon
- ▶ Orthographic learning research
  - Computational/computer models
    - Multiple competing versions
  - Cognitive/behavioral models
    - Ehri's theory of sight word learning (orthographic mapping)
    - Share's theory of word learning (self-teaching hypothesis)

# David Share's Self-Teaching Hypothesis

- ▶ We teach ourselves most of the words we know
- ▶ Orthographic learning occurs one word at a time
- ▶ Orthographic learning is implicit – typically does not involve conscious thought or effort
- ▶ As students sound out words, they are forming orthographic connections
  - When newly encountered words are not sounded out, they are poorly remembered
- ▶ From 2<sup>nd</sup> grade on, typically developing readers remember words after only 1 to 4 exposures

# Linnea Ehri's Orthographic Mapping Theory

- ▶ *Orthographic mapping* is the mental process we use to store words for immediate, effortless retrieval.
  - ▶ In other words, orthographic mapping is what we do to make an unfamiliar written word into an automatic “sight word.”
- 

# Linnea Ehri's Orthographic Mapping Theory

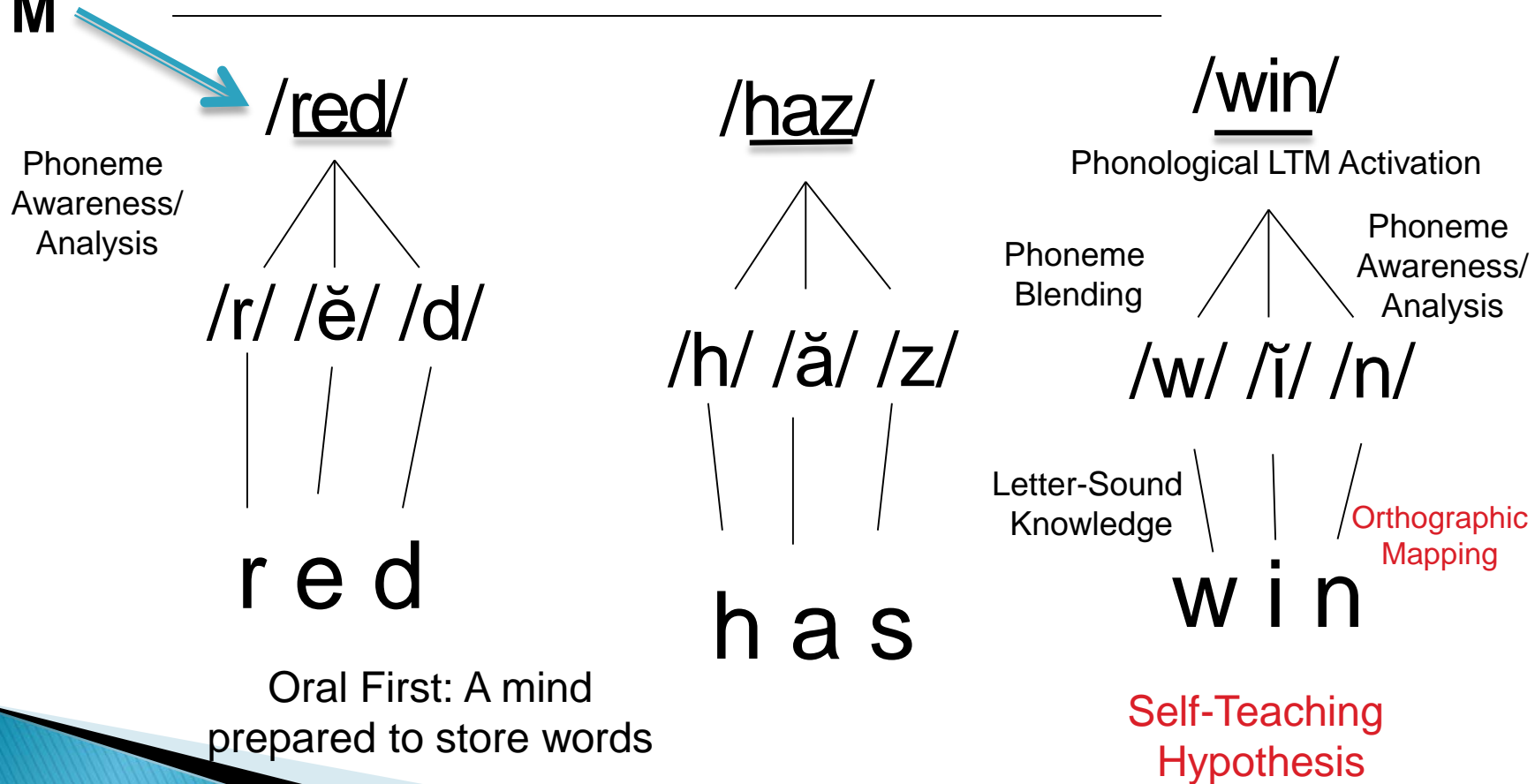
- ▶ Sight words are highly familiar spellings (i.e., letter sequences), regardless of the visual look of the word
  - e.g., bear, BEAR, **Bear**, bear , **bear**, *BEAR* , bear, *bear*, BEAR
- ▶ Sight words are anchored in long-term memory (LTM) via a connection between something well established in LTM (the word's pronunciation) and the stimulus that needs to be learned (the letter sequence in the word's spelling)
- ▶ Phonemic segmentation and letter-sound skills are central to this connection-forming process

