TEXAS CENTER for LEARNING DISABILITIES

Learning for SUCCESS
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The Texas Center for Learning Disabilities (TCLD) investigates the classification, early intervention, and remediation of learning disabilities.

Understanding Dyslexia and Its Implications for Identification and Treatment

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Things we know

- Dyslexia is real. People with dyslexia often have other problems (ADHD, math, written expression). Not the only type of RD
- Many children at-risk for dyslexia can be taught to read with early identification and explicit, comprehensive reading instruction
- Remediation of dyslexia after Grade 2 requires high intensity and explicit, comprehensive reading instruction
- We know lots about brain function, malleability (plasticity in development and in relation to intervention) and the heritability of dyslexia

Things we don't know

- Exactly how many people have dyslexia
- The level of intensity required to remediate dyslexia
- How "dyslexia" differs from "other" word level disorders
- How to scale effective identification and intervention and translate what's known from science
- How to use the research on brain function and heredity to identify and intervene with dyslexia (no dyslexia genes)
- Accommodations and adjuncts for people with intractable reading problems

Misunderstandings About Dyslexia

- Definition and Prevalence
- Role of IQ
- Specificity
- Effective Interventions
- Methods of Service Delivery
- Brain Structure and Function

Definition: Word Level Reading Difficulties

Most common and best understood form of LD (Dyslexia)

- A common problem: Largest single group of students in special education: almost 2/5 of all children identified for special education
- Many children not identified for special education have word level difficulties
- Addressed in IDEA as "basic reading" domain and often through 504

IDA DEFINITION OF DYSLEXIA

Dyslexia is a specific learning disability that is neurological in origin. It is characterized by difficulties with accurate and/or fluent word recognition and by poor spelling and decoding abilities. These difficulties typically result from a deficit in the phonological component of language that is often unexpected in relation to other cognitive abilities and the provision of effective classroom instruction. Secondary consequences may include problems in reading comprehension and reduced reading experience that can impede the growth of vocabulary and background knowledge.

Adopted by the Board of Directors: November 12, 2002

Important Research Findings

1. Dyslexia occurs primarily at the level of the single word and involves the ability to decode and spell printed words in isolation (accurately and automatically). It leads to problems reading text, but is not a text level disability.

Important Research Findings

2. **Single word decoding problems in reading and spelling are strongly associated with problems segmenting words and syllables into phonemes.**

Alphabetic Principle

- Print represents speech through the alphabet or other visual symbol
- Regardless of surface appearance (orthography), words represent internal units based on sound (phonemes)
- In learning to read, the child makes explicit an implicit understanding that words have internal structures linked to sounds (phonological awareness)
- Reading is parasitic on language

Important Research Findings

3. Dyslexia occurs as part of a natural, unbroken continuum of ability--what causes good reading also causes poor reading (Shaywitz et al., 1992).

The attributes of dyslexia are dimensional: variations on normal development. One theory explains success and failure in reading. Prevalence depends on the threshold

What is the Prevalence?

- Most estimates are 3-7% (often assume effective intervention, exclusions, no comorbidity), but still depends on threshold
- Snowling and Melby-Lervag (2015) meta-analysis of genetically sensitive designs:

+ family risk < 10th %tile (34%); > 10th %tile (53%); about 45% overall

-family history <10th %tile (11%); > 10th (16%)

Important Research Findings: IQ

4. **Dyslexia is best identified through assessments of reading and spelling skills, and instructional response**

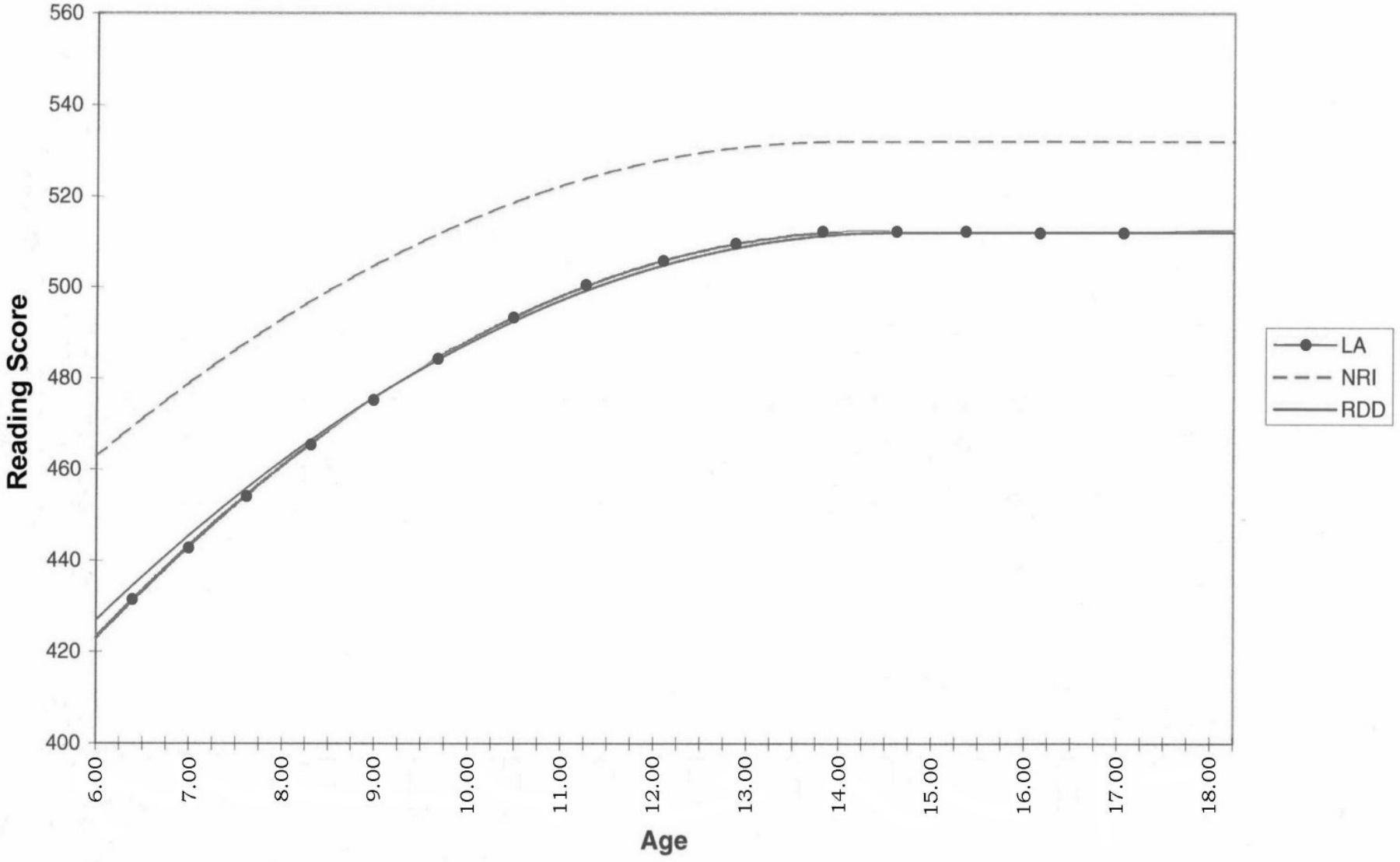
IQ tests are not necessary (Dyslexia is uncoupled from IQ): Methods for identification of LD based on IQ-discrepancy or patterns of cognitive strengths and weaknesses lack validity.

