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

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Today's Objectives

1. Understand word-level reading development, including fluency
2. Learn why some children struggle in word reading
3. Learn the highly effective yet "elusive" research based reading interventions

Related Resources

On Important Topics I Will Not Cover

Vocabulary and Reading Comprehension:

Beck, I. L., McKeown, M. G., & Kucan, L. (2013). *Bringing Words to Life: Robust Vocabulary Instruction* (2nd ed.). New York, NY: Guilford Press.

Oakhill, J., Cain, K., & Elbro, C. (2015). *Understanding and Teaching Reading Comprehension: A Handbook.* New York: Routledge.

Students for whom English is a non-native language:

Geva, E., & Wiener, J. (2014). *Psychological Assessment of Culturally and Linguistically Diverse Children and Adolescents: A Practitioner's Guide.* New York, NY: Springer.

Geva, E., & Ramirez, R. (2015). *Focus on Reading (Oxford Key Concepts for the Language Classroom).* New York: Oxford University Press.

Resources for Scientifically-Based Information on Reading

- IES Practice Guides (U.S. Department of Education)
  - *Foundational Skills to Support Reading for Understanding in Kindergarten Through 3rd Grade*
  - *Assisting Students Struggling with Reading: Response to Intervention (RtI) and Multi-Tier Intervention in the Primary Grades*
- The Reading League
  - Website – Live Events
  - The Reading League Journal

Introducing the Field of the Scientific Study of Reading

- Huge field
  - Approximately 650 to 800 new empirical articles appear in English (the international language of science) every year!
- Heavily grant funded
  - Tens of million of dollars each year in the U.S. alone (i.e., apart from the $13–$15 billion on general & special educational *remediation*)
- Many niche areas within the broader reading research enterprise

Key Terms to Understand this Presentation

- Auditory vs. phonological
- Phonological vs. phonemic
- Orthography and orthographic
- Phonological awareness vs. phonics
  - Many balanced literacy *and* phonics advocates aren't clear on this
- Decoding
  - Phonic decoding and word-level reading
- "Sight word" and sight word vocabulary
  - Also called orthographic lexicon

An Important Note About Poor Word Reading and Dyslexia

- Researchers do not distinguish between "dyslexia" and "poor word reading" (with caveats)
  - That's based upon popular lore over the last 100+ years
- Researcher Definition:

  Word-level reading difficulty despite adequate opportunity, effort (not due to blindness, deafness, emotional disturbance, or low IQ)
  - October 2017 – boost from the chair of the UK Reading Panel

  A problem translating research to practice:
  Where do we draw the line?
- Relationship to IDEA in general
  - Cuts across many disability categories

The Phonological-Core Deficit of Dyslexia
(i.e., the cause(s) of poor word reading despite the caveats)

- 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 of them)
- Very well established with no substantive alternatives

FINDINGS FROM READING RESEARCH

WORD-LEVEL READING SKILL DEVELOPMENT AND WORD-LEVEL READING DIFFICULTIES

The Largely "Untapped" Intervention Research

The little known origins of RTI

- **TIER 1**: Prevention research in 1980s-1990s
  - 50%-75% reduction in reading problems (reviewed by the *National Reading Panel*, 2000)
  - E.g. Foorman et al., (1998) *Journal of Educational Psychology*
- **TIER 2**: Vellutino, et al. (1996) *Journal of Educational Psychology*
  - Reduced RD kids down to 3% under 30th %ile & 1.5% under 16th %ile!
  - Results maintained 3 years later
- **TIER 3**: Torgesen et al., (2001) *Journal of Learning Disabilities*
  - Severely RD 3rd to 5th graders (mean standard score on Word ID = 67)
  - *Mean* improvement was 14 SS points at post test, 18 points 2 years later
  - 40% discontinued from special educational reading support
  - Replicated with older students and adults
    - A common faulty assumption is that there is a 'statute of limitations' on reading improvement

The Largely "Untapped" Intervention Research

The little known origins of RTI

- Doesn't this all sound too good to be true?
- RTI was designed to "capture" these amazing results
  - Yet focus seems to have shifted to the "framework" and "process" of RTI
  - The actual instructional approaches were lost in translation
    - Everyone has to find these elusive "research-based" approaches on their own
  - Those highly successful intervention approaches will be covered next