# How We “Map” Words

## “Transparent” Words

(i.e. words with one-to-one correspondence)

PLTM



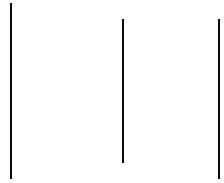


# How We “Map” Words

Words that are “Opaque”  
(i.e. words without a one-to-one correspondence)

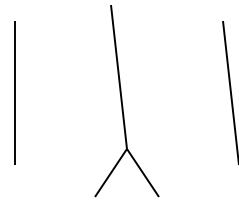
---

/m/ /ā/ /k/



m a k e

/r/ /ē/ /d/



r e a d

/c/ /ō/ /m/



c o m b

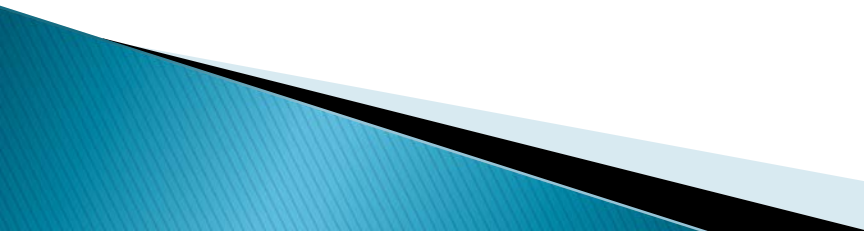
# What about irregular words?

- Irregular and opaque words take longer to learn
  - Only 1–2 extra exposures for typical readers; many more for RD
- Most irregular words are off by only one element
  - (*said, put, comb, island*; multiple violations are rare: *one, iron*)
- Irregular words not a challenge for orthographic mapping
  - “Exception words are only exceptional when someone tries to read them by applying a [phonic] decoding strategy. When they are learned as sight words, they are secured in memory by the same connections as regularly spelled words . . .” (Ehri, 2005 p. 171–172)

