

Stern Center
for Language and Learning


Debunking Neuromyths
February 14, 2024
Webinar for NNEA-IDA

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Agenda

1. How does skilled reading develop?
2. What is the neurological signature of dyslexia?
3. What is a neuromyth?
4. What are common neuromyths related to learning and dyslexia?
5. Why do neuromyths persist?



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National Network of Education Assessment


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Learning Objectives

1. Define dyslexia including its prevalence rate, underlying cause, and neural signature
2. Define a neuromyth
3. Explain evidence to dispel common neuromyths related to reading and dyslexia



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National Network of Education Assessment

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130 million adults in the U.S. have low literacy skills. 54% of American adults read below the equivalent of a 6th-grade level. *Gallup analysis of data from the U.S. Dept of Education*

HOW LITERACY AFFECTS US ALL

Those who struggle with reading early in their schooling are more likely to drop out of high school, to experience periods of unemployment, to live in poverty, and to end up in the criminal justice system.

Illiteracy is one of the most solvable problems of our time.

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What causes dyslexia?

- Heritable and brain-based
- Core deficit in dyslexia is **phonological processing**
 - "...Language problems that ultimately impact the visual learning of reading." -[Dr. Kenneth Pugh](#), Haskins Laboratory
- NOT caused by vision problems
- NOT caused by a lack of books at home

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How widespread is dyslexia?

School Population ← SPED
About **13-14%** of the school population nationwide are identified as having a handicapping condition that qualifies for Special Education (SPED) services.

SPED Students | **LD Students**
One **half** of all students who are identified for special education are classified as having a learning disability (LD). About **85%** of those students have a primary learning disability in reading and language processing.

Population as a whole
Up to **15-20%** of the population as a whole may have symptoms of dyslexia, including slow or inaccurate reading, weak spelling, and poor writing. Not all will qualify for Special Education, but most benefit from systematic, explicit instruction in reading, writing, and language (AKA, **Structured Literacy** Instruction).

Find solutions at the International Dyslexia Association (IDA) • [eida.org](#)
Source: IDA Fact Sheet, "Dyslexia Basics" • Moats & Dakin (© 2016 Cowen For IDA)

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Separating Science from Neuromyth

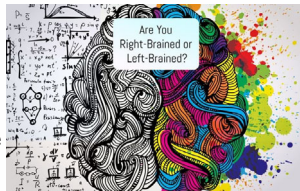
1. Left-Brained or Right-Brained
2. Multiple Intelligences
3. VAK Learning Styles
4. Vision therapy, colored overlays, or lenses
5. Dyslexia font
6. Coordination Exercises (such as Brain Gym)
7. Brain-Training Programs

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1. Left-Brained or Right-Brained

Claim: “The left and right hemispheres control separate processes and **personality** traits.”

- Left Brain:
 - logical, analytical, factual
- Right Brain:
 - creative, emotional, intuitive



Source: <https://heywise.com/quiz/are-you-right-brained-or-left-brained/>

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1. Left or Right Brain Science says: *Neuromyth!*

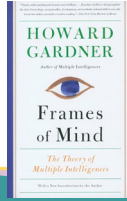
"The pop culture idea (creative vs. logical traits) has **no support in the neuroscience community** and flies in the face of decades of research about brain organization, the functional roles of the two brain hemispheres and evidence from patients with lesions in one or the other hemisphere in the brain." ~Dr. Jeffrey Anderson

Source: <http://www.bbc.com/news/blogs-trending-35640368>

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2. Multiple Intelligences

- **Claim:** Howard Gardner divided human cognitive abilities into 7 intelligences:
 - 1. logic-mathematics
 - 2. verbal
 - 3. interpersonal
 - 4. spatial
 - 5. music
 - 6. movement
 - 7. intrapersonal



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3. Multiple Intelligences (MI) Science says: *Neuromyth!*

- Neuroimaging supports **functional connectivity**, how functional modules in the brain transfer information (anatomically, biochemically, etc.) to each other.
- Meta-analysis of 20 neuroimaging studies involving language, logic, math, and memory showed the **same frontal areas of the brain were involved-not a different set of neural mechanisms as Gardner claimed** (Duncan, 2001).

Geake, J. (2008). Neuromythologies in education. *Educational research*, 50(2), 123-133.

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3. VAK Learning Styles

- **Claim:** Students can be tested to determine their dominant learning style and taught in that learning style.
 - Based on assumption that information gained through **one sensory modality is processed independently** in the brain from information gained through another sensory modality.

Newton, P. M. (2015). The learning styles myth is thriving in higher education. *Frontiers in psychology*, 6, 1908.

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3. VAK Learning Styles

- Do not confuse this with multisensory instruction, which is supported by fMRI research.
 - **Simultaneously seeing and hearing the same information** works better than first just seeing and then hearing it (Calvert, Campbell, and Brammer, 2000).
 - “Learning... requires the coordinated use of visual, auditory, and kinesthetic modalities, in addition to memory, emotion, will, thinking and imagination.” - Dr. John Geake, Oxford, UK

Geake, J. (2008). Neuromythologies in education. *Educational Research*, 50(2), 123-133.



