Prevention, Identification, and Remediation of Reading Delays: Recent Research

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Why this presentation?

"It takes research 50 years to influence daily classroom practices."

(Allington, 2013)

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Agenda

🗩 Talk about some research

🔍 Outline what we learn from it regarding:
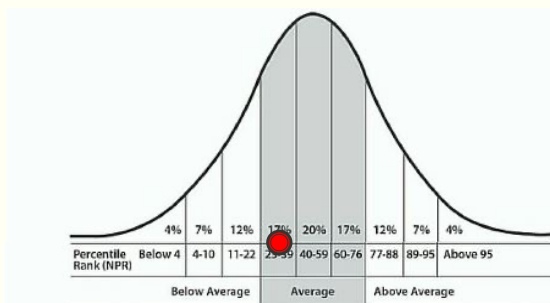
Identification

Prevention

Remediation

👥? Thoughts & questions

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Some terms we will use...

4% 7% 12% 17% 20% 17% 12% 7% 4%

Percentile Rank (NPR) | Below 4 | 4-10 | 11-22 | 23-39 | 40-59 | 60-76 | 77-88 | 89-95 | Above 95

Below Average   Average   Above Average

Percentile: the location of a score on the distribution of all scores. Percentile rank indicates that a student scored as well as, or better than, the percent of students in the same age and grade

Rapid Automated Naming (RAN)

(Ebaid & Crewther, 2020)

Correlation: a relation between two or more variables. A correlation does not equal causation

Variance: how far each number in the set is from the mean (average)

Word Reading (WR) and Decoding (D) - often used interchangeably, is the automatic recognition of a word without the need for segmentation

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Decoding and Reading Comprehension (RC): A Test of the Decoding Threshold Hypothesis (Wang et al., 2019)

Simple View of Reading (Gough &Tunmer, 1986)	Lexical Quality Hypothesis (Perfetti & Hart, 2002)	Self-Teaching Hypothesis (Share, 1995)
RC = WR x LC		

Research Questions:

1.What is the relation between Decoding and Reading Comprehension?

2. How does being above or below a certain decoding threshold predict future development in RC?

Study 1: grades 5–12 students (N=10,450)

Study 2: 3-year longitudinal data set was taken from the same school district (N=34,016)

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Decoding and Reading Comprehension: A Test of the Decoding Threshold Hypothesis (Contd.)

Table 3
WRD Cutoff Point Identified by Linear Regression and Broken Line Regression: Below the Cutoff Point There Was No Relation Between WRD and RC

N	Grade	Cutoff WRD score (linear regression)	Cutoff WRD percentile (linear regression)
2,038	5	235	38th
2,478	6	235	35th
2,368	7	234	32th
2,086	8	231	18th
897	9	237	20th
534	10	238	19th

Note. WRD = word recognition and decoding; RC = reading comprehe
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(Wang et al., 2019)

The relation between WR and RC is nonlinear: for students with weaker WR, comprehension was not strongly related to decoding, with a decoding threshold beneath which WR did not predict RC skill.

Students who scored below the WR threshold reached a ceiling in RC or achieved minimal growth in subsequent years.
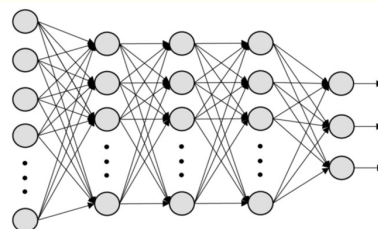
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A Novel Approach for Detection of Dyslexia Using Convolutional Neural Network with EOG signals

A few terms defined:

- **Electrooculogram** is a method of studying eye movements by measuring the change of electric potential between the cornea and the Bruch's membrane.