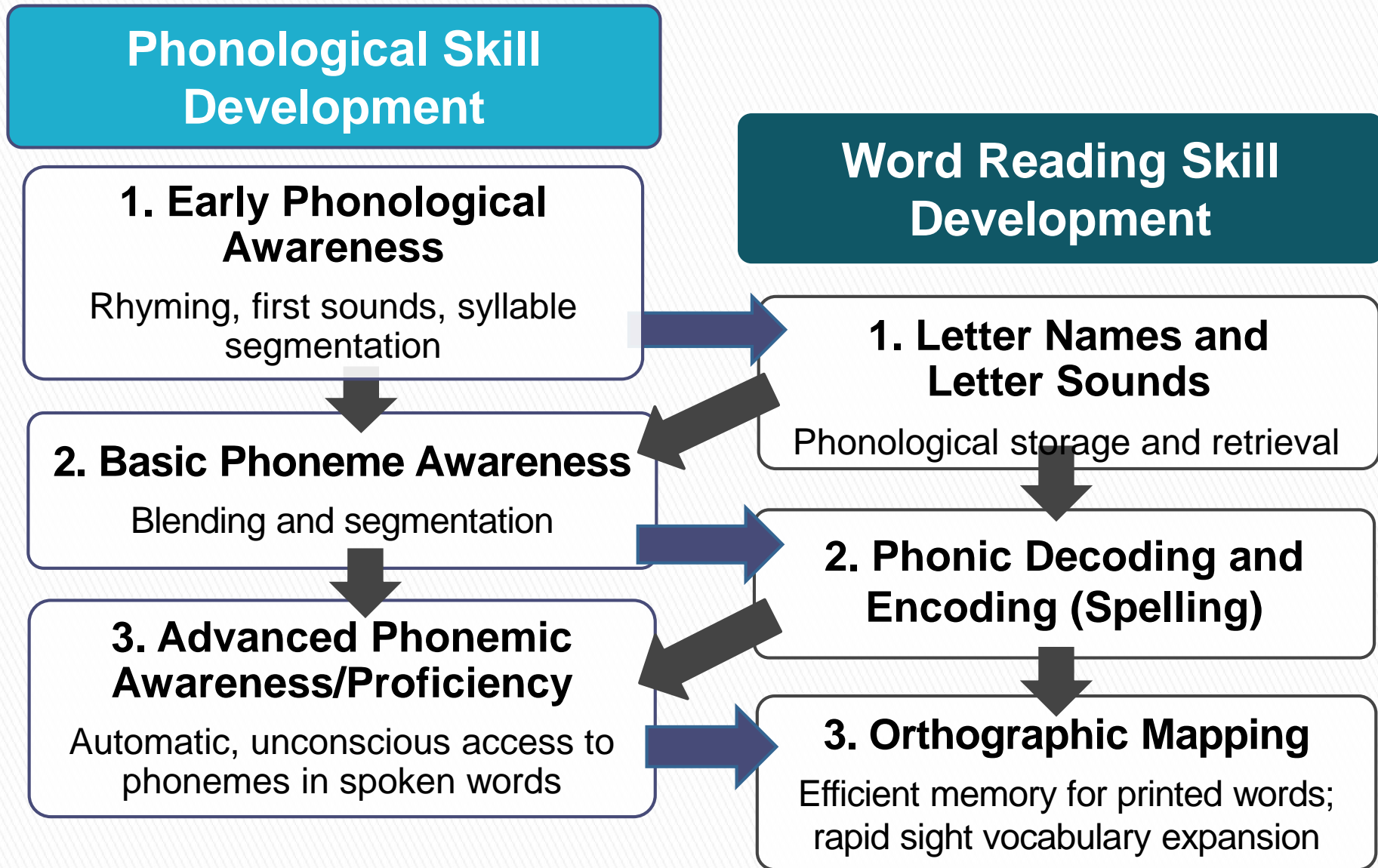
# What about irregular words?

- Many regular words require mapping “adjustments like irregular words
  - Silent e words, vowel digraphs, consonant digraphs are all opaque
  - Multisyllabic “regular” words with vowel reduction require mapping adjustment, much like irregular words (e.g., *holiday, market*)
- Irregular words are not the *cause* of reading problems in English
  - Even very regular orthographies (e.g., Italian, Spanish) have RD, and their RD is based upon poor orthographic mapping
  - It makes English phonic decoding harder to learn, but these irregularities are not the cause of poor sight word reading
  - Even regular words are poorly represented in the orthographic lexicons of poor readers

# How Words are Learned for Instant, Effortless Retrieval

- ▶ Orthographic mapping requires:
    - Letter–sound proficiency
    - Phonemic proficiency (this goes well beyond what is tested on our universal screeners)
    - The ability to establish a relationship between sounds and letters unconsciously while reading
  
  - ▶ Orthographic mapping develops naturally in 60%–70% of students via exposure to literacy activities
    - Most students learn to read regardless of how they were taught
- 