To properly assess word-level reading difficulties, we need a

CRASH COURSE ON HOW WORDS ARE LEARNED

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

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

The Alphabetic Principle

- Consider the difference between Chinese writing vs. alphabetic writing
- We do not write words!
  - We write sequences of characters designed to represent sequences of phonemes in spoken words
- Alphabetic writing involves phoneme–based characters
- Poor cognitive 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
  - *Recall that we do not remember words by visual memory!*

The Four Classic Reading Approaches

- Clear delineation between them based on the instruction's unit of focus
  - Teachers may sample strategies from multiple approaches
- They fall along a continuum of unit size
  1. **Letters/graphemes** – phonics approach
  2. **Word parts/rime units** – linguistic/word family approach
  3. **Words** – whole word approach
  4. **Sentences/paragraphs** – whole language/balanced literacy

The Four Classic Reading Approaches

- In every study I've seen, one has the best results
- In every study I've seen, one has the weakest results
- What they share in common
  - -None adequately addresses both levels of word-level reading

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 required for meaning, not for recognizing familiar words
- Skilled readers are good at sounding out new words
  - This is tremendously more reliable than guessing
- Poor readers 1) know do not recognize most of the words they read and 2) are not good at sounding out words, so they *must* rely on guessing from context

Syntactic/Grammatical

- Required for meaning, but virtually uncorrelated with word reading

Grapho-phonic

- Refers to sampling letters, not sounding out words phonically
- Skilled readers effectively sound out unfamiliar words with help from set for variability and contextual facilitation (90%-98% accuracy rate)
  - By contrast, guessing is ineffective (8% to 25% accuracy)

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

- 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
- 1960s to 1980s miXeD cAsE sTuDiEs
  - Adams' comment about debating with students
  - Kevin reading Calvin & Hobbes
  - Our "abstract representation" of every letter
  - If a first grader learns "bear" he can instantly identify "BEAR"
  - Consider all the fonts and personal handwriting we read

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

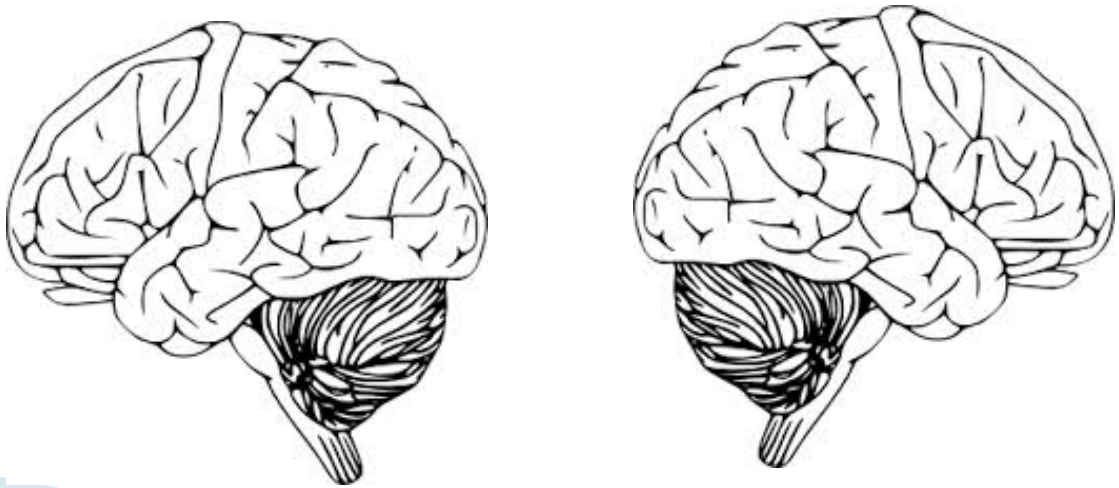
- Word reading correlates strongly with phonological skills
  - *Phonological awareness & Word Reading: r* = .5 to .7;
- Note how we sometimes "block" on names of people and things (visual memory), but never written words
- Most students who are deaf struggle tremendously with word-level reading
  - *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