Important Research Findings: Weak relation of outcomes with IQ

5. Children Do *NOT* Outgrow Dyslexia

- Over 70% identified as dyslexic in Grade 3 remained dyslexic as adults
- Without adequate intervention, dyslexia is a lifelong, chronic disorder
- IQ is weakly related to intervention outcomes (Stuebing et al., 2009; 2014)

Shaywitz et al. (1996)



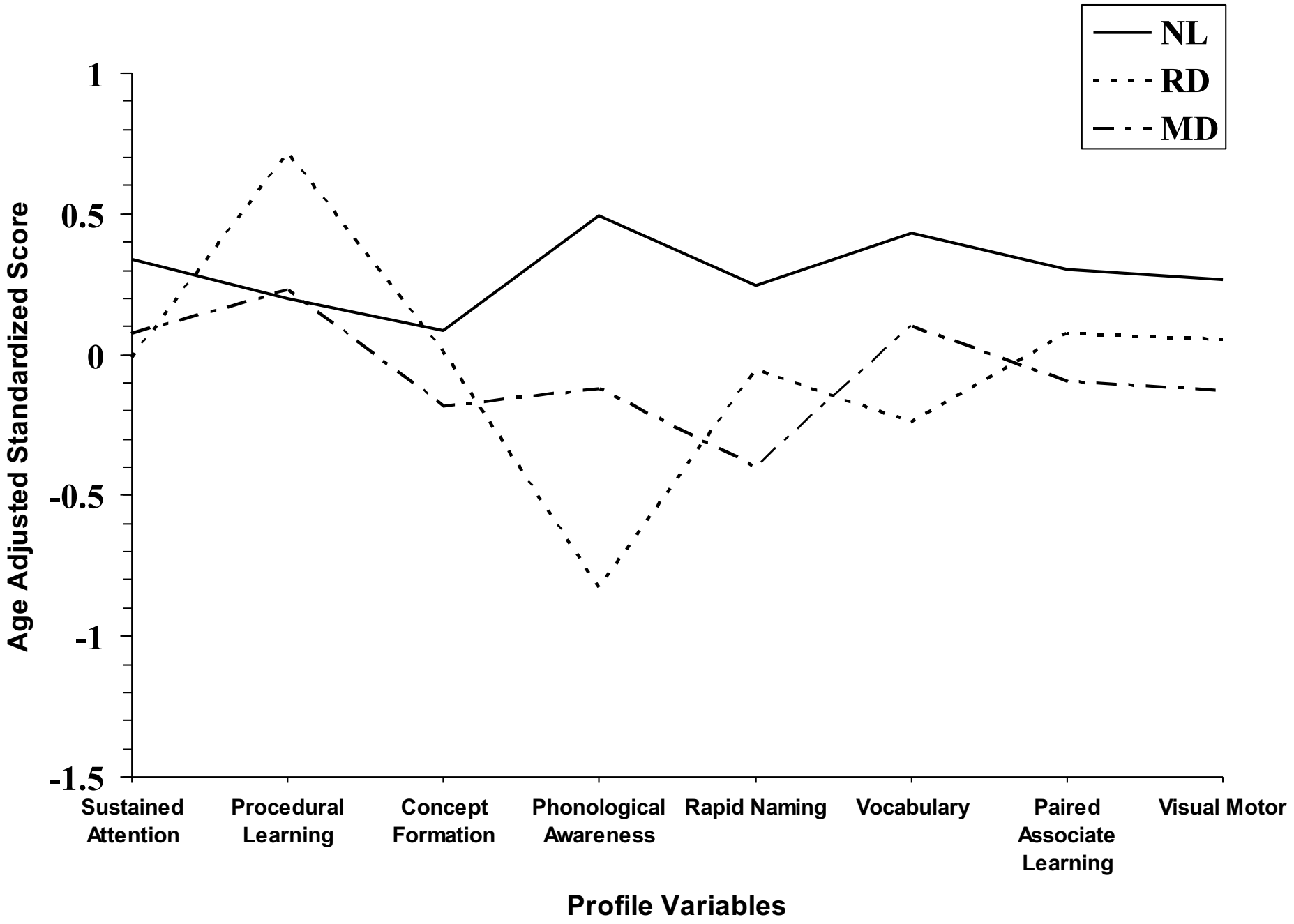
Important Research Findings

6. People with dyslexia have problems outside phonology

- *Comorbidity*- academics, ADHD, oral language
- Word recognition not the only type of RD (text level disorders are not dyslexia)

Specificity

- Dyslexia is real; consensus definition is narrow
- Dyslexia is often part of a complex presentation; generalist genes affect multiple LDs and ADHD (continuity hypothesis)
- Comorbidity: ADHD common; if language and working memory problems significant, math impaired; anxiety is common. Written expression and reading comprehension almost always impaired
- Phonological processing/decoding presentation shines through the glare of complexity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Sustained Attention
Procedural Learning
Concept Formation
Phonological Awareness
Rapid Naming
Vocabulary
Paired Associate Learning
Visual Motor
Profile Variables

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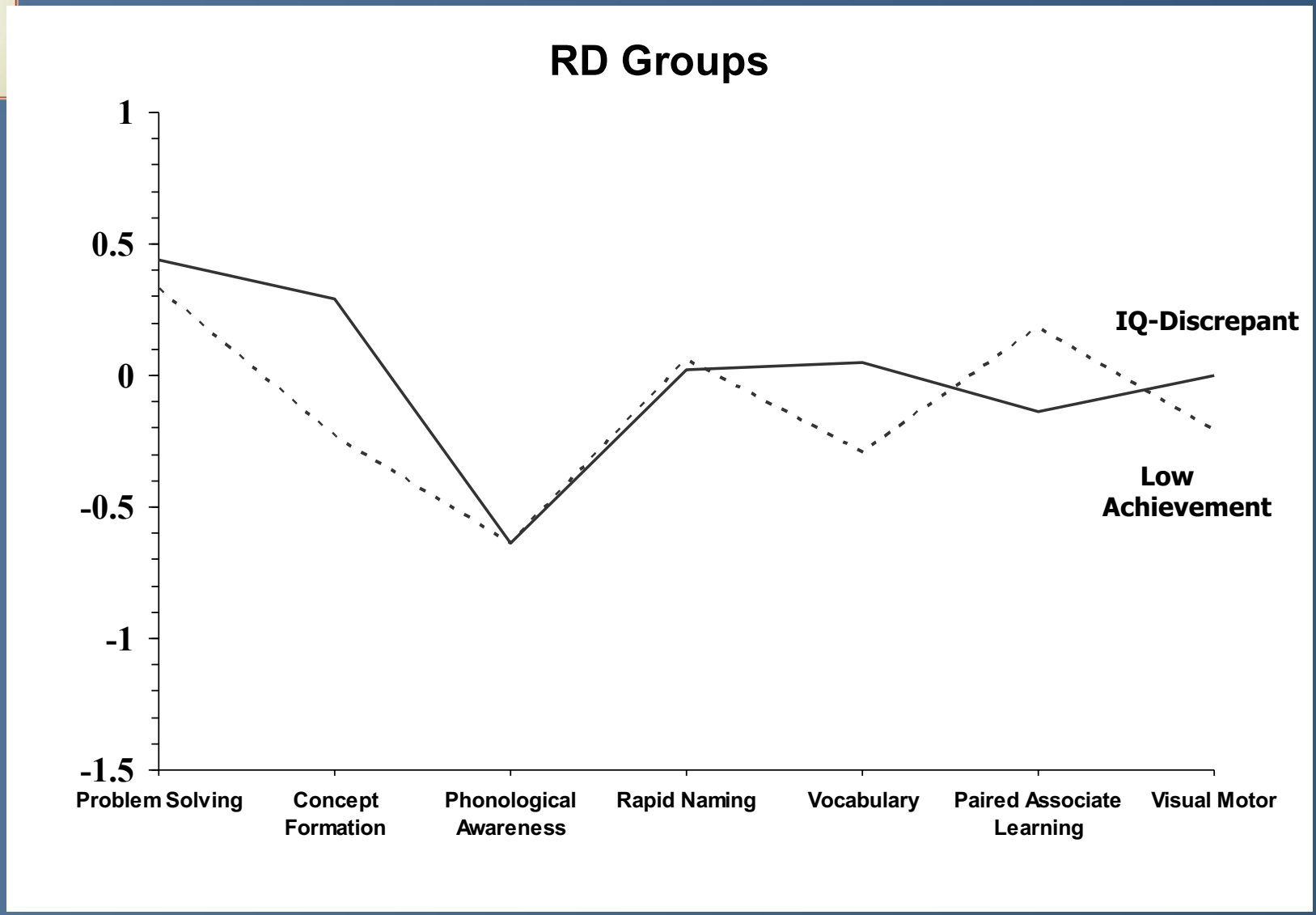

