#DeleteDeficitThinking; Why “Low Kids” and “High Kids” is Inaccurate, Ineffective, Unethical, and Counterproductive

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• Taught for 10 years as a general ed. classroom teacher, special ed. co-teacher, resource room teacher, preschool intervention specialist in New York City, San Francisco and Los Angeles.

• MA in Learning Dis/Abilities from Teachers College

• PhD in Urban Education (focus on Mathematics, Science and Technology) from CUNY Grad Center

• Assistant Professor at UC Santa Barbara in Mathematics Education and Special Education

• Disability Studies in Education
Think Time . . . (respond in Chat)

• Have you seen deficit thinking used to understand students who are not high performing in math? What does that look like, sound like?

• What myths have you heard about the math potential of students with Learning Disabilities (LD, dyslexia, etc.)?
The myth of low kids and high kids

Where does it come from?
Why does it matter?
How can we stop it?

“my low kids”

“my high kids”

Slides by Rachel Lambert @mathematize4all
Students with disabilities (and all students who are currently not achieving at their potential) need access to rigorous, inquiry-based curriculum bc:

- Access to identities as mathematical thinkers
- Access to engagement in the wonders of math/STEM
- Access to college/STEM careers

SwD are excluded because they are tracked into low tracks/special education tracks and endless intervention.
Myth of low and high kids: Where does it come from?

• Tests as the most important markers of student math achievement. Tests on a linear scale (high and low)

• Pervasive (and damaging) conceptions of intelligence as linear and one-dimensional.
Myth of low and high kids: Where does it come from?

• Intelligence tests invented by Binet to better describe the complexity of “intelligence” or knowing of a single individual

• Transformed in the US into a static, one-dimensional “measure” of intelligence. Connected to eugenic movements and the widespread oppression of people with disabilities.
Myth of low and high kids: Where does it come from?

- Tests as the most important markers of student math achievement. Tests on a linear scale (high and low)
- Pervasive (and damaging) conceptions of intelligence as linear and one-dimensional.
- Our system prioritizes quantitative data about kids above other kinds of data.
A misunderstanding about minds

Jagged Profiles for Intelligence

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Chapter 3: The Variability of Learners

Introduction
Experience and common sense suggest that all individuals are unique and learn in ways that are, to varying degrees, particular to them. And in the past quarter century, science has elucidated the great variability of the human capacity to learn. Yet our educational system is designed around the idea that most people learn the same way and that a “fair” education is an identical one. These ideas influence every aspect of our educational system. To understand why we need to move away from these underlying assumptions, we turn to the latest findings on the learning brain.

From one perspective, human brains are remarkably similar. But to neuroscientists, this similarity is an illusion—an artifact of inspecting them from afar. Up close, individual brains are remarkable distinctive in their anatomy, chemistry, and physiology. Like each person’s fingerprints, every brain is unique. Yet some of the differences are systematic and predictable. Scientists often seek to uncover these systematic differences by comparing the brains of individuals from different groups, such as people of different genders, ages, cultures, native languages, or degrees of expertise.1

What they find is fascinating. Consider the brain scan in the image below.

Figure 3.1. The brain of a person with autism. Reprinted with permission from Macmillan Publishers Ltd.

Access to this free, online book on UDL
http://udltheorypractice.cast.org/
In an experiment looking for physiological differences, researchers explored how the brains of individuals diagnosed with autism differ from those not diagnosed with autism. They asked both groups to engage in exactly the same task—an intelligence measure called the Raven’s Progressive Matrices—while measuring their brain activity via scanning technologies such as FMRIIs and PET scans. They found little difference between the two groups in most areas of the brain, but there was one area (an area of complex visual perception highlighted in yellow in Figure 3.1) where the individuals with autism differed quite consistently from the comparison group.

How can we interpret this difference? Many people might assume that the highlighted area would represent some kind of damage or dysfunction among individuals with autism. But the findings actually show something quite different. On this type of task, individuals with autism generally show superior performance. The scientists were not looking for sources of dis-ability but rather vari-ability. They were looking for what is different about the brains of individuals with autism who have enhanced abilities.