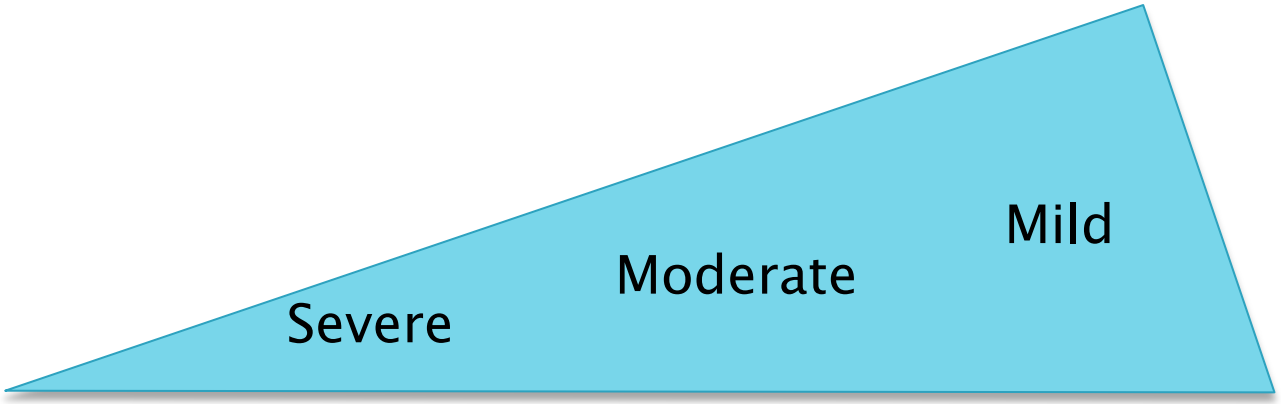
  are all processed in different areas/sub-systems of the brain!

  (Cattell's findings from 1886 now make sense)



Concerns About the Efficacy of Phonics

- 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

How Sight Vocabulary is Developed

An Introduction to Orthographic Mapping

A Common Misconception About Reading: "Children Learn to Read in Different Ways"

- This confuses *teaching* and *learning*
  - We teach things they don't learn; they learn things we don't teach!
- We TEACH reading in different ways; they LEARN to read ***proficiently*** in only one way
- Teaching is what we do—learning is what their brains do
- It's amazing there's even one way our brains read so efficiently
  - Perceive words in 1/20th of a second
  - Read 150-250 words a minute
  - Have 30,000 to 70,000 words in our instant, orthographic lexicon
  - Add new words to that lexicon after 1 to 4 exposures
- There are not 2, 3 or 4 ways our brain is set up to do that!
- All skilled readers have the same basic skills
  - All skilled readers can read nonsense words, even if not taught phonics
  - All skilled readers have large and continuously expanding sight vocabularies

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 new words are not sounded out, they are poorly remembered
- From 2nd grade on, typically developing readers remember words after only 1 to 4 exposures