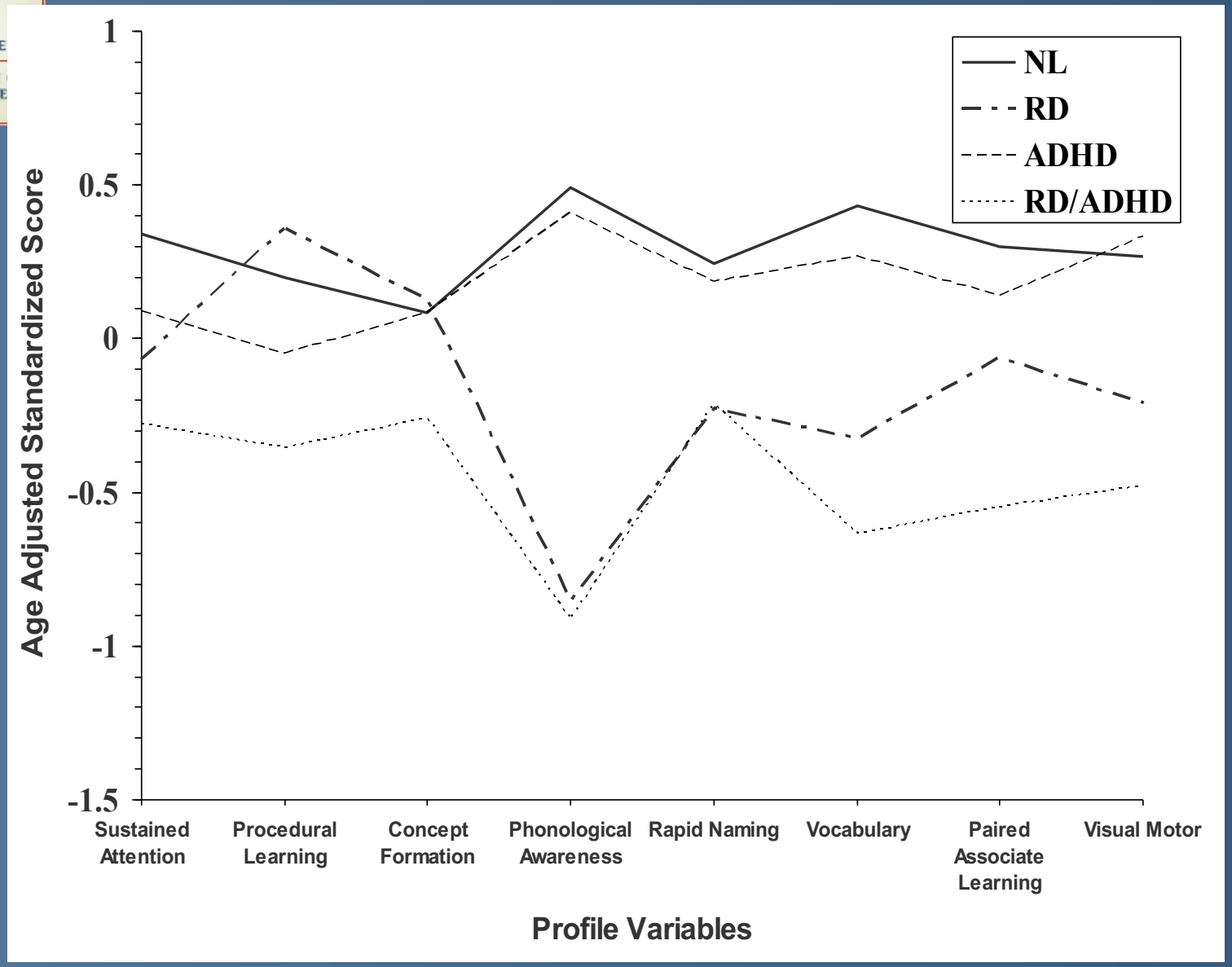
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Sustained Attention
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Profile Variables

Important Research Findings

7. Dyslexia can (often) be prevented.

   Remediation requires much more intensity

   Skills that prevent dyslexia must be taught early in school

   Remediation after Grade 2 demonstrably less effective (Connor; Lovett): diminishing returns

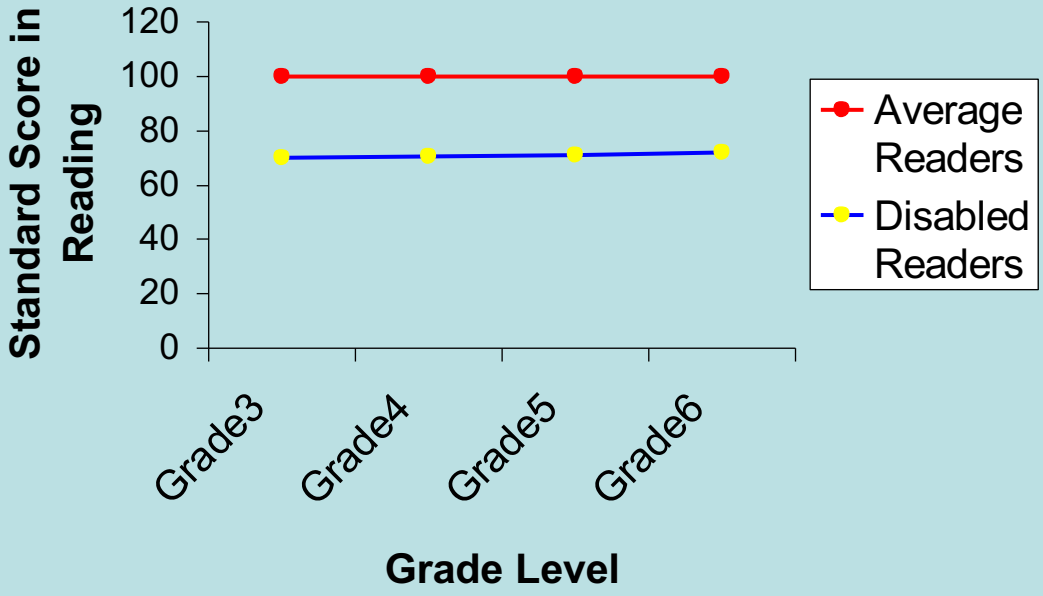
Important Research Findings

- Some children placed in special education are instructional casualties because they did not get the needed instruction early in development
- Dyslexia (or any LD) should not be identified in the absence of documentation of adequate instruction (IDEA 2004)
- We know very little about effective accommodations and adjuncts for children and adults with severe reading problems

8. Effective Intervention

- Teach phonics EXPLICITLY with an approach that includes comprehension and fluency components (NRP about explicitness, not phonics). Differentiate based on student needs
- No specificity of appropriate interventions. Research supports explicit, comprehensive, differentiated approaches at classroom and supplemental level
- Research does not support multisensory (in traditional sense), balanced, systematic, manualized, multiple cuing systems, discovery or constructionist or rule-based approaches
- Traditional service delivery models ineffective; Screen, prevent, remediate, accommodate (MTSS: opposite of typical sequence)

Change in Reading Skill for Children with Reading Disabilities who Experience Growth in Reading of .04 Standard Deviations a Year



Early Intervention is Effective

- Prevention studies show that 70- 90% of at risk children (bottom 20%) in K- 2 can learn to read in average range. Prevents automaticity problems.

Remediation is not a solution!

Decoding usually teachable at any age with sufficient intensity

Reading rate is limited because the proportion of words in grade level passages that children can read "by sight" is less than for average readers.

How do you close the gap when the student is already 3- 5 years behind (exposure and experience, not age)?

Early Development of Reading Skills: A Cognitive Neuroscience Approach (Jack M. Fletcher – PI)
Grade 1 Multi-Tiered Intervention Funded by NSF though the IERI

Patricia Mathes and Carolyn Denton: Early Reading Intervention (Mathes et al., RRQ, 2005; Denton et al., 2006, JLD). Recipient, Albert J. Harris award, 2007, IRA

A. Papanicolaou, P. Simos: Brain Activation Patterns (Simos et al., Neuropsychology, 2005; 2007; JLD, 2007)

Interventions

Enhanced Classroom Instruction

- Whole grade screening and progress monitoring: at-risk = bottom 20%
- District provided extensive professional development and new materials

Supplemental Instruction

- Some children also received an additional 40’ of daily small group instruction for 30 weeks (about 80 hours)

Proactive Intervention (Mathes, Torgesen)

- Explicit instruction in synthetic phonics, with emphasis on fluency.
- Integrated decoding, fluency, and comprehension strategies (actual stories by authentic authors with phonics principles).
- 100% decodable text
- Prescriptive: Carefully constructed scope and sequence designed to prevent possible confusions taught to mastery taught to mastery

Responsive Intervention

- Explicit instruction in synthetic phonics (blending) and analogy phonics (word families)
- Taught decoding, using the alphabetic principle, fluency, and comprehension strategies in the context of reading and writing
- No scope and sequence
- Teachers responded to student needs as they are observed.
- Leveled text, not phonetically decodable