The brains of individuals with autism do show some systematic patterns that differ from the brains of those not identified as autistic. Whether that variation is a liability or a benefit depends entirely on the task being performed. On the Raven’s Progressive Matrices, individuals with autism tend to perform better. On a different measure of intelligence—for instance, one that relies primarily on language—individuals with autism usually underperform when compared with others.
Learner Variability (and patterns across that variability)

• Brain consists of networks that develop through interconnections

• While genetics + experience make us each different, there are patterns across brains that show us consistent patterns in variability (in attention, memory, visual processing, engagement)

• Does it seem like low or high make sense here?
A misunderstanding about minds

1. There is no “normal” or “average” brain. We all have varied profiles across multiple dimensions of “intelligence”
2. Neurodiversity
3. Neuroplasticity

No such thing as a single axis along which to rank our brains, our ability in math, or our potential in math.

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WHAT K TO 12 MATH IS LIKE

WHAT K TO 12 MATH SHOULD BE LIKE
Misunderstanding mathematical development

Static Stages of Development

Overlapping Waves Theory

Fosnot & Dolk (2002)

Siegler (1998)
Where does it come from?

• Our history as seeing schools as sorters, rankers,
• Understanding intelligence as a number
• A misunderstanding about math
• A misunderstanding about mathematical development

Any Questions?

One more
• Lack of understanding about disability. Let’s look specifically at Specific Learning Disabilities . . .

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Dyslexia? SLD?

Specific Learning Disorder with impairment in:

- **Written Expression**
  - Spelling accuracy
  - Grammar & punctuation accuracy
  - Clarity or organization of written expression

- **Mathematics**
  - Number sense
  - Memorization of arithmetic facts
  - Accurate or fluent calculation
  - Accurate math reasoning

- **Reading**
  - Word reading accuracy
  - Reading rate or fluency
  - Reading comprehension

Note: *Dyslexia* is an alternative term used to refer to a pattern of learning difficulties characterized by problems with accurate or fluent word recognition, poor decoding and poor spelling abilities.

Source: The Diagnostic and Statistical Manual of Mental Disorders, 5th edition
Dyslexia or LD in reading is 80-90% of all SLD.

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What I hear . .

• Don’t all students with learning disabilities NEED explicit instruction in math?
• I don’t know how to teach those kids. I wasn’t trained.
• He has so many gaps.
• My low kids need direct instruction.
• Those students don’t belong in our classes.
• She’s not ready for the math in my classroom. She doesn’t know her numbers!
• He can’t handle multiple strategies.

Medical/Deficit Model of Disability
Fill in the blank:
“my high kids need ____”

“my low kids”

“my high kids”

Concepts
Can think
Enrichment

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Fill in the blank:
“my low kids need _____”

<table>
<thead>
<tr>
<th>“my low kids”</th>
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</thead>
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<td>Must master basics first!</td>
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Deficit Mythologies about the Mathematical Potential of SwLD

“Indefensible, Illogical, and Unsupported”; Countering Deficit Mythologies about the Potential of Students with Learning Disabilities in Mathematics

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(This article belongs to the Special Issue Dispelling Myths about Mathematics)

https://www.mdpi.com/2227-7102/8/2/72
Myth One: Students with LD can ONLY learn from direct instruction

"Although these findings confirm that explicit instruction is an important tool for teaching mathematics to students with LD, it is important to note that there is no evidence supporting explicit instruction as the only mode of instruction for these students" (National Mathematics Advisory Panel, 2008, p. 1229).
Students with LD can learn from Inquiry-based instruction

Enhanced Anchored Instruction

- Multi-modal algebra curriculum. Deep investigative problems, including video. Focused on training teachers to equalize small group work, and teacher MKT. Participation equalized and strong achievement gains by LD students. (Bottge et al., 2001; Bottge et al., 2007; Bottge et al. 2010; Bottge et al., 2015)
Students with LD can learn from Inquiry-based instruction

Cognitively Guided Instruction (CGI)

• CGI algebra routine in 3\textsuperscript{rd} grade class over 1 year, participation of students with IEPs initially low, but equalized over the year through strong teacher support. SwD able to solve algebraic problems without direct instruction (Foote & Lambert, 2011)

• Behrend (2003) documented unique strategies of SwLD.