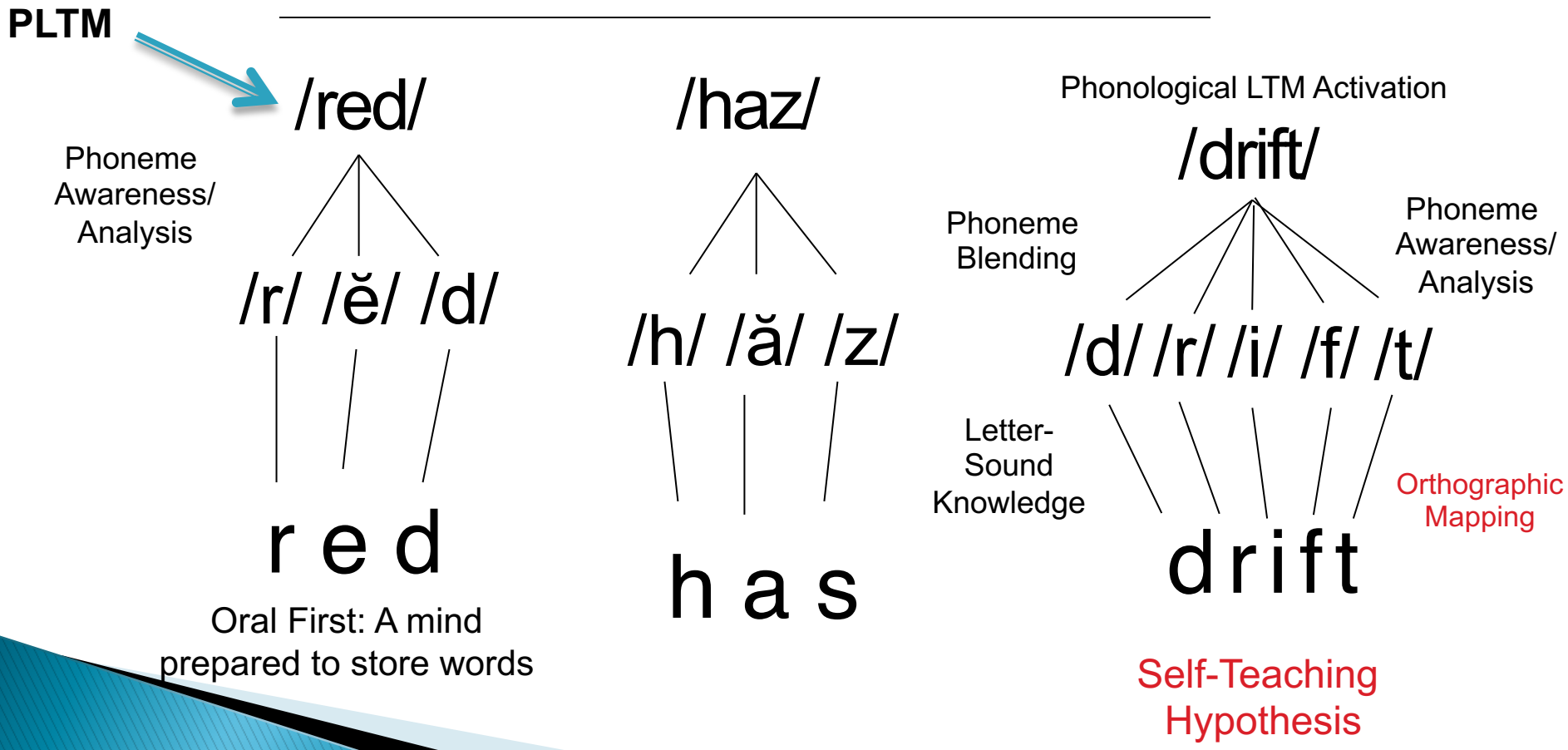
Linnea Ehri's Orthographic Mapping Theory

- 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 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