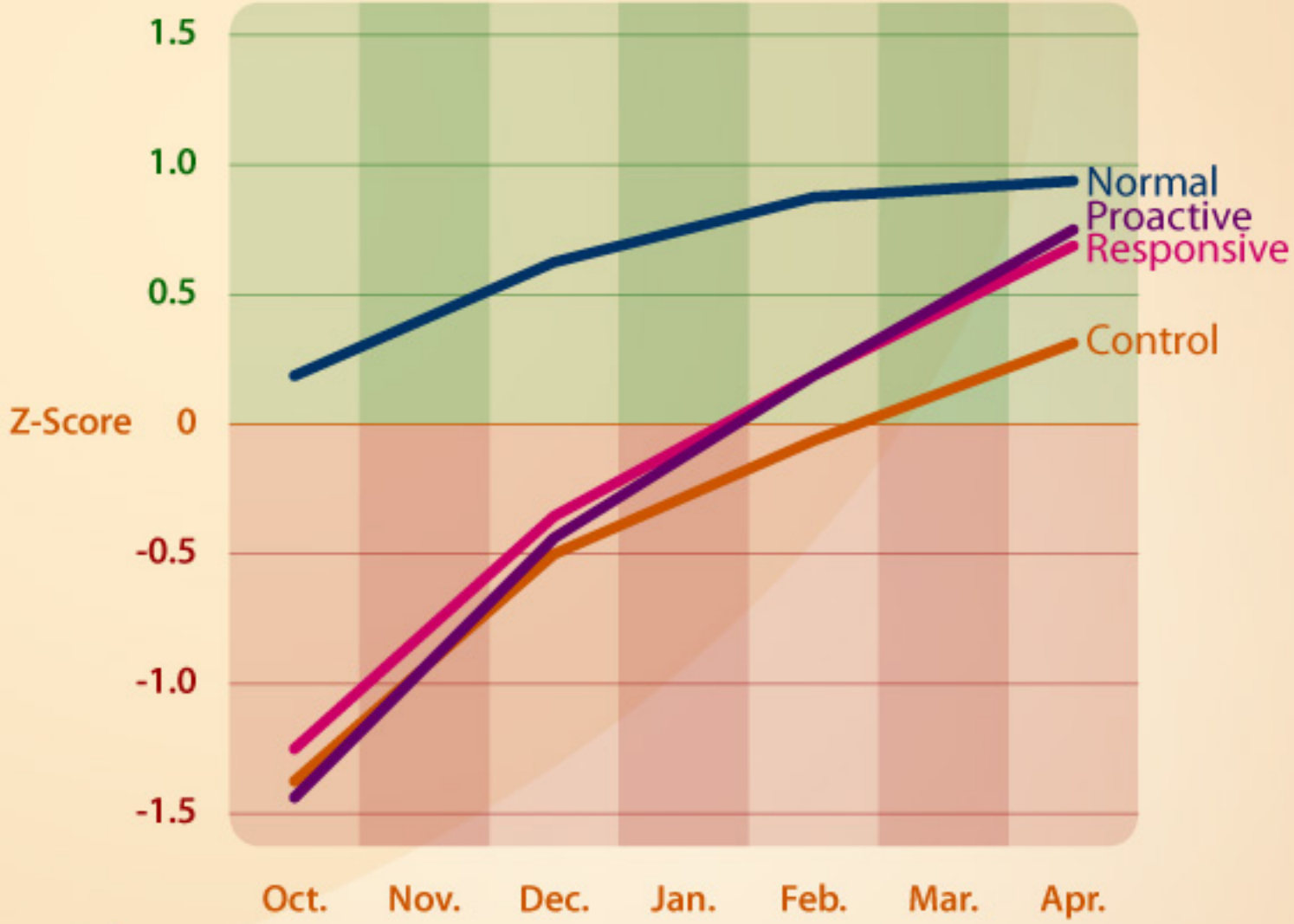
The Responsive Intervention

- Fluency Work (Repeated Reading) and Assessment: 8-10 minutes
- Word Work: 10-12 Minutes
- Supported Reading

  10-12 Minutes
- Supported Writing:

  8-10 Minutes

Growth in Fluency by Intervention



ScaleUP

What percentage of children don't respond adequately to quality intervention?

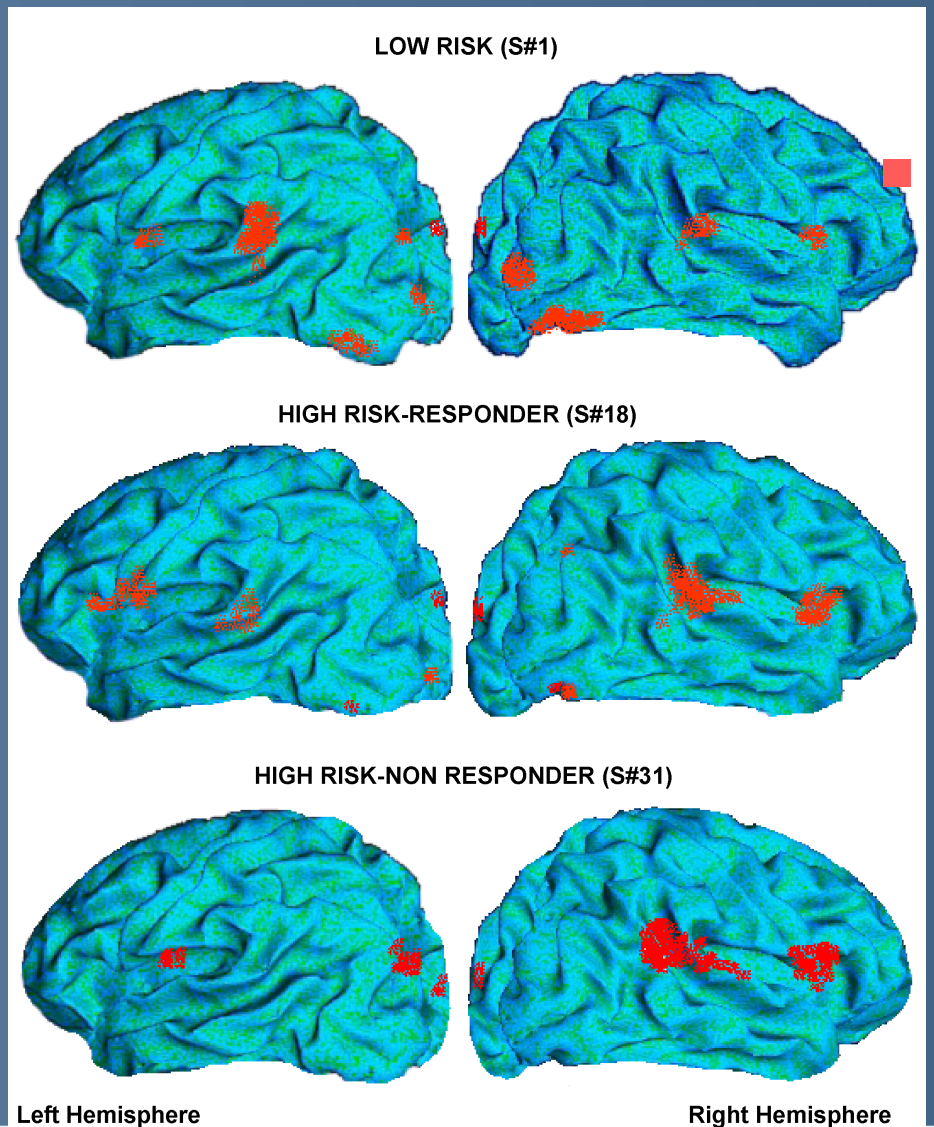
ECI only: 15/92 = 16% (3.2% of school population)

ECI + Tutoring:

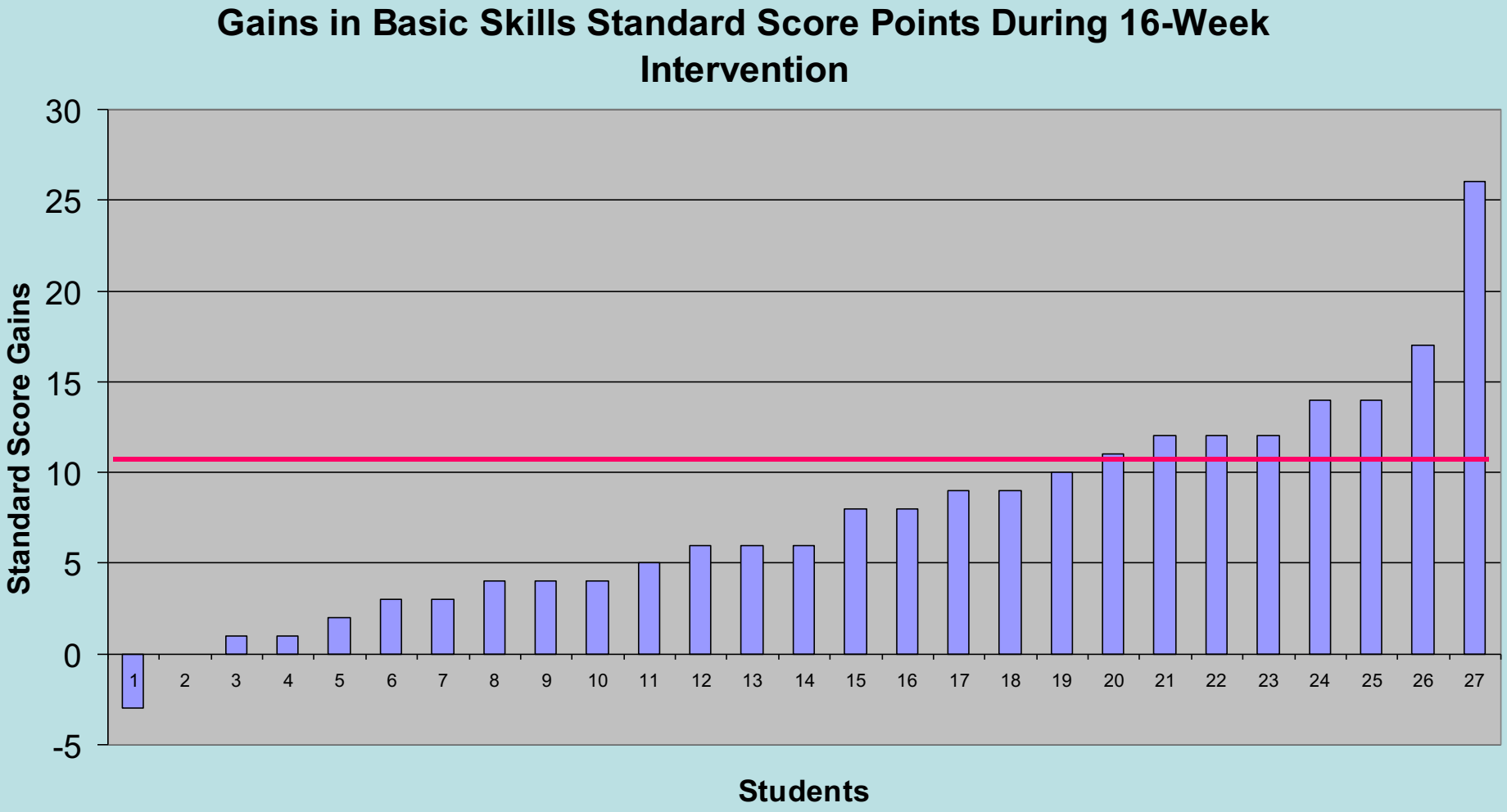
- **7/163 = 4% (<1% of school population)**

(Basic Reading < 30th percentile) (5 others did not meet fluency benchmarks)

Grade 1 Intervention (pseudoword task)



Simos et al (Neuropsychology, 2005)- after Grade 1 intervention in Mathes et al. (RRQ, 2005)



(Denton et al., JLD, 2006)

Scaling Up Responsive Reading Instruction

- 31 schools from 16 rural, urban, and suburban school districts across about a 28,600 square mile area
- 40 teachers; 422 at-risk first grade readers
  - Screened all first grade students in the schools
  - Random assignment of at-risk students to treatment and comparison (typical practice) within each school
  - About 43% of comparison students received an alternate school-provided Tier 2 reading intervention

Denton, Nimon, Mathes, Swanson, Kethley, Kurz, & Shih (2010). *Exceptional Children*.

ScaleUP

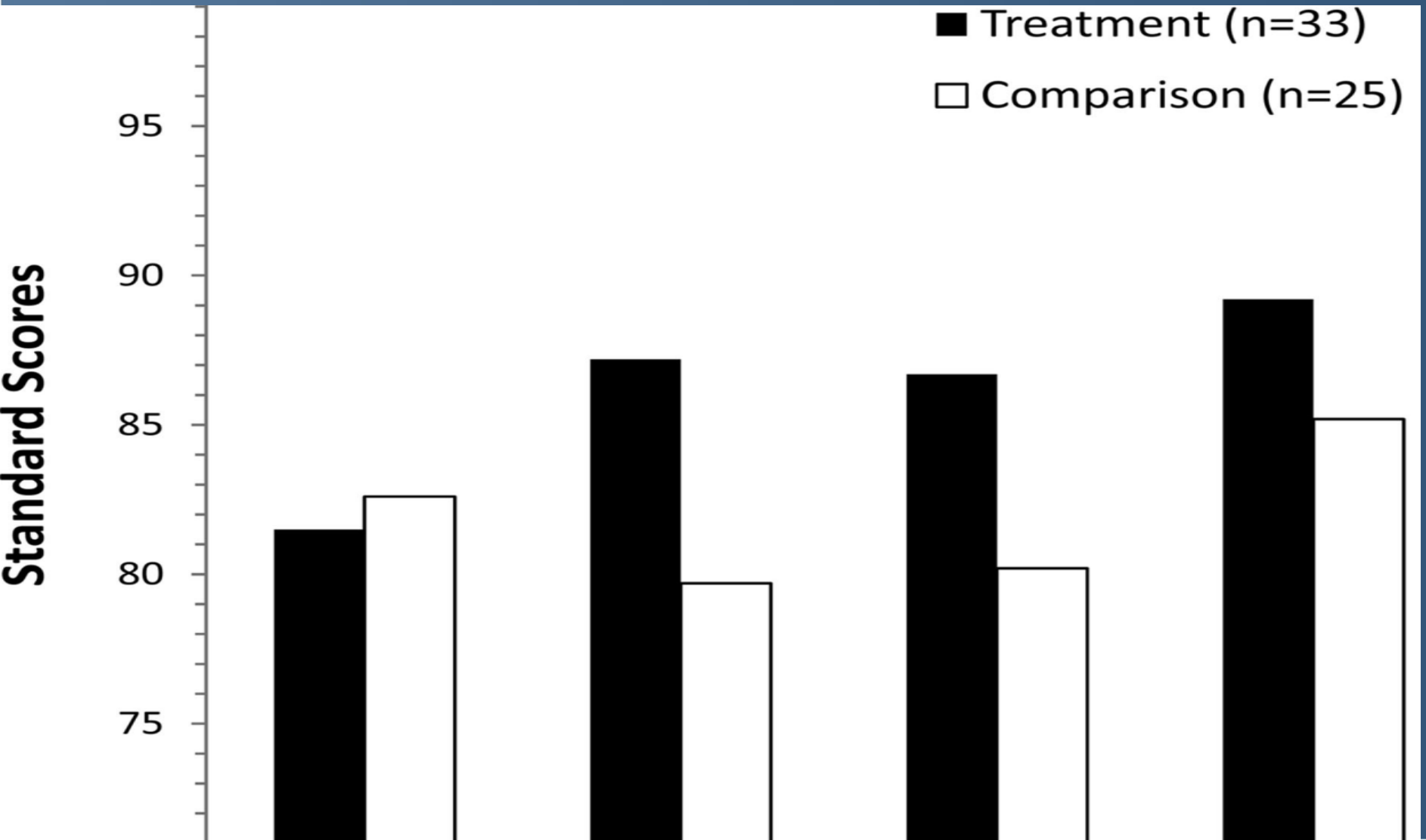
Results

- Statistically and practically significant group differences favored the treatment schools for all reading measures with effects in the moderate to large range
- Benchmarks for adequate intervention response: WJIII Basic Skills Composite ≥ Standard Score 93: 91% of treatment and 79% of comparison met benchmark