• CGI problem solving with students with disabilities, found that students with LD were supported in solving open-ended problems through teacher scaffolds and MKT. Also found that teachers reported being better able to understand their students with disabilities. (Moscardini, 2007, 2011)

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Myth Two: Students with LD cannot create their own strategies and should not be taught using multiple strategies

  \[91 – 78\]

- Peters et al. (2014), SwD moved between multiple strategies for multi-digit subtraction.
- Behrend (2003) SwLD constructed strategies in fractions
- Hunt & Empson (2014); Hunt & Tzur (2017) SwLD constructed their own strategies in equal sharing problems
Students with disabilities (and all students who are currently not achieving at their potential) need access to rigorous, inquiry-based curriculum bc:

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SwD are excluded because they are tracked into low tracks/special education tracks and endless intervention.
Image search for “learning disability”
What do you notice and wonder?

Decoding Dyslexia, a Common ...
medlineplus.gov

Learning disabilities explained - Kids ...
kidsspeak.info

Learning disability* label was redefined

I have dyslexia. I can't spell

Understanding learning disability | The ...
herald.co.zw

Signs & Symptoms of Learning Disabilities in Kids
epainassist.com

Learning disorders - Queensland Brain ...
qbi.uq.edu.au

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Neurodiversity

- Biological fact: neurological diversity is part of humanity
- A social justice movement created by autistic self-advocates (Robertson & Ne’eman, 2008; Boundy, 2008; Robison, 2017)
- Differences exist, not as deficits, but part of natural human diversity
- Extended to dyslexia/learning disabilities, ADHD, mental illness (“mad pride”) and others

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**MIND strengths** (Eide & Eide, 2011)

**Material Reasoning** Three-dimensional spatial reasoning mechanical ability.

**Interconnected Reasoning** perceive relationships and patterns (intuition)

**Narrative Reasoning** remember important personal experiences, understand abstract information in terms of narrative

**Dynamic Reasoning** the ability to perceive and take advantage of subtle patterns in complex and constantly shifting systems or data sets

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*Dyslexia linked to talent: Global visual-spatial ability*

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*Slides by Rachel Lambert @mathematize4all*
“As a dyslexic, I’ve never been good at calculations or recalling rote facts like times tables. Here’s the thing: beyond a certain point in mathematics, it’s not really about calculations.”

“Geometry class was when math became interesting, and easier for me. Suddenly I was in a world, not of strands of symbols to be processed, but of shape, space, lines, angles, concepts, and narrative-like proofs. Suddenly everything made sense.”

https://toomai.wordpress.com/2014/09/17/dyslexic-mathematician/

What does it mean to be “good at math”?
Neurodiversity + Dyslexia

Challenges
• Phonological processing
• Memory for disconnected facts and procedures
• Working memory
• Executive functioning (planning, self-regulation)
Study on Dyslexic Mathematicians

• Collaboration with Edmund Harriss (University of Arkansas)
• Interviews with 5 research mathematicians (all currently working at universities) who are dyslexic
I talk in ghosts and mists. My brain seems to be really, really comfortable with just throwing out ideas. It just really is very flexible. It doesn't like boxes. It's just very, very flexible. And so, I get a sense that something is true, or something that I want, I need, is there. And then my brain really doesn't get bothered by the fact that some ideas don't work, it just will throw out lots and lots of ideas and sort of wander. And that drives co-authors nuts, because they'll say, "Oh, I see? That idea doesn't work." And it doesn't slow me down one bit. My brain just has like five other weird ideas, two of which you can throw out immediately, and the three others you have to spend time on. And it just sort of keeps working that way.
Visualization

• P1 learns through “geometry first, thinking through space” and “I can do immensely technical work in images that others can do in language."

• P4 describes a strong predilection for thinking visually, not just in mathematics but across topics; “Well my entire memory is sort of visual, it's like playing back little snippets of film.” Interested in “three-dimensional geometry and topology. Anything that I can draw or sculpt or anything that's like three dimensional and sort of visual-based.”
Issues with Memorization of Mathematical Facts and Procedures

A: Was there any part of math, like in elementary school, middle school, or high school that was challenging for you?
P2: No.