(Creel, 2019)

- **Artificial Neural Networks are** computational models inspired by the way neurons receive, process, and pass along signals. Neural networks can be trained to recognize patterns in training data and use these patterns to classify novel data.
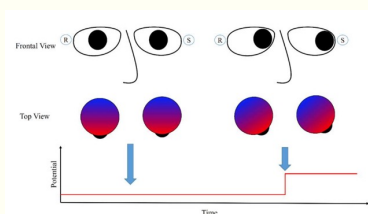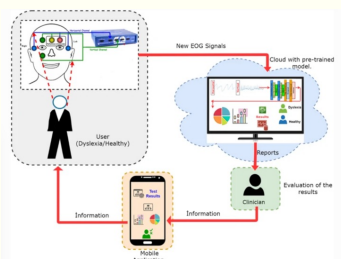

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A Novel Approach for Detection of Dyslexia Using Convolutional Neural Network with EOG signals

(Chang, 2019)

(Ileri et al., 2022)

- Struggling readers demonstrate similar eye movement patterns:
  - More frequent saccades
  - Extended fixation time
  - Frequent regressions, return sweeps, re-reading, and line skipping

- These eye movement patterns are a physiological representation of impaired automaticity

- Researchers used a combination of EOG signal & machine learning to interpret the signal
  - This method achieved classifier accuracy of 98.70% and 80.94% for horizontal and vertical channel EOG signals, respectively (Ileri et al., 2022)

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Reading Mindset (RM)
(Tock et al., 2021)

1. How can Reading Mindset be measured reliably?

2. How does Reading Mindset relate to Word Reading and Reading Comprehension outcomes for students?

Image Sourse: https://donwinn.blog/2020/03/04/dying-to-read-and-write/

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Reading Mindset (Contd.)

| Item	Content
RM1	If a book is hard to read, I stop reading it.
RM2	I feel like I am one of the worst readers in my class.
RM3	If I have to read out loud in class, I feel scared.
RM4	If I make a lot of mistakes while reading, I quit trying
RM5	When I have to work hard at reading, it makes me feel like I am not very smart.
RM6	When someone reads better than me, I'm jealous.
RM7	I don't like when my teacher corrects me when I'm reading.

(Petscher et al., 2017)

RM correlates strongly with WR and RC, with RM being a stronger predictor for RC than WR.

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Predicting Reading Problems 6 Years into the Future: Dynamic Assessment Reduces Bias and Increases Classification Accuracy

Test   Test

Teach
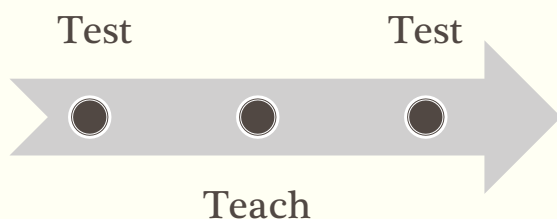
- **Dynamic Assessments:** are interactive assessments that involve providing feedback between cycles of assessment.

- These assessments seek to measure potential to learn rather than static knowledge at a fixed point in time.

- Static assessment measures may have poor classification accuracy due to their floor effects.

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Predicting Reading Problems 6 Years into the Future: Dynamic Assessment Reduces Bias and Increases Classification Accuracy

- **Core question:** how well does a dynamic assessment of decoding administered in Kindergarten predict reading attainment in later grades?
  - Does the addition of a dynamic assessment of reading add predictive validity above and beyond existing static measures?

- Results:
  - The dynamic assessment administered in Kindergarten was a fair to good predictor of future reading difficulty for White and Hispanic students.
  - Dynamic assessments provided predictive validity well into the future (up to six years).
  - Overall, adding in traditional static measures did not drastically increase the predictive validity (Petersen et al., 2018).

- Dynamic assessment required 3 minutes to administer

- Early identification leads to more effective early remediation

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Some other findings we did not have time for:

- **Double Deficit Theory (Ozernov-Palchik et al., 2022):** Children who struggle with both phonological processing and RAN will be the most severely impaired word readers.

- **The role of word knowledge in error detection (Harris et al., 2022):** Does word knowledge alone or error monitoring and word knowledge impact comprehension? Executive function delays observed in individuals with dyslexia may be a symptom of dyslexia rather than a cause.

- **Anxiety and reading (Vaughn et al., 2022):** Students who received anxiety training with reading intervention performed significantly better on RC tasks.

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Last few ...

- **The role of Orthography in Pronunciation (O'Leary & Ehri, 2020):** Pre-readers with alphabetic knowledge draw on orthographic representations to improve their memory of proper names' pronunciation.

- **Acquisition Rate (AR) and reading interventions (Burns et al., 2017):** Short-term memory and word reading skills were found to have had significant correlation with AR.

