

In the chat: Introduce yourself and perhaps share what questions you bring into this session

Leveraging Student Strengths: Neurodiversity and Mathematics

Dr. Rachel Lambert

University of California Santa Barbara

Dr. Rachel Lambert

- Taught for over 10 years as a special educator, resource room teacher, and inclusive classroom educator.
- MA in Learning dis/Abilities from Teachers College
- PhD in Urban Education (focus on Mathematics, Science and Technology)
- Associate Professor at University of California Santa Barbara in Mathematics Education and Special Education
- Disability Studies in Education Scholar
- Website: mathematizing4all.com
- [@mathematize4all](https://www.instagram.com/mathematize4all)



Critical analysis of research on the math learning of students with disabilities

My research

UDL Math and Design
Thinking as educators
redesign curriculum, interactions, routines, spaces and systems

Studies of how students with disabilities construct identities as math learners (focus on Latinas with LD/ADHD/EB)

Reimagining intervention

All my research is available for free at my website:
mathematizing4all.com

Today

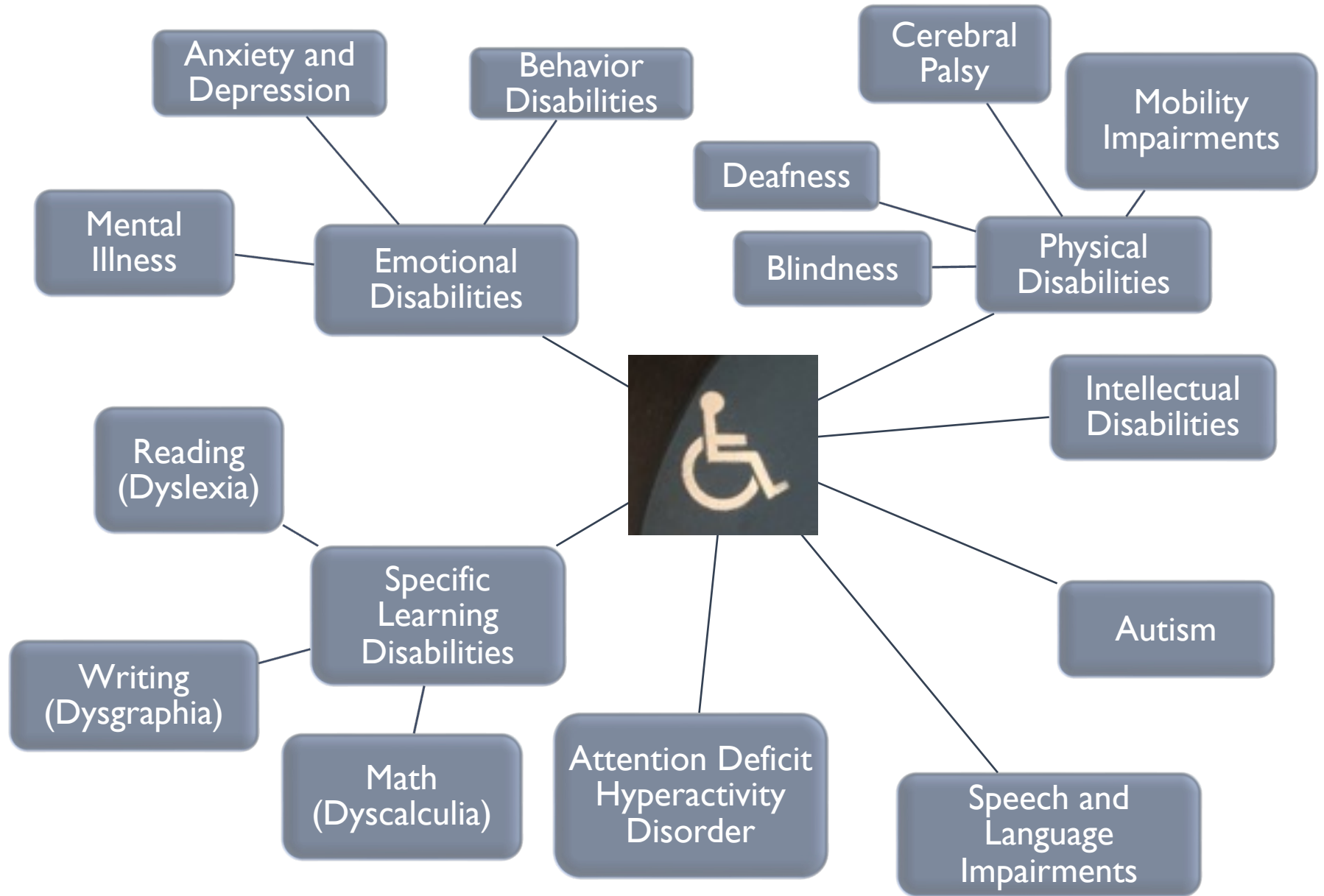
- What is neurodiversity?
- How does it matter in math?
- How can we design mathematics experiences that leverage neurodiverse strengths and reduce barriers?