Scaling is Feasible

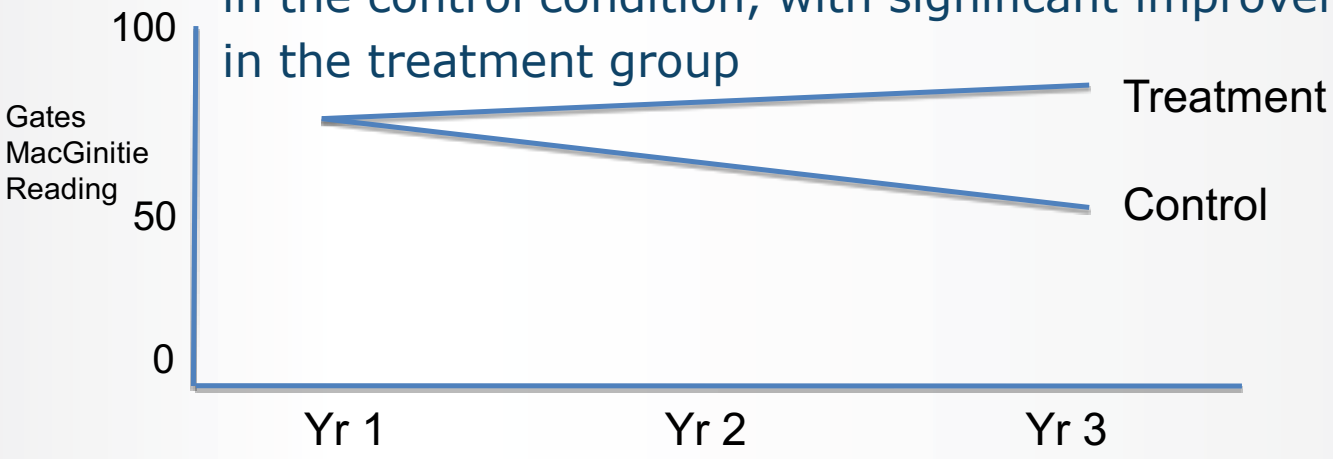
- Despite variability in implementation and the fact that many comparison students received an alternative Tier 2 intervention, the research intervention was associated with significantly higher outcomes than typical practice on multiple measures.
- Supports the feasibility of wide-scale implementation of RTI preventative models

Persistence: Blachman et al., 2014: 10 Year Follow-up

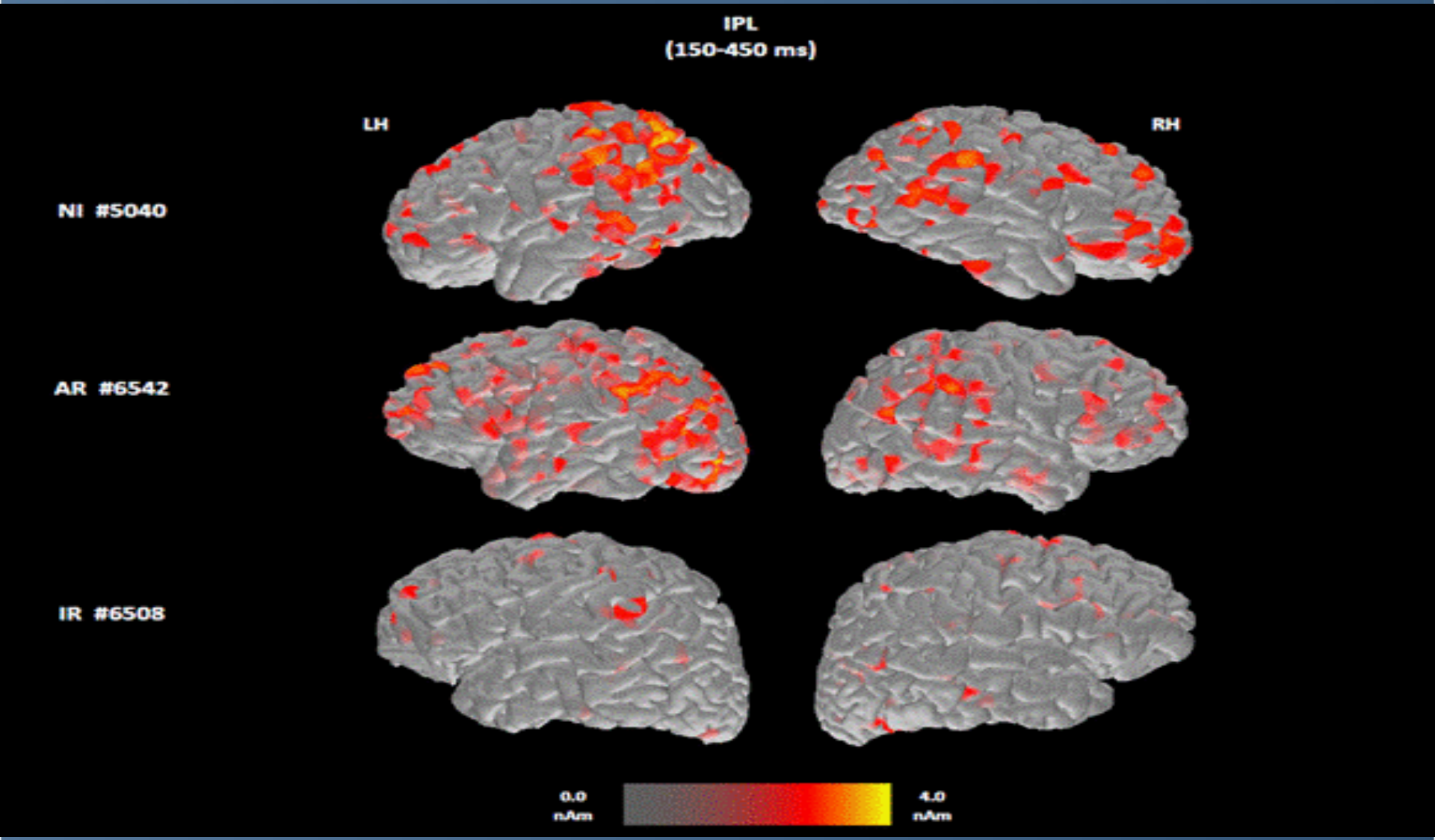


- NICHD middle school studies – intensive interventions for adolescents with severe reading difficulties

Cohort of minimal responders followed for three years indicated a decline in performance for the participants in the control condition, with significant improvement in the treatment group



Baseline MEG Scans (Rezaie et al., 2011)



9. Neuroscience explains why

- Two metaphors

1. Language is parasitic on speech (Liberman; sublexical, dorsal system)

2. Reading is unlocking language from vison (Dehaene) or language at the speed of sight (Seidenberg)

- Malleability in development and in instructional response, but access and experience is key for automaticity
- What does "word blindness" mean?

Neurobiological Factors

- Reading, math, and writing are heritable traits, but individual gene effects small
- In reading, heredity accounts for 50- 80% of variance in outcomes; increases with age
- No genes specific to poor development (e.g., no dyslexia genes); common disorder-common variate vs. common disorder-rare variant
- Strong understanding of neural systems, which are malleable and mostly normalizing
- Field has moved away from "bad- gene, bad brain" theory to the idea of genes that make brains at risk and risk is modified by environment
- No simple biological test for LD, but biology is not destiny

Dual Route Theory

- Dorsal (assembled) route: sublexical, must access phonological representation and identify substituent parts (indirect)- reading is parasitic on language
- Ventral (stipulated or addressed) route: lexical, directly from word form to pronunciation (Reading is unlocking language from vision; language at the speed of sight
- Operate in parallel depending on the properties of the word