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3. VAK Learning Styles Science says: *Neuromyth!*

“Good teachers find a variety of ways to engage students... What has been refuted is the notion of attempting to match teaching to individual students’ supposed learning style.”

- Steve Masson and Jeremie Blanchette Sarrasin (at Universite du Quebec)

Masson, S. & Sarrasin, J.B. (2015). Neuromyths in education: It's time to bust these widely held myths about the brain. *Canadian Education Association* (28-31).
<https://static1.lapresse.ca/images/10c0b84e4b8dc7856772c1c502b19e20099a8b5d56c4b1479219495556/Masson2015.pdf>



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4. Vision Therapy

(Including Colored Overlay Assessment and Meares-Irlen Syndrome)

Claim: Eye exercises, colored filters and lenses can alleviate visual distortions for people with symptoms of dyslexia.

“Vision therapy is designed to teach the child how the brain controls the eyes, to improve their visual skills and how to apply these new skills to **improve reading, learning, concentration and attention.**”

Source: <https://www.optometrists.org/vision-therapy/>



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Claim: Who can benefit from vision therapy?

"Parents and teachers should be on the lookout for the following red flags that indicate a vision problem:

- Reading below grade level
- Reduced reading comprehension
- Loss of place, repetition, and / or omission of words while reading
- Confusing similar words, such as 'was' and 'saw'
- Reversing letters such as b, d, p and q
- Spelling difficulties
- Dislikes or avoids homework
- Writing numbers backwards, such as 2 & 5 or 6 & 9
- Difficulty maintaining attention
- Difficulty changing focus from distance to near and back again
- Poor judgment of depth
- Messy handwriting"

Source: <https://www.optometrists.org/vision-therapy/guide-to-vision-therapy/what-is-vision-therapy/>



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Behavior Analysis Practice (2016) 9:191-198
DOI: 10.1007/s12575-016-9407-7

EMPIRICAL REPORT

The Effect of Colored Overlays on Reading Fluency in Individuals with Dyslexia

Tiffany Freese Denton¹ · James N. Meindl²

"The data from this study suggest that colored overlays **do not** improve performance on reading, but other evidence-based treatments do. It is also important to note that preference for an intervention, such as colored overlays, is not indicative of effectiveness."



Denton, T. F., & Meindl, J. N. (2016). The effect of colored overlays on reading fluency in individuals with dyslexia. *Behavior analysis in practice*, 9(3), 191-198.

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4. Vision Therapy

Doctors say: *Neuromyth!*

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Journals Education Guidelines Multimedia News CME MOC Residents

Clinical Education / Guidelines / Clinical Statements

About Clinical Statements

JUL 2014

Joint Statement: Learning Disabilities, Dyslexia, and Vision - Reaffirmed 2014

AAP, AAPOS, AAO and AAO-Hoskins Center for Quality Eye Care
Comprehensive Ophthalmology, Pediatrics, Ophthalmic Strabismus

<http://www.aao.org/clinical-statement/joint-statement-learning-disabilities-dyslexia-vis>

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AAP and AAO say: *Neuromyth!*

"Vision problems can interfere with the process of learning; however, vision problems are not the cause of primary dyslexia or learning disabilities. **Scientific evidence does not support the efficacy of eye exercises, behavioral vision therapy, or special tinted filters or lenses** for improving the long-term educational performance in these complex pediatric neurocognitive conditions. Diagnostic and treatment approaches that lack scientific evidence of efficacy, including **eye exercises, behavioral vision therapy, or special tinted filters or lenses, are not endorsed and should not be recommended.**

<http://www.aao.org/clinical-statement/joint-statement-learning-disabilities-dyslexia-vis>



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5. Dyslexia Font

Claim: By changing the font, individuals with dyslexia will have better reading accuracy.

ABCDEF GHI J KLM
NOPQRSTU VWXYZ
a b c d e f g h i j k l m
n o p q r s t u v w x y z
0 1 2 3 4 5 6 7 8 9 ! ? #

Retrieved from
<https://www.dyslexia-reading-well.com/dyslexia-font.html>



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5. Dyslexia Font Science Says: *Neuromyth!*

- Several solid, peer-reviewed research studies were conducted investigating dyslexia fonts in 2016, 2017 and 2018. Together there was consensus that the Dyslexie or Open Dyslexic font have **no measurable benefits.**

Source: <https://www.edutopia.org/article/do-dyslexia-fonts-actually-work/>



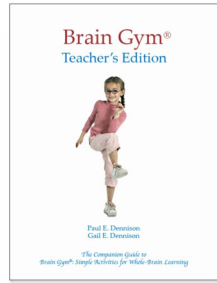
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6. Coordination Exercises (Brain Gym)

- **Claim:** Short bouts of coordination exercises can improve the integration of left and right brain function, “activate” the brain, and help students learn.
- Brain Gym International promise to improve concentration, memory, grades in reading, writing, and math.



Masson, S. & Sarrasin, J.B. (2015). Neuromyths in education: It's time to bust these widely held myths about the brain. *Canadian Education Association* (28-31).



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Is physical activity helpful?