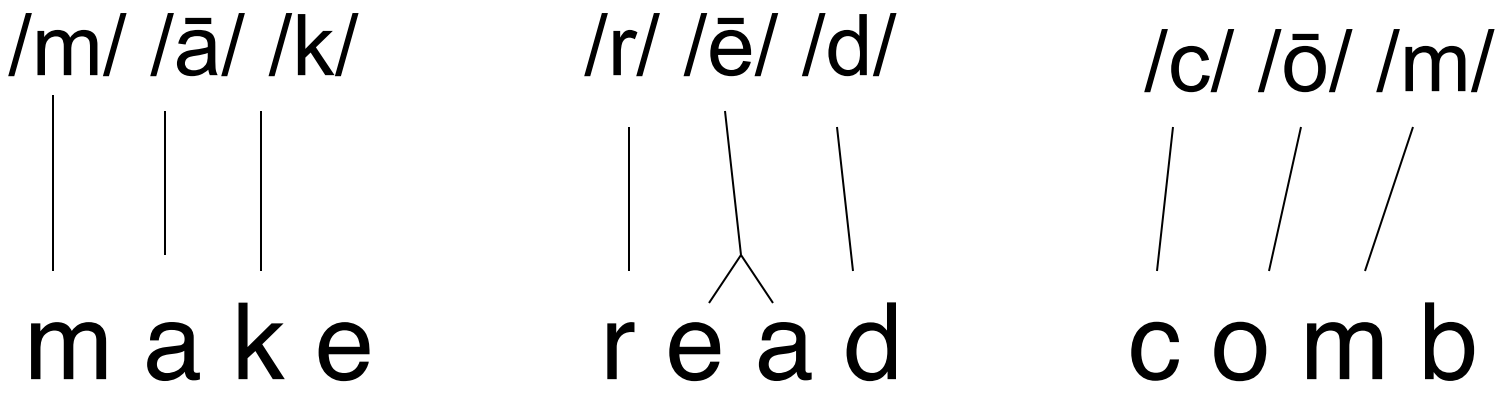
"Transparent" Words

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



How We "Map" Words

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



Orthographic Mapping

- Orthographic mapping is the mental process we use to turn an unfamiliar written word into an instantly accessible, and familiar "sight word"
- *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 about 60%-70% of students via exposure to literacy activities
  - Most students learn to read regardless of how they were taught

What about irregular words?

- Irregular words only take a few extra exposures to learn
- Most irregular words are off by only one element
  - (*said, put, comb, island*; multiple violations are rare: *one, iron*)
- 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 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)

Effective Use of Flash Cards
From the Perspective of Orthographic Mapping

- Introduce the word orally first
- Segment into phonemes verbally (no letters)
- Emphasize each phoneme
- Ask for letters associated with phonemes
- Build a “phonological framework”
  - Focus first on regular letter-sound connections
- Elaborate if possible
- Then work that word into a stack of flash cards

What Determines Reading Fluency?

- The NRP only *defined* fluency (speed, accuracy & prosody) but did not explain what determines fluency
- The elusive key to reading fluency is:

SIGHT VOCABULARY SIZE

- With a large sight vocabulary:

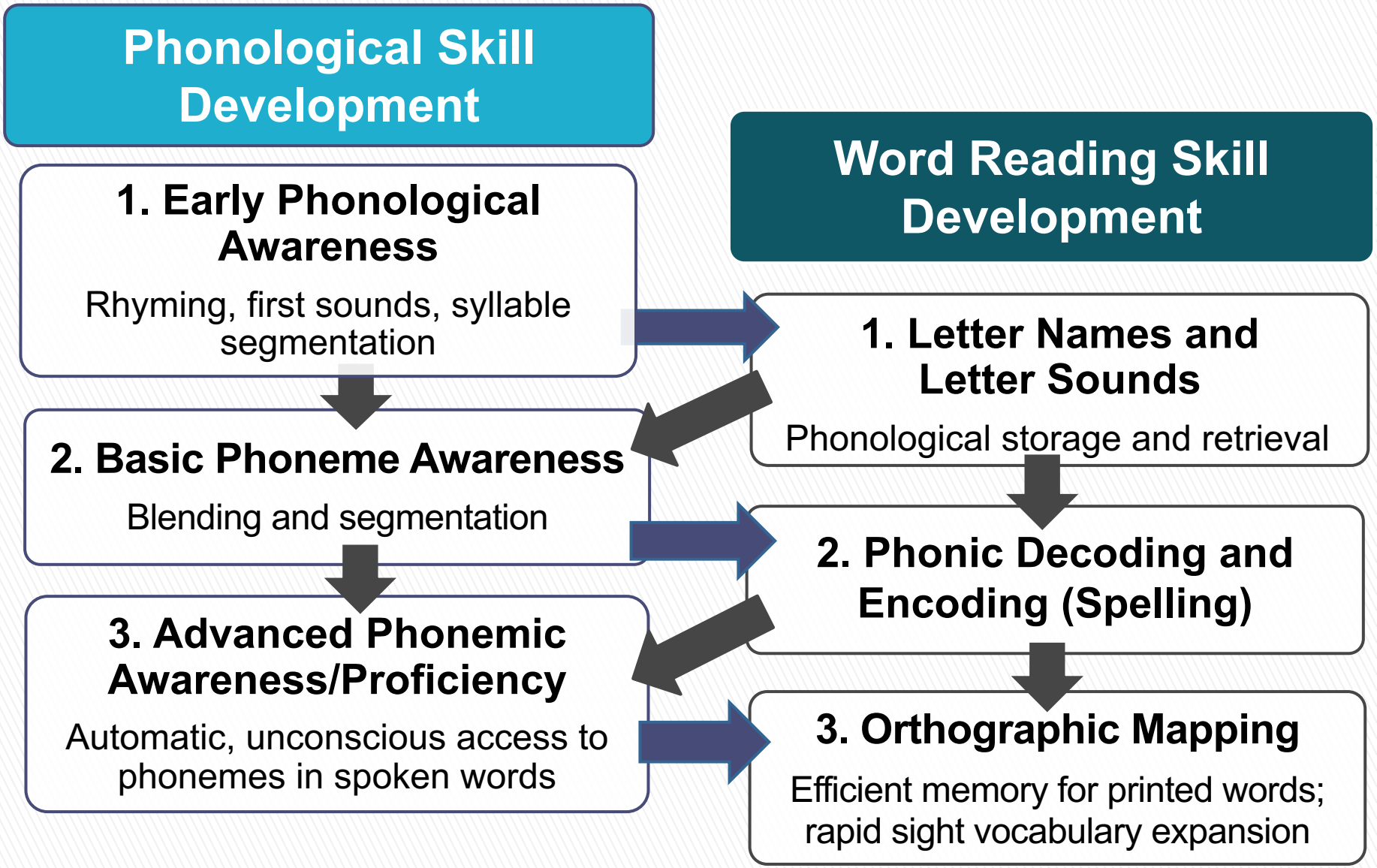
  Most (or all) words "pop out"; reading is *fast* and *accurate*
- With a limited sight vocabulary:

  Reading is effortful and not fluent
- Conclusion: Fluency is a BY-PRODUCT of a large and ever expanding sight vocabulary – it is not a separate reading-related skill independent of other word reading factors

The Development of Word Reading Based on Phonological Skills

Phonology: The Foundation of Alphabetic Writing

The Developmental Relationship Between Phonological Skills and Word-Level Reading



PREVENTION AND INTERVENTION

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
- Quick Survey:
  - How many of you work in schools that have a formalized, systematic, whole class, Tier 1 PA training in K-1?

Findings from the 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., 2nd graders vs. 5th graders vs. 9th 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 (2nd percentile? 10th? 20th? 30th?)
- Contrary to the expectations, the first two show small effects and the other three show no consistent effects
  - SES showed greater impact with reading comprehension, however
- This is all good news!
  - We can't change kids' SES or age or initial severity, and we typically don't have enough personnel for 1:1 group sizes

Findings from the Intervention Research

- Standard score point gains from normed assessments are the only way to know if children are actually "catching up"
- *About* 85%–90% of intervention studies show 0 to 9 SS point improvements while about 10%–15% of intervention studies show 10 to 25 SS point improvements
  - Results maintained at 1, 2, 3 & 4 year follow ups (depending on the study)
  - Results from the 0–9 studies often lost in follow up studies
- A "tripartite" division within the intervention research
  - *Minimal results group:* 0 to 5.85 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

The Phonological Proficiency Intervention Continuum

Three categories based on outcomes align with three different intervention approaches relative to orthographic mapping!

- This provides confirmation of the orthographic mapping hypothesis
- Superb alignment of theory with empirical outcomes

- 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 1st grade)

The Phonological Proficiency Intervention Continuum

- This pattern in the *intervention* research aligns with the *orthographic learning* research into Ehri's and Share's theories
- This pattern is perfectly consistent with the alphabetic nature of our writing system
- This pattern is inconsistent with guessing strategies, whole word memorization, or phonics that does not directly teach/train oral phonemic awareness skills
- We must ask ourselves, which do we prefer for the children we teach, 3–4 normative standard score point gains or 14–17?
- Regardless of the explanation found in the orthographic learning literature, these results represent best practice

SUMMARY AND CONCLUSIONS

Summary

- Skilled word-level reading requires good phonemic skills and good letter-sound skills
  - Due to the phonemic nature of our alphabetic writing system
- All skilled word readers are good at phonic decoding and orthographic mapping (remembering words) while weaker readers are weak in both
  - Phonics skills are essential, but not enough
  - Skilled readers have large sight vocabularies, weak readers do not
- Fluency is largely a function of sight vocabulary size
- Reading problems are correctable and preventable
- The most highly effective word-reading intervention outcomes trained phonemic awareness, letter-sound skills, and provided reading practice