- **Mindfulness meditation as an intervention (Youngs, 2021):** A single, brief mindfulness meditation intervention led to improvements in visual short-term memory capacity for faces.
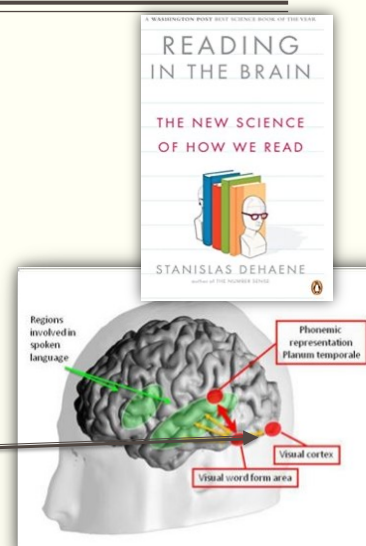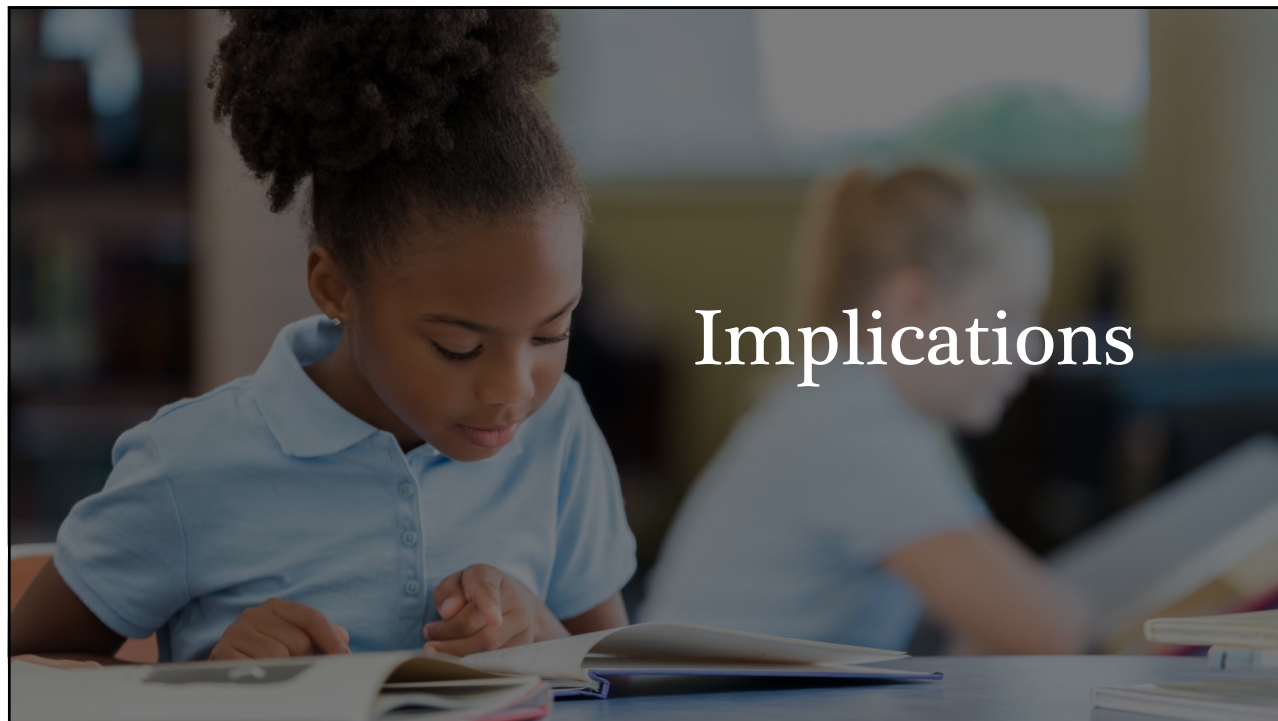

Image Credit: Dehaene, 2013

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Implications

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IDENTIFICATION

Early detection mitigates **many secondary impacts** of reading disability.

Advances in predictive models unlock **simpler methods of identifying deficits** that enable more wide-spread adoption.

Evidence suggests that when reading disabilities are identified early, much of the impact of the deficit can be effectively remediated.