Disability is complex

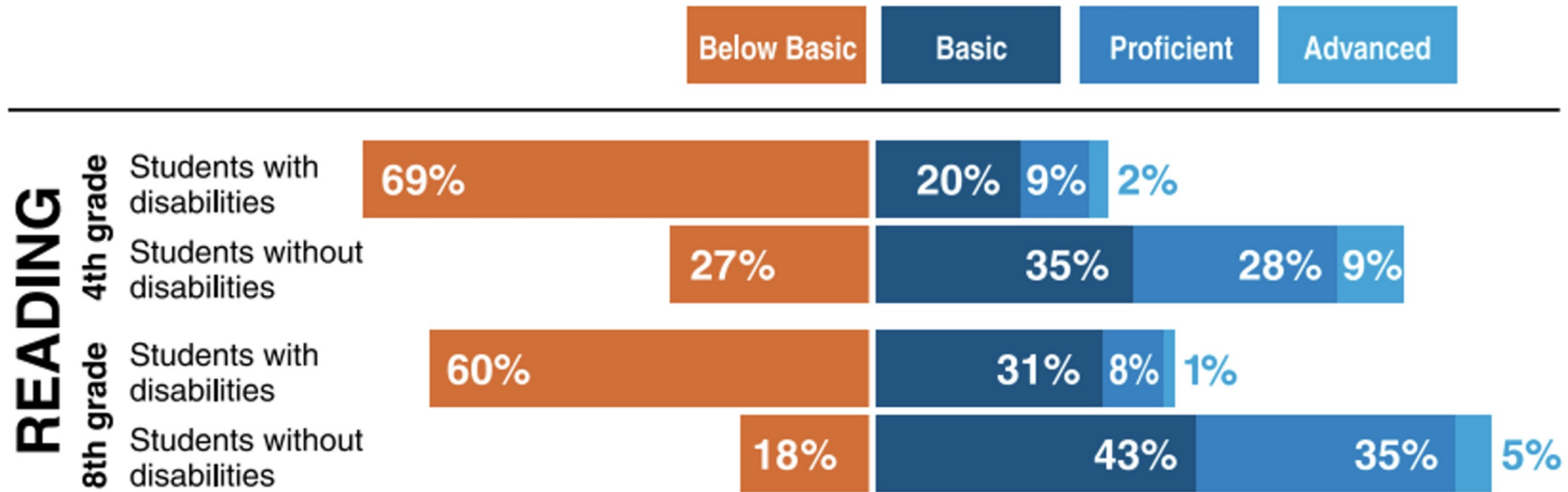
**An IEP
Special Education
services**

But also

**An identity
A community
A political
movement for
justice and
inclusion**



National Assessment of Educational Progress (NAEP) 2013: How Students With and Without Disabilities Perform