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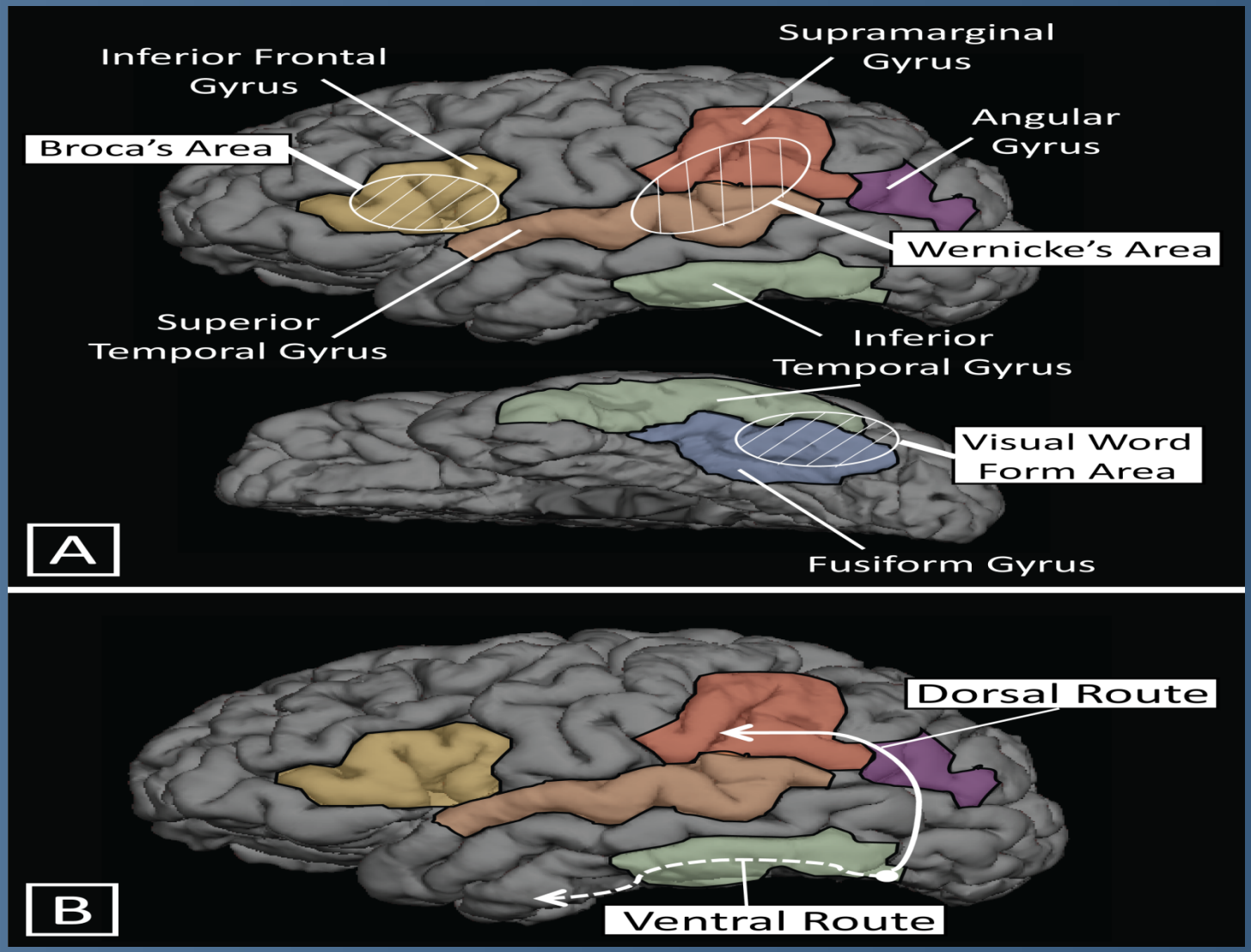
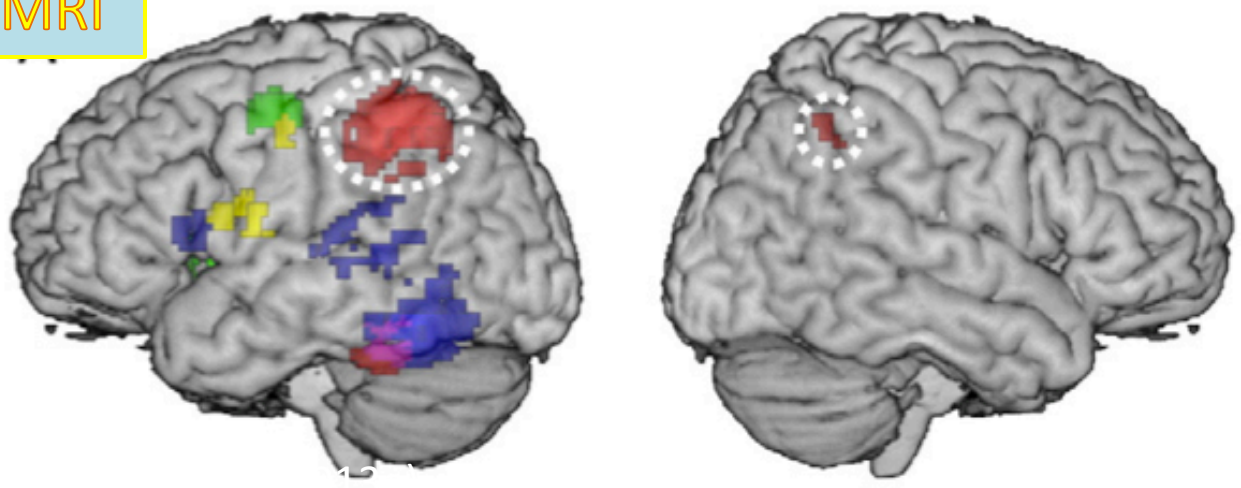
The Reading Brain



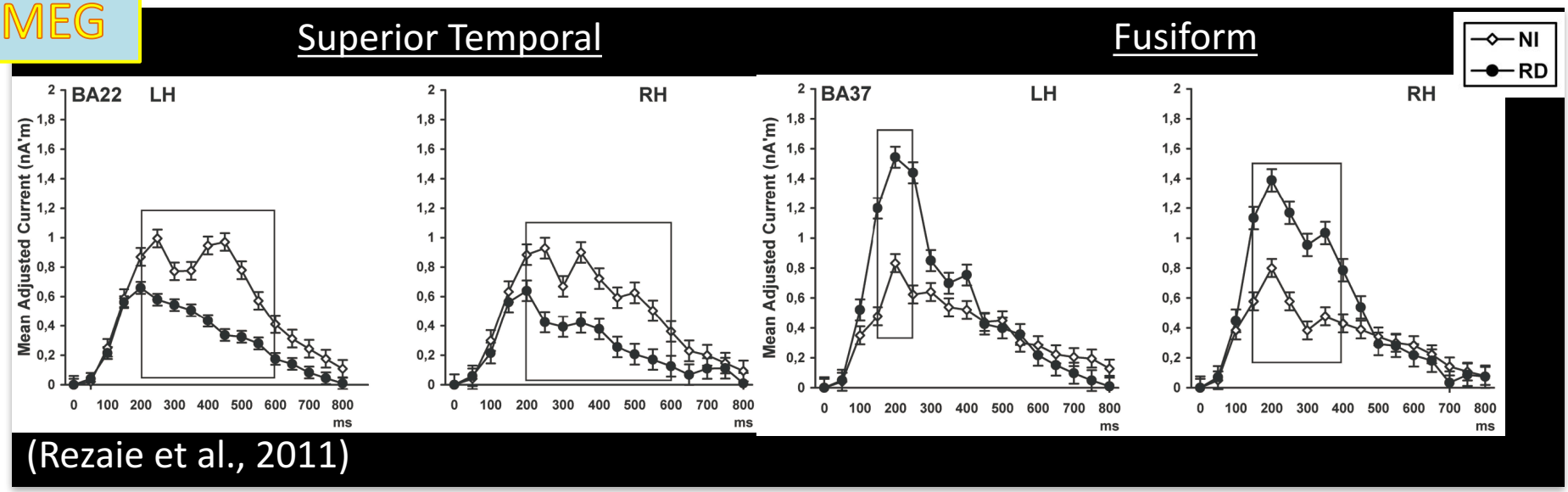
Functional Neuroimaging Studies of Dyslexia