More precise identification enables **better allocation of resources**

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PREVENTION AND REMEDIATION

Pay specific attention to RAN, PA, and Letter names for emergent Readers.

/c/-/a/-/t/

Intensify Decoding and Language Comprehension instruction
- Consider time as a factor
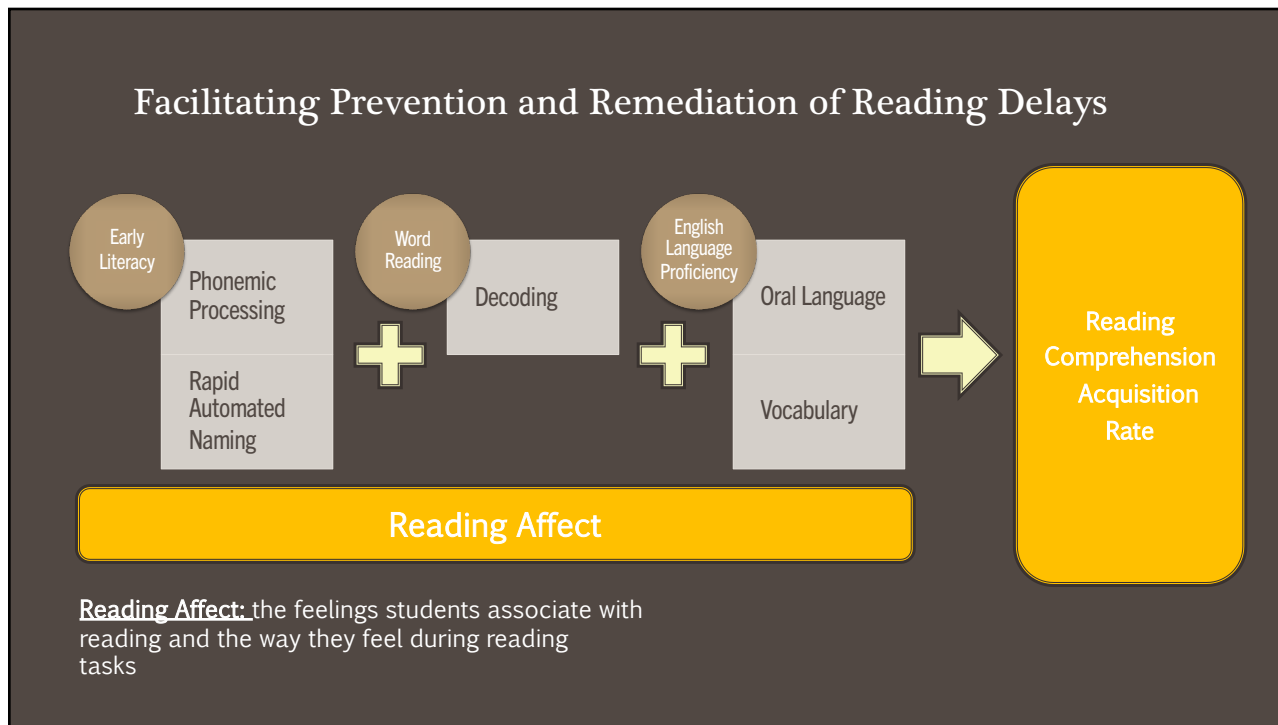- Diagnostic scores

Work on reading mindset:
- Corrective feedback
- Mindful moments
- Safety in routines
- Set up for success

Interventions for dyslexics: Knowledge-based, rather than process based

(i.e., targeting development of orthographic, phonological, and semantic representations to develop improved reading speed, fluency, and error detection, rather than the other way around).

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Facilitating Prevention and Remediation of Reading Delays

Early Literacy

Phonemic Processing

Rapid Automated Naming

Word Reading

Decoding

English Language Proficiency

Oral Language

Vocabulary

Reading Comprehension Acquisition Rate

Reading Affect

Reading Affect: the feelings students associate with reading and the way they feel during reading tasks

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In Closing...

" If we don't know how we
learn, how on earth do we
know how to teach?"