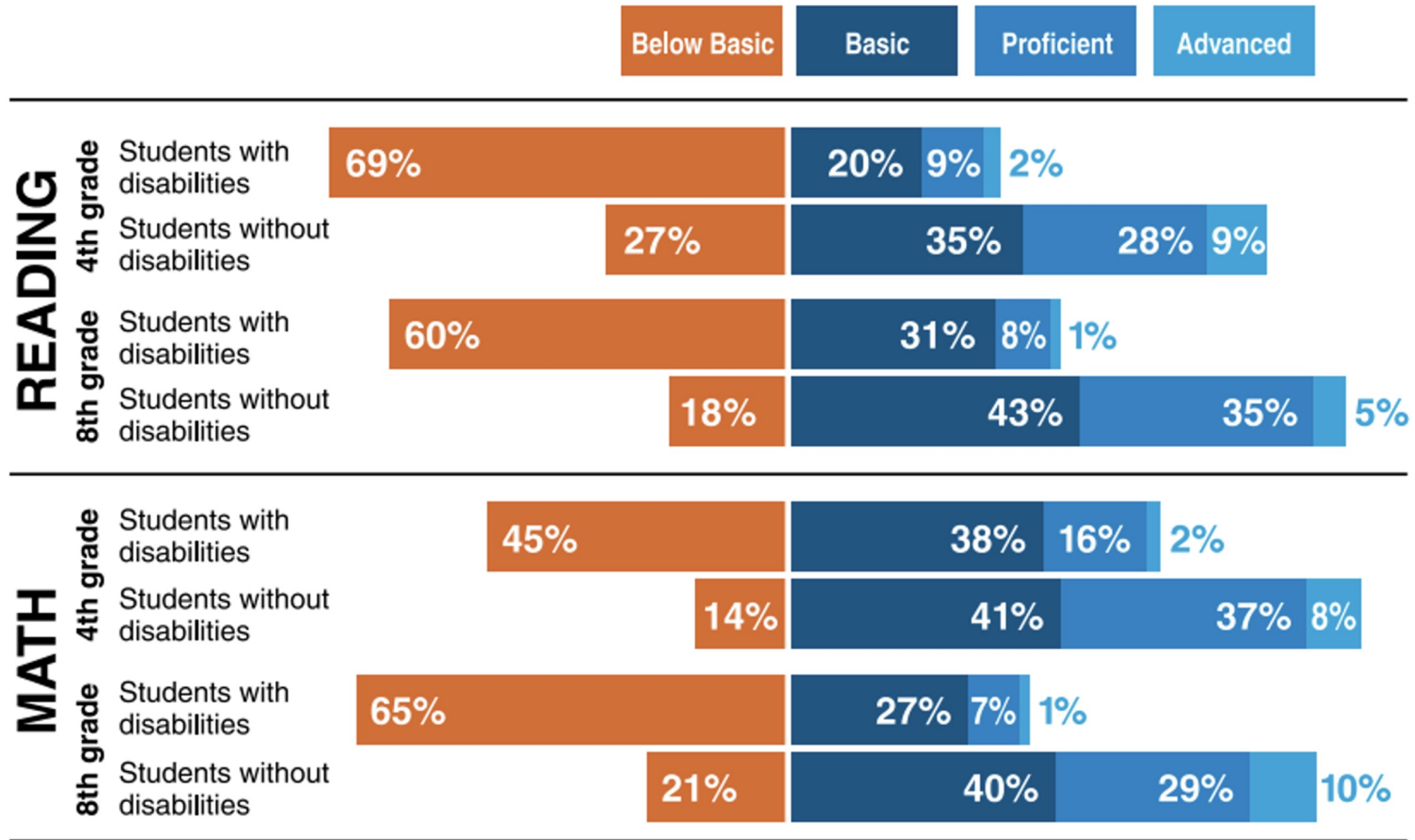


Source: National Assessment of Educational Progress, Reading and Mathematics Grade 4 and 8 National Results, 2013.

Students with disabilities includes students with both IEPs and 504 plans.

Slides by Rachel Lambert UCSB mathematizing4all.com

National Assessment of Educational Progress (NAEP) 2013: How Students With and Without Disabilities Perform