- Yes, exercise has a positive impact on learning and lowers rates of obesity, anxiety, and stress.
 - One study showed moderate to vigorous exercise 30 minutes a day showed a positive, measurable impact on all students and decreased the severity of ADHD symptoms.

Hillman, C. H., Pontifex, M. B., Castelli, D. M., Khan, N. A., Raine, L. B., Scudder, M. R., & Kamijo, K. (2014). Effects of the FITKids randomized controlled trial on executive control and brain function. *Pediatrics*, 134(4), e1063-e1071.

- There are *many* ways to get moving!
 - Teachers do not need expensive, specialized training on coordination exercises based on misconceptions of brain function.

Source: <https://childmind.org/article/adhd-and-exercise/>



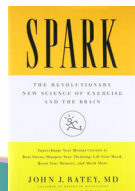
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6. Brain Gym Science says: *Neuromyth!*

- Does this mean that general exercise is good for the brain in general? **Yes!**
- Does this mean that pressing specific spots on one's body or crossing the midline will enhance activation of specific areas of the brain? **No!**



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7. Brain-Training Programs

- **Claim:** fun (computer) games can boost your working memory, attention, and problem-solving skills
 - Based on idea of neuroplasticity
- Examples: Luminosity, LearningRx, and CogMed have more than more than 100 million subscribers.



Rossignoli-Palomeque T, Perez-Hernandez E and González-Marqués J (2018) Brain Training in Children and Adolescents: Is It Scientifically Valid? *Front. Psychol.* 9:565. doi: [10.3389/fpsyg.2018.00565](https://doi.org/10.3389/fpsyg.2018.00565)



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www.uiuc.edu

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7. Brain-Training Programs

Science says: *Neuromyth!*



Do "Brain-Training" Programs Work?

David J Simons¹, Walter R Boot², Neil Charness³, Susan E Gathercole⁴, Christopher F Chabris⁵, David Z Hambrick⁶, Elizabeth A L Stine-Morrow⁷

PMID: 27697851 DOI: 10.1177/1529100616661983

Simons, D. J., Boot, W. R., Charness, N., Gathercole, S. E., Chabris, C. F., Hambrick, D. Z., & Stine-Morrow, E. A. (2016). Do "brain-training" programs work? *Psychological Science in the Public Interest*, 17(3), 103-186. <https://pubmed.ncbi.nlm.nih.gov/27697851/>

Daniel Simons, Ph.D., University of Illinois at Urbana-Champaign:

- Brain games are touted as quick-fix solution for a complex problem "and quick fixes tend not to work."
- "Very few of these studies measure real-world outcomes at all."

Source:
<https://www.sfn.org/sitecore/content/home/brainfacts2/neuroscience-in-society/tech-and-the-brain/2019-do-brain-training-games-make-you-smarter-013019>



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7. Brain-Training Programs

More Science says: *Neuromyth!*

- Read more here:
<https://www.vox.com/2016/1/6/10724096/science-brain-games-lumosity>

REPORT

Brain games like Lumosity are snake oil. Don't waste your money.

By Kate Hetherington | @katehetherington | Jan 6, 2016, 3:05pm CST

f t y 100%



- Must Read**
1. Scientists whopped a bunch of older brains... in brain-training — and
 2. A prescription for how

Today, Explain
Understand the world and make sense of the most important stories of the day.

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Why do neuromyths persist? Top 5 Takeaways

1. There is usually a **glimmer of truth** in all neuromyths, and it is important for families, educators, and school leaders to be critical consumers of all of programs and claims.
2. The human brain was **not wired to read or write**, so explicit, systematic literacy instruction is necessary.



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What have we learned?

3. We learn best when we utilize **multiple sensory pathways**, not one "dominant learning style."
4. Dyslexia is not a problem with the visual system, but a language-based processing disorder. There are **no easy fixes**, like a dyslexia font, covered overlays, or computer games to fix working memory.



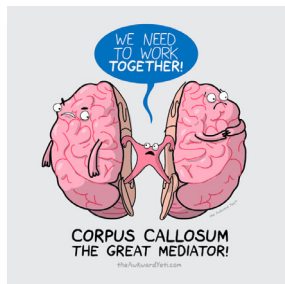
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What have we learned?

5. Our two brain hemispheres do have different cognitive specialties, but they are well integrated that they seldom cause significant processing conflicts.



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What is effective literacy instruction?

- Evidence-based instruction means
 - Based on evidenced-based instructional **principles**
 - Peer-reviewed research
 - Multiple research studies across multiple settings
- **How does this claim fit into the overall scientific consensus?**



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Evidenced-Based Literacy Instruction

- Simply put, developing readers must first master letter-sound correspondence from *systematic* phonics instruction which incorporates phonemic awareness, handwriting, and spelling instruction.
- These foundational skills can and *should* be taught alongside rich vocabulary, read-alouds, and knowledge building opportunities.



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Thank you

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- You can learn more about neuromyths:
 - [Neuromyths: The 10 Top Misconceptions about your Brain](#)
 - [Neuromyths in education: Prevalence and predictors of misconceptions among teachers](#)



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