(Dehaene, 2021)

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References

Allington, R. L. (2013). What really matters when working with struggling readers. The Reading Teacher, 66(7), 520530. https://doi.org/10.1002/TRTR.1154

Chang, W.-D. (2019). Electrooculograms for Human-Computer Interaction: A Review. Sensors (Basel, Switzerland), 19(12). https://doi.org/10.3390/s19122690

Creel, D. J. (2019). Chapter 33 - The electrooculogram. Handbook of Clinical Neurology, 160, 495-499. https://10.1016/B978-0-444-64032-1.00033-3

Dehaene S. (2013). Inside the letterbox: how literacy transforms the human brain. Cerebrum : the Dana forum on brain science, 2013, 7.

Dehaene, S. (2021). How we learn: Why brains learn better than any machine … for now. Penguin Books.

Ebaid, D., & Crewther, S. G. (2020). The contribution of oculomotor functions to rates of visual information processing in younger and older adults. Scientific Reports, 10(1). https://doi.org/10.1038/s41598-020-66773-5

Feinauer, E., Hall-Kenyon, K. M., & Everson, K. C. (2017). Rethinking the linguistic threshold hypothesis: Modeling the linguistic threshold among young Spanish-English bilinguals. Bilingualism: Language and Cognition, 20(5), 886-902. https://doi.org/10.1017/S1366728916000626

Harris, L. N., Creed, B., Perfetti, C. A., & Rickles, B. B. (2022). The role of word knowledge in error detection: A challenge to the broken error monitor account of dyslexia. Annals of Dyslexia, 72(2), 384-402. https://doi.org/10.1007/s11881-021-00248-8

Ileri, R., Latifoğlu, F., & Demirci, E. (2022). A novel approach for detection of dyslexia using convolutional neural network with EOG signals. Medical & Biological Engineering & Computing, 60(11), 3041-3055. https://doi.org/10.1007/s11517-022-02656-3

Petersen, D. B., Gragg, S. L., & Spencer, T. D. (2018). Predicting reading problems 6 years into the future: dynamic assessment reduces bias and increases classification accuracy. Language, Speech & Hearing Services in Schools, 49(4), 875–888. https://doi.org/10.1044/2018_LSHSS-DYSLC-18-0021

References (Continued)

Petscher, Y., Al Otaiba, S., Wanzek, J., Rivas, B., & Jones, F. (2017). The relation between global and specific mindset with reading outcomes for elementary school students. Scientific Studies of Reading, 21(5), 376-391. https://doi.org/10.1080/10888438.2017.1313846

O'Leary, R., & Ehri, L. C. (2020). Orthography facilitates memory for proper names in emergent readers. Reading Research Quarterly, 55(1), 75-93. https://doi.org/10.1002/rrq.255

Ozernov-Palchik, O., Sideridis, G. D., Norton, E. S., Beach, S. D., Wolf, M., Gabrieli, J. D. E., & Gaab, N. (2022). On the cusp of predictability: Disruption in the typical association between letter and word identification at critical thresholds of RAN and phonological skills. Learning and Individual Differences, 97, 102166. https://doi.org/10.1016/j.lindif.2022.102166

Tock, J. L., Quinn, J. M., Otaiba, S. A., Petscher, Y., & Wanzek, J. (2021). Establishing a reading mindset measure: A validation study. Assessment for Effective Intervention, 46(4), 281-291. https://doi.org/10.1177/1534508420936753

Vaughn, S., Grills, A. E., Capin, P., Roberts, G., Anna-Mária Fall, & Daniel, J. (2022). Examining the effects of integrating anxiety management instruction within a reading intervention for upper elementary students with reading difficulties. Journal of Learning Disability, 55(5), 408-426. https://doi.org/10.1177/00222194211053225

Wang, Z., Sabatini, J., O'Reilly, T., & Weeks, J. (2019). Decoding and reading comprehension: A test of the decoding threshold hypothesis. Journal of Educational Psychology, 111(3), 387–401. https://doi.org/10.1037/edu0000302

Dehaene, S. (2010). Reading in the brain: The new science of how we read. Penguin Books.

Youngs, M. A., Lee, S. E., Mireku, M. O., Sharma, D., & Robin, S. S. K. (2021). Mindfulness meditation improves visual short-term memory. Psychol Rep, 124(4), 1673-1686. https://doi.org/10.1177/0033294120926670