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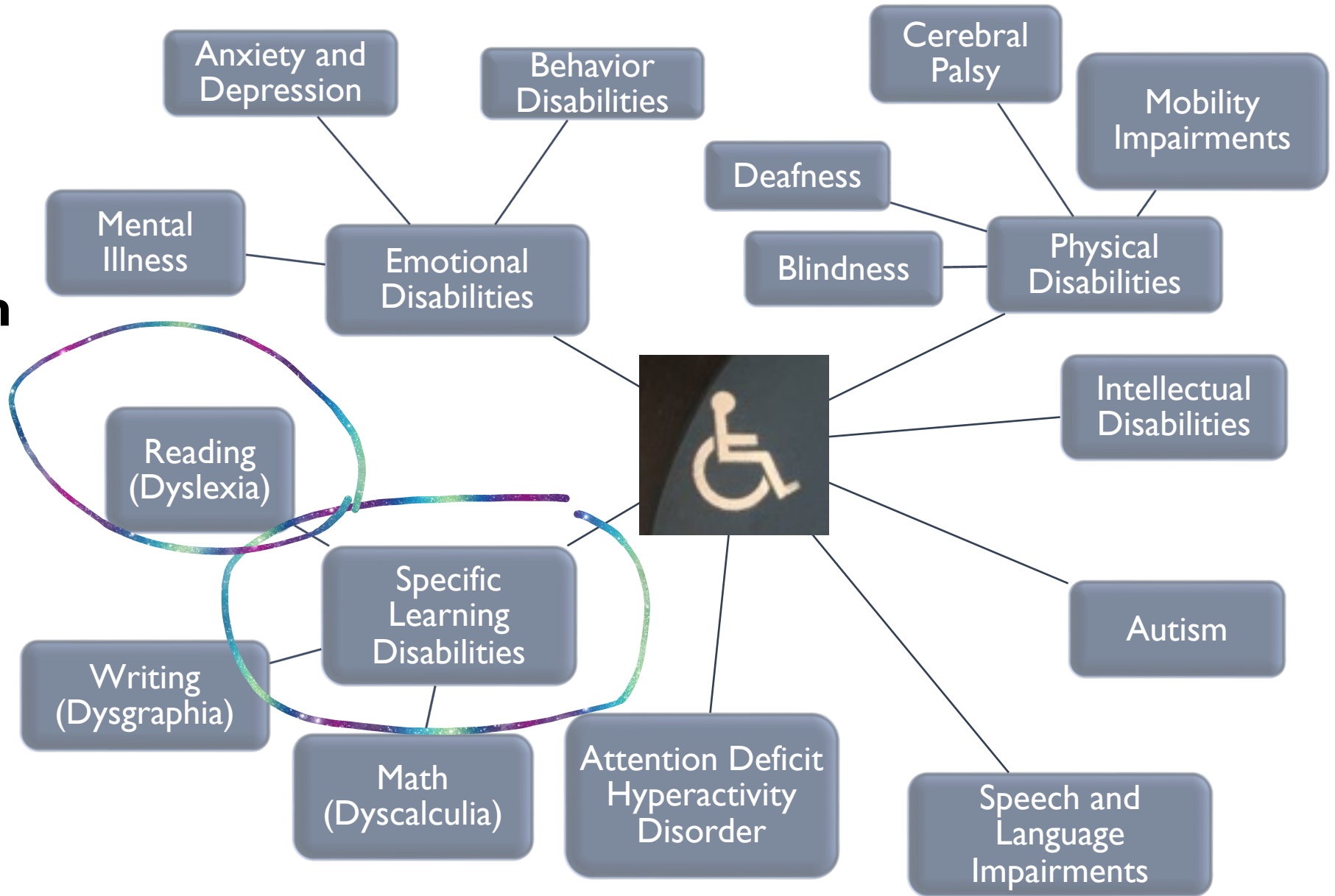
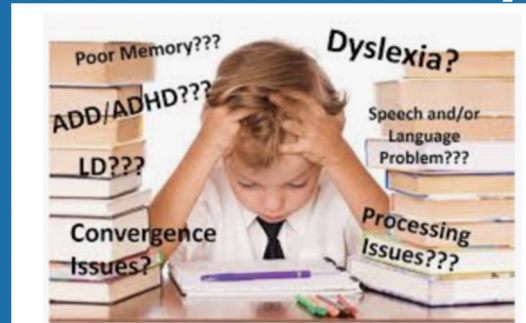




Image search for "learning disability"



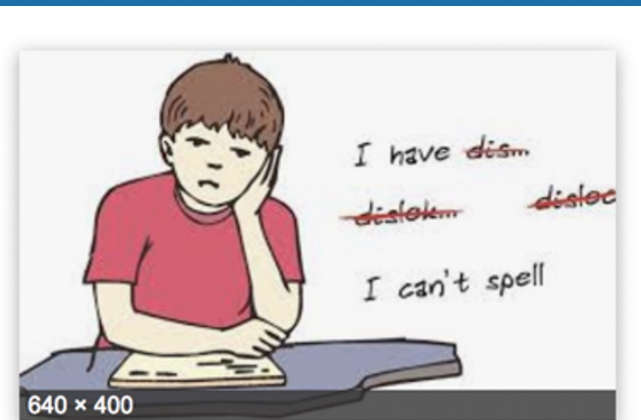
Decoding Dyslexia, a Common ...
medlineplus.gov