# The Developmental Relationship Between Phonological Skills and Word-Level Reading



# Sight Vocabulary and Reading Fluency

- *Sight words* are effortless & pre-cognitive—words “pop out”
- The elusive key to reading fluency is:

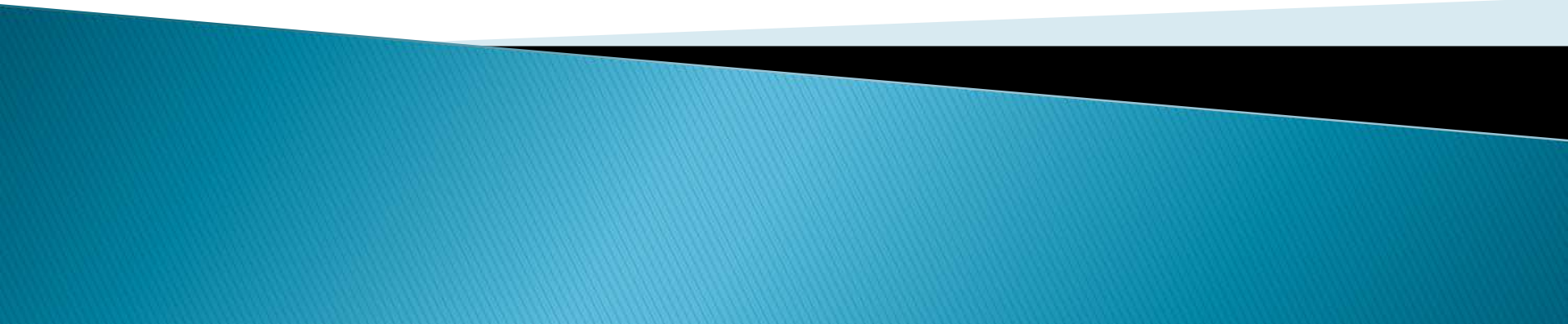
## SIGHT VOCABULARY SIZE

- With a large sight vocabulary:
  - Most (or all) words “pop out”; reading is *fast* and *accurate*
- With a limited sight vocabulary:
  - Reading is effortful and often inaccurate because too many unfamiliar words require attention and strategic decoding
  - Poor fluency is NOT about speed of access to known words

# The “Path” to Fluent Word Reading

- **Word reading fluency** is primarily based on the . . .
- Size of the **sight vocabulary/orthographic lexicon**, which is based on . . .
- How skilled a student is in remembering words (**orthographic mapping skills**) combined with reading experience, and orthographic mapping is based on . . .
- **Letter–sound proficiency**/automaticity (unconscious access to the sounds letters represent) AND
- **Phonemic proficiency**/automaticity (unconscious access to phonemes in spoken words)
- This latter skill is a universally missing element
- (Develops in typical readers, but not in struggling readers)

# PREVENTION AND INTERVENTION

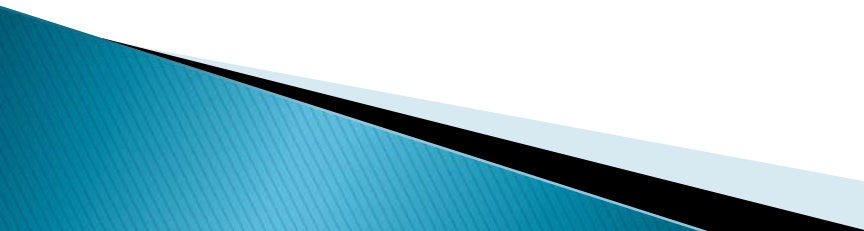




# Research-Based Principles vs. Research-Based Programs

- ▶ The problem with the term “research based”
- ▶ No Consumer Reports–style opportunity exists
  - *What Works Clearinghouse*, *bestevidence.org*, etc. have major problems
    - Use of effect size to determine efficacy
    - Very limited number of studies for any given program
- ▶ The National Reading Panel (NRP) avoided this by focusing on principles and approaches, not programs
- ▶ IES Practice Guides focus on principles and approaches
- ▶ There is no substitute for well-informed educational professionals
  - Analogy of carpenter and tools