A: So memorization of facts was not challenging for you?
P2: Oh I never could memorize anything. I had to derive everything . . . Yeah, I've never been good at memorizing things, just like I couldn't memorize how to spell words, I couldn't memorize facts in math. So I paid attention in class, and I had good enough teachers that they derived everything. And I figured out how to derive everything I needed to know, and I just derived everything I needed to know. You take a trig class, for instance, okay ... I know the trig identity for sin of alpha plus beta. From that trig identity, I can derive all the other ones. And then if I needed any of them, I would just do that. But I never actually like memorized them. I still don't memorize them.
Challenges
• Phonological processing
• Memory for disconnected facts and procedures
• Working memory
• Executive functioning (planning, self-regulation)

Strengths (Eide & Eide, 2011)
• Visual spatial thinking
• Creativity
• Pattern finding
• Thinking in narratives
• Seeing the “big picture”

How might this pattern of strengths and weaknesses matter in math class?
Neurodiversity + Dyslexia

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School math
Real mathematics

Slides by Rachel Lambert @mathematize4all
Why this matters: Equity

• This myth of the low kids disproportionately affects Black, Latinx and Indigenous students, emergent bilinguals, students with disabilities.

• When we start thinking a child is “low”, that colors every interaction we have with them.

• When we teachers see math ability as fixed, as limited, we make it so.
How does it feel?

In the LD Bubble


Slides by Rachel Lambert @mathematize4all
Why it matters: Lynn’s story

“I was brought to the "special" room to “catch up”. No one ever said this to me directly; it was what I overheard: "Scoring low", "Not trying," "Lazy." . . . As the years passed . . . the shame turned into a deep-rooted self-hate.”

Lynn’s story

“The [Resource Room] teachers were very kind, but I believe now that they underestimated me. I would do what they told me to do . . . but I was rarely asked to really think . . . I think I did a lot of memorizing, but not much understanding.”

Lynn’s story

“I said, "Yes," and grabbed a seat next to my friend. I did not have any paper or a book, I just sat and listened. I was in a "real" class with normal students. As I sat in that class, something magical happened to me. I could understand what he was teaching. I was learning. I even started participating in the class, raising my hand and answering questions. I was LD. But then again I wasn't. I still couldn't multiply or divide very well, and I had to use elaborate ways to come up with the answer. But I wasn't memorizing, I was thinking, and I was figuring out the answer.”

Low kid or high kid?

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“my low kids”
- Procedures
- Cannot think on their own
- Remediation
- Must master basics first!

“my high kids”
- Concepts
- Can think
- Enrichment

Slides by Rachel Lambert @mathematize4all
To summarize

• High and low come from old-fashioned ideas about learning, learners, and math.

• Kids aren’t low, our expectations often are. Expectations shape access, labels shape student’s self-understanding. Self-understandings shape how we engage in math.

• High kids and low kids is inaccurate, unscientific, unhelpful, unethical, and counter productive.
Myth: There are such a thing as “low kids”

1. Scientifically inaccurate
   • Neuroplasticity
   • Neurodiversity as scientific fact (all brains are different)
   • Learner Variability (CAST, UDL) There is no “normal” or “average” brain. We all have varied profiles across multiple dimensions of “intelligence” (Rose)
Myth: There are such a thing as “low kids”

1. Inaccurate based on research in mathematics education
   • No one path through a concept, but predictable patterns
   • Learning math is not linear, but a trajectory
   • We can be amazing at topology but still not know our multiplication facts!

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Myth: Sorting our kids into high and low is good for them

- They know what you are doing
- They take up the labels you offer them
- The practice of ability grouping generally is inequitable for students in the “low” groups

Instead- Universal Design for Learning
What can we do?

• Call it out. Every time.
• Kids aren’t broken, our system is. Creatively resist and reform our system.
• Invite ways to give kids like Lynn access to what math really is: thinking.

Slides by Rachel Lambert @mathematize4all
A misunderstanding about minds

What do you notice and wonder?

Neurodiversity + Dyslexia

Challenges
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- Working memory
- Executive functioning (planning, self-regulation)

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Real mathematics

Misunderstanding mathematical development

Questions?
In Chat Box Please

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Fosnot & Dolk (2002)
Siegler (1998)
Playlist (other cites in slides)

- Final report Scottish Attainment Challenge Cognitively Guided Instruction Project (Moscardini & Sadler, 2018)