Learning disabilities explained - Kids ...
kidsspeak.info



"Learning disability" label was redefined



640 x 400

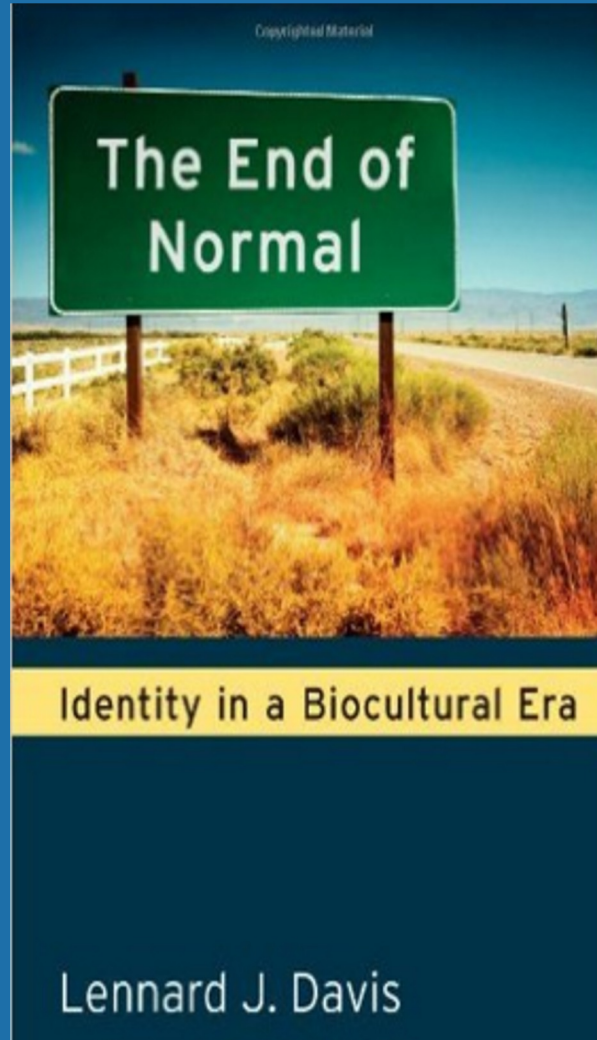
Understanding learning disability | The ...
herald.co.zw



Learning Disabilities in Kids ...
epainassist.com



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



Our society is a
revolution in how
we see disability



The Disability Rights Movement

Capital Crawl (1990)

Protests for
Obamacare (2017?)



ACCESS IS LOVE



Disability Justice

INTERSECTIONALITY
LEADERSHIP OF THOSE
MOST IMPACTED
ANTI-CAPITALISM
cross-movement organizing
wholeness
sustainability
cross-disability solidarity
INTERDEPENDENCE
COLLECTIVE & collective
ACCESS *Liberation*

Sins Invalid

An Unshamed Claim to Beauty in the Face of Invisibility

Models of Disability

Medical

- A defect/deficit
- Individual
- Fix the deficit, remediate the individual

Social

Impairment-
cognitive and
physical
differences

- Society, cultural contexts
DISABLE
- Fix the context:
classrooms,
curriculum

Models of Disability

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Strengths

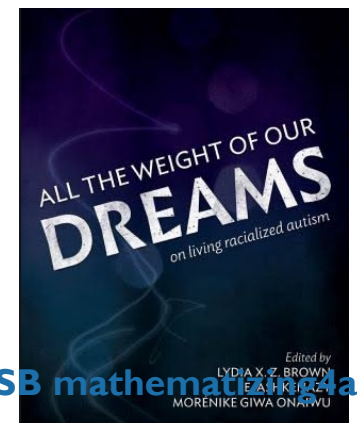
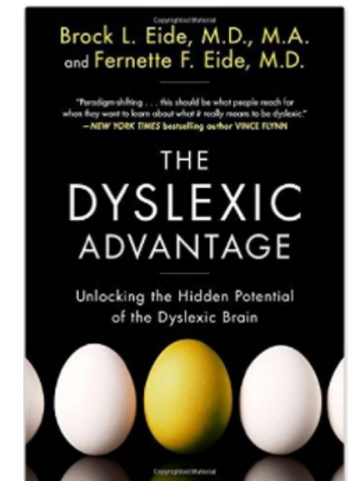
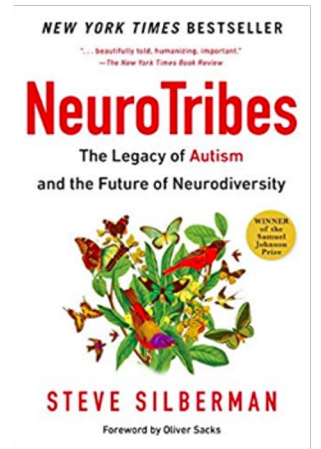
Challenges