# Role of Socio-Economic Factors

- ▶ Socioeconomic Status (SES) is moderately correlated with reading outcomes
    - But correlation does not mean causation
  - ▶ Effective instruction and intervention have been shown to be highly effective with low SES students
    - However, reading comprehension (RC) difficulties may continue
      - Yet word reading no longer compromises reading comprehension, so there are RC improvements
  - ▶ Often blame is misplaced – inadequate instructional philosophies and practices get conflated with low SES
- 

# English Language Learners

- ▶ Hundreds of studies with consistent findings
  - Findings support the Simple View of Reading
  - Word reading develops similarly to native speakers (in the absence of the phonological–core deficit)
  - Perhaps brief time lag, depending on age, previous reading acquisition, similarities across languages, etc.
  - PA transfers across languages
  - Comprehension lag (5–6 years) due to language development

# Prevention: Tier 1 Results

## K-1 phonological Awareness Instruction

- ▶ *Overall* improvement in reading scores
- ▶ Average of 8 standard score points
- ▶ Results did not always last after 1-2 year follow ups

HOWEVER . . .

- ▶ At-risk students averaged 13 standard score point gains!
- ▶ Gains increased to an average of 20 points at 6 month to 2 year follow ups!

# I. Prevention of Word-Level Reading Difficulties

- ▶ Tier 1 instruction – What is effective K–1?
  - KEY COMPONENTS
  - Phonological Awareness
  - Letter–Sound Knowledge
  - Connecting phonological awareness to word–level reading
  - Good teaching techniques based on general learning principles
    - Seems to be the focus of RTI efforts
- ▶ Early, rigorous development of PA and LS skills in K–1 dramatically reduces the number of struggling readers
- ▶ Quick Survey:
  - How many of you work in schools that have a formalized, systematic, whole class, Tier 1 PA training in K–1?

# A Recent Finding about Intervention Research

- ▶ Numerous reviews of intervention research and meta-analyses have been conducted since 1999
- ▶ They routinely look at the obvious factors:
  - Socioeconomic Status (SES)
  - Age of students (e.g., 2<sup>nd</sup> graders vs. 5<sup>th</sup> graders vs. 9<sup>th</sup> graders)
  - Length of intervention (e.g., 35 hours? 65 hours? 110 hours?)
  - Group size (e.g., 1:1? 1:3? 1:5? 1:8? whole class?)
  - Severity of problem (2<sup>nd</sup> percentile? 10<sup>th</sup>? 20<sup>th</sup>? 30<sup>th</sup>?)
- ▶ Contrary to the expectations, the first two show small effects and the other three show no consistent effects
  - SES showed much impact with reading comprehension, however

# A Recent Finding about Intervention Research

- ▶ Using standard scores to determine effectiveness
- ▶ This results in three groups of intervention results
  - *Minimal results group*: 0 to 5 standard score improvements
    - Mostly 2–4 points
  - *Moderate results group*: 6 to 9 standard score improvements
    - Mostly 6–7 points
  - *Highly successful group*: 10 to 25 standard score point improvements
    - Mostly 14–17 points

# A Recent Finding about Intervention Research

*These three groups approached instruction differently!*

- ▶ Minimal Group (0 – 5.85 SS improvements)
  - None formally trained phonological awareness/analysis
  - Most did explicit, systematic phonics
  - All provided reading practice with connected text
- ▶ Moderate Group (6–9 SS improvements)
  - All did explicit, systematic phonics
  - All provided reading practice
  - All trained phonological segmentation and/or blending
    - This is “basic phonological awareness” (mastered by most at end of 1<sup>st</sup> grade)
- ▶ Highly Successful Group (10–25 point improvements)
  - Aggressively addressed and “fixed” PA issues using advanced PA training
  - All did explicit, systematic phonics
  - All provided reading practice with connected text



# Summary

- Word-level reading is primarily phonological
- This is based upon the alphabetic nature of our writing system
- Visual skills not a source of reading problems
- Skilled readers are all good at phonic decoding and orthographic mapping – neither is optional
- Fluency is a function of sight vocabulary size
  - And a few other smaller contributors
- Reading problems are very preventable
- The most highly effective word-reading intervention outcomes trained advanced phonemic awareness, letter-sound skills, and did reading practice