fMRI



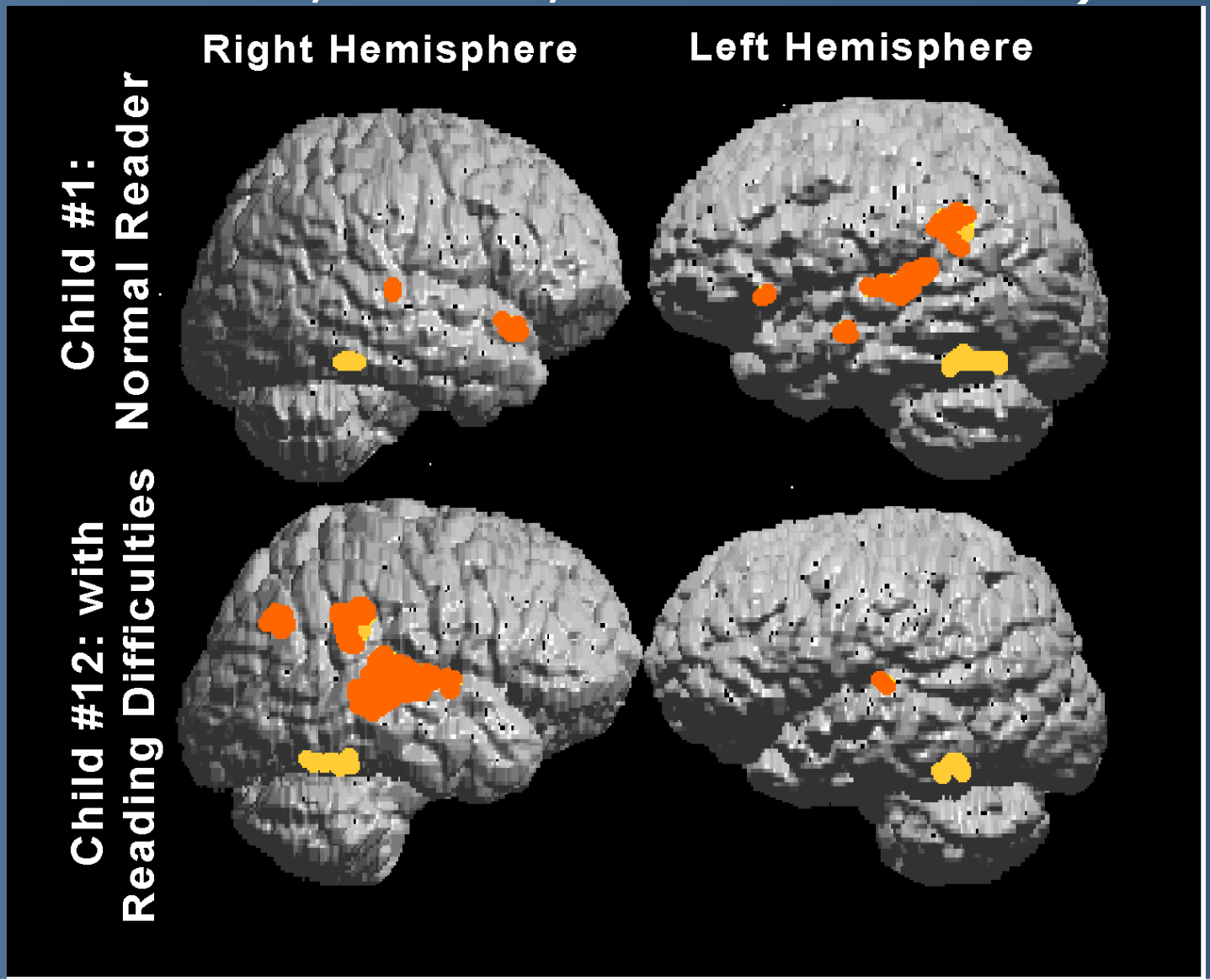
- Children dyslexic underactivation
- Children dyslexic overactivation
- Adult dyslexic underactivation
- Adult dyslexic overactivation

MEG



(Rezaie et al., 2011)

Brain Function in Dyslexia (Simos et al., 2001; Pseudowords)



Neural Response to Intensive Intervention

Does the pattern of brain activation change in response to intervention?

8 children with severe dyslexia

8 week intense phonologically- based intervention (2 hours a day= up to 80 hours of instruction)

Simos et al., *Neurology*, 2002

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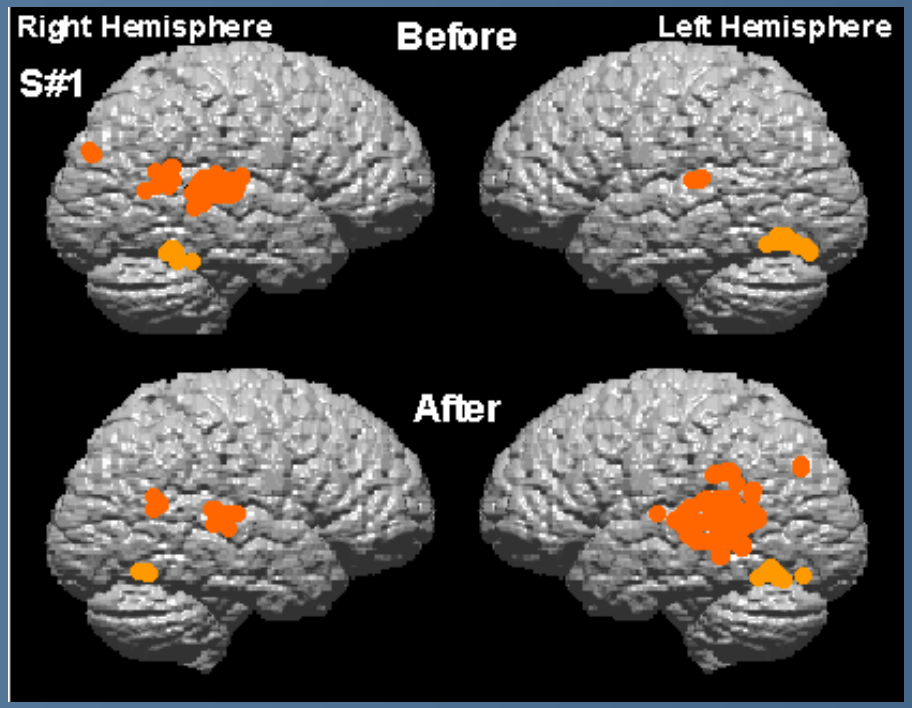
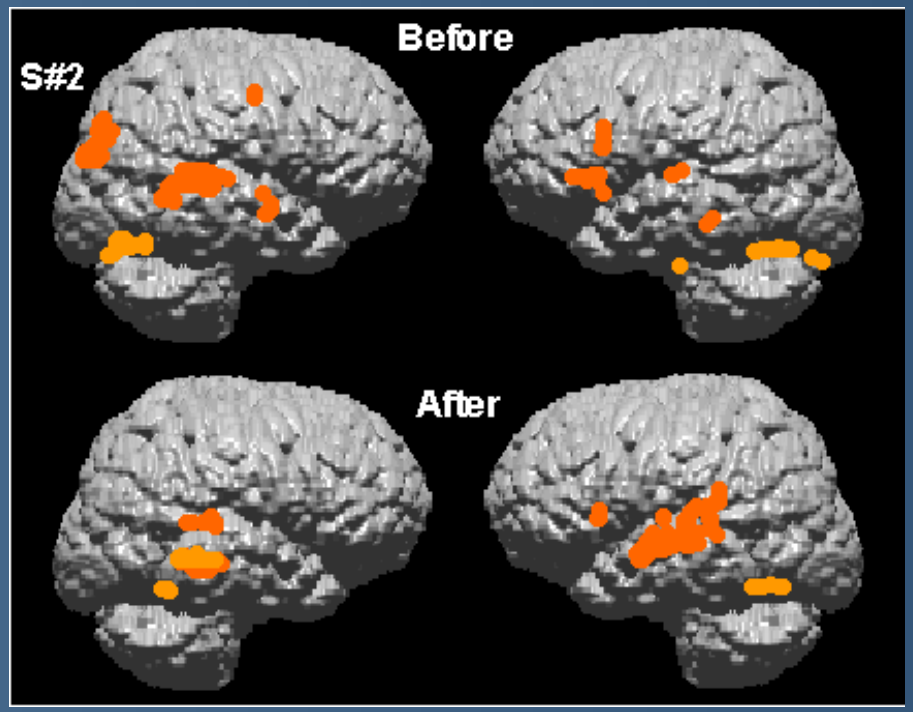
Neural response to intervention; (Pseudoword Task; Simos et al., 2002)





Heritability: Individual Differences in Ability Traits

- Reading, math, and writing are heritable traits, but individual gene effects small
- In reading, heredity accounts for 50- 80% of variance in outcomes
- No genes specific to poor development (e.g., no dyslexia genes)
- Genetic correlation increases with grade (Olson et al., 2014)
- Move away from "bad- gene, bad brain" theory to the idea of genomic organizations that make brains at risk and risk modified by environment: Biology is not destiny

10. What do We Need to Know?

- Individual differences in instructional responses
- Programming for comorbidity: General factors
- Intensive intervention
- Neurobiological malleability
- Accommodations and adjuncts: What to do about intractable learners
- Scaling

Who is Dyslexic?

- The student who does not respond to quality instruction*: hard to teach, not unable to learn*
- Low achievement and inadequate instructional response
- Often preventable with early intervention
- Heritable, but neural systems are malleable in development and instructional response

Reading Sculpts the Brain, But Must Be Taught!!

- "We are all born with dyslexia. The difference among us is that some are easy to cure and others are not."

  - Liberman, 1996

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