Neurodiversity



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
- Focus on understanding strengths and challenges from insider perspectives
- Extended to dyslexia/learning disabilities, ADHD, mental illness (“mad pride”) and others



Neurodiversity



Greta Thunberg · Aug 31, 2019

@GretaThunberg · [Follow](#)

When haters go after your looks and differences, it means they have nowhere left to go. And then you know you're winning!
I have Aspergers and that means I'm sometimes a bit different from the norm. And - given the right circumstances- being different is a superpower.

[#aspiepower](#)



Greta Thunberg

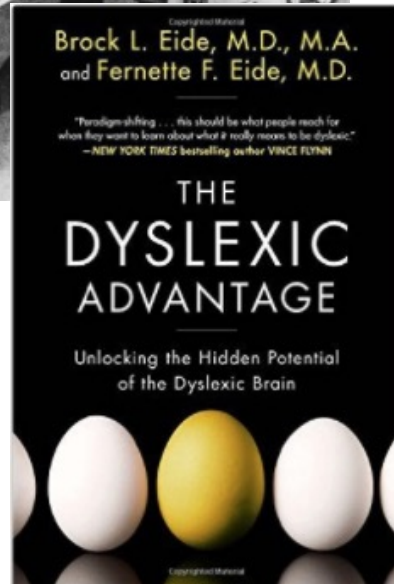
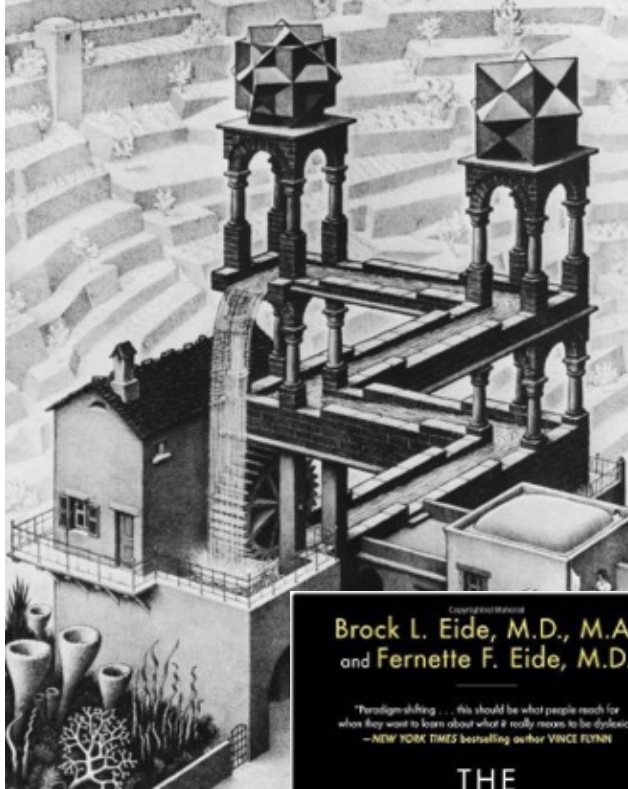
@GretaThunberg · [Follow](#)

I'm not public about my diagnosis to "hide" behind it, but because I know many ignorant people still see it as an "illness", or something negative. And believe me, my diagnosis has limited me before. >

2:46 PM · Aug 31, 2019



Neurodiversity: Dyslexia



Dyslexic Strengths

- 3-D spatial thinking including mechanics (Attree et al. 2009).
- Interconnected reasoning (Everatt, et al., 2008).
- Original thinking and creativity (Akhavan et al., 2009; Everatt et al., 1999).

Neurodiversity + Dyslexia/LD

Challenges may include:

Phonological processing

Memory for facts and procedures

Working memory

Executive functioning

Neurodiversity + Dyslexia/LD

Challenges may include:

- Phonological processing
- Memory for facts and procedures
- Working memory
- Executive functioning

Strengths may include:

- Visual spatial processing
- Creativity
- Pattern finding, seeing connections
- Seeing the “big picture”
- Narrative thinking

How might this pattern of strengths and challenges (while different for everyone) matter in math class?

Neurodiversity + Dyslexia/LD

Challenges may include:

Phonological processing
Memory for facts and procedures
Working memory
Executive functioning



School math

Strengths may include:

Visual spatial processing
Creativity
Pattern finding, seeing connections
Seeing the “big picture”
Narrative thinking



Real math

A dyslexic research mathematician:

“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”?

Today

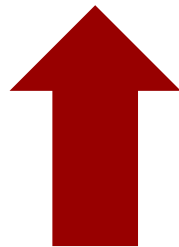
- What is neurodiversity?
- How does it matter in math?
- How can we design mathematics experiences that leverage neurodiverse strengths and reduce barriers?

What have you heard about teaching math to students with disabilities?

To students with LD/dyslexia in particular?
(in chat)

What I hear ..

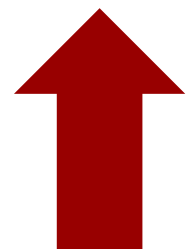
- Don't all students with disabilities NEED explicit instruction in math?
- I don't know how to teach those kids. I wasn't trained.
- He has so many gaps.
- My low kids need
- She's not ready for the math in my classroom. She doesn't know her numbers!
- He can't handle multiple strategies.



Medical/Deficit Model of Disability

Many times, I hear Ss with learning disabilities cannot think conceptually. Should just be given procedures. Is there research out there to refute this? If so, can you point me in a direction?? [#iteachmath](#) [#mtbos](#)

“The premise that secondary students with LD will construct their own knowledge about important mathematical concepts, skills, and relationships . . . is [indefensible, illogical, and unsupported by empirical investigations.](#)” (Jones et al., 1998, p. 161).



Medical/Deficit Model of Disability

The False Deficit Binary

“my low kids”

“my high kids”

“Low kids need”

Intervention

Direct Instruction

Procedures

“High kids can handle”

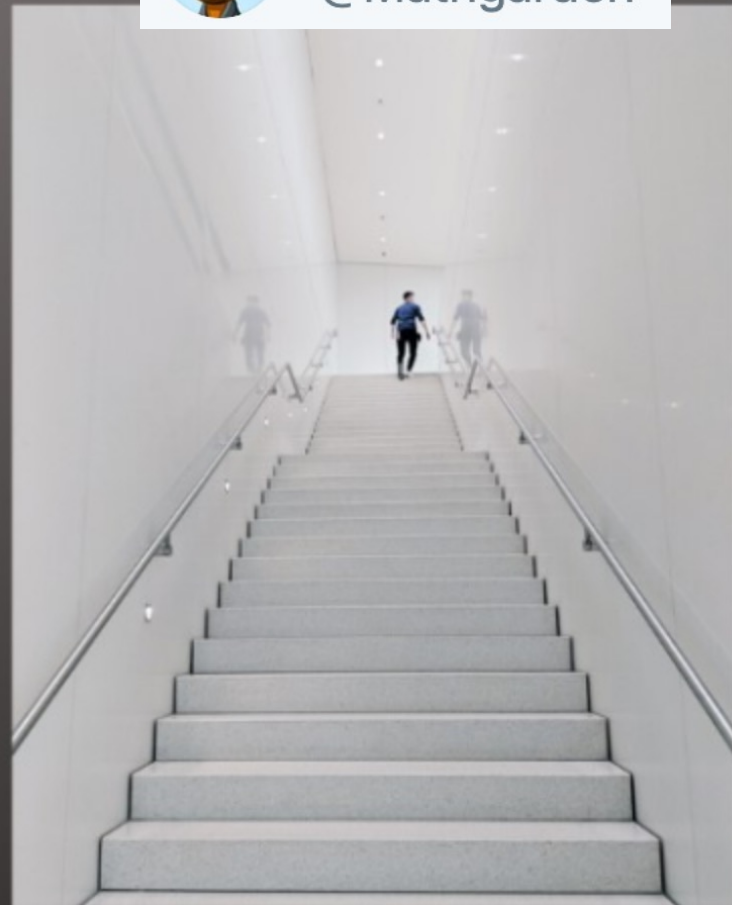
Inquiry Instruction

Concepts

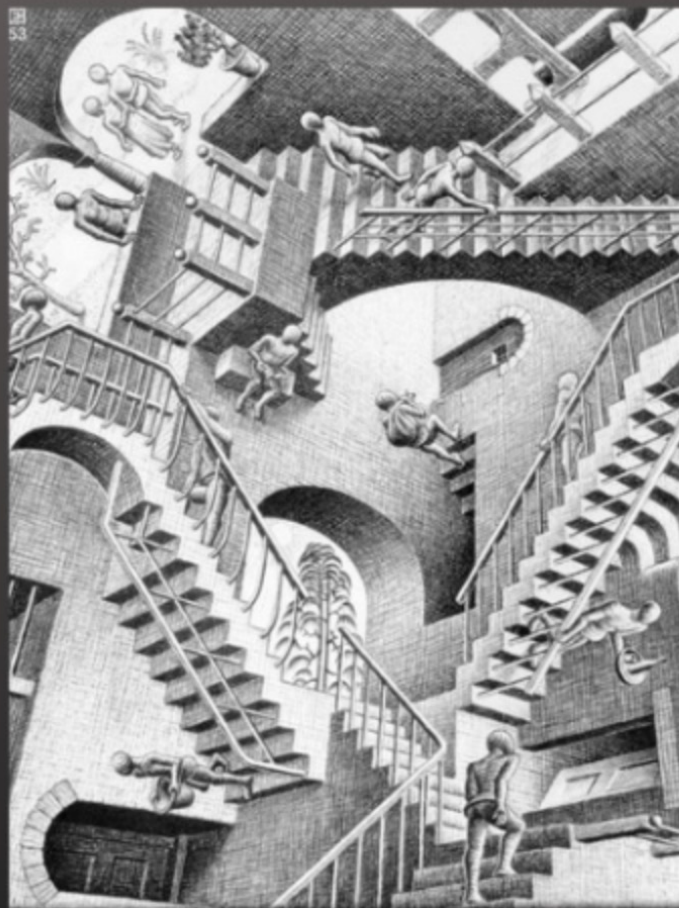
Enrichment



Sunil Singh
@Mathgarden



WHAT K TO 12
MATH IS LIKE



WHAT K TO 12
MATH **SHOULD**
BE LIKE



Insider accounts of dyslexia from research mathematicians

Rachel Lambert¹  · Edmund Harriss²

Accepted: 19 December 2021
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Abstract

Within educational research, dyslexia and other disabilities are typically conceptualized as deficits. The theory of neurodiversity encourages researchers to conceptualize cognitive differences as natural forms of human diversity with unique sets of challenges and strengths. Using neurodiversity as our theoretical framework, we analyze the experiences of five research mathematicians with dyslexia as told through personal narratives to find



Edmund Harriss
Curvahedra

A research study on dyslexic mathematicians

Participants

- 5 research mathematicians who self-identified as having dyslexia
- 4/5 white, 4/5 cis male (a major limitation)
- Not all comfortable with disclosure
- Co-researcher identified as a dyslexic mathematician

Research Questions

- What strengths and challenges do research mathematicians with dyslexia connect to their dyslexia?
- How does dyslexia affect their trajectory as mathematicians?

Visual thinking

- 4/5 participants were in topology
- Think through “geometry first, thinking through space”
- “I can do immensely technical work in images that others can do in language.”
- Visuals support complex mathematical thinking, especially 3-D.



Edmund Harriss
Curvahedra

Intuitive Ways of Mathematical Thinking

I talk in ghosts and mists. My brain seems to be really, really comfortable with just throwing out ideas .. 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.

Ways Around Memorization of Mathematical Facts

Rachel: Was there any part of math, like in elementary school, middle school, or high school that was challenging for you?

Study Participant: No.

Rachel: So memorization of facts was not challenging for you?

Study Participant: 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. . . . I figured out how to derive everything I needed to know, and I just derived everything I needed to know . . . But I never actually like memorized them. I still don't memorize them.

I could've explained to you with a picture why nine times five was 45, and my friends could tell you that it was 45 but they couldn't tell you why. And it struck me as really upsetting that someone that, just memorizing that number, was valued more than me understanding why that was the right answer. And it's always been a problem. But it just seems to me that why something is true is much more important than knowing that it is true.



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A research study on
dyslexic
mathematicians

Visual
thinking

Intuitive Ways of
Mathematical
Thinking

Ways Around
Memorization
of Mathematical
Facts

How can we design mathematics experiences that leverage neurodiverse strengths and reduce barriers?

Today

- What is neurodiversity?
- How does it matter in math?
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Dyslexia/LD students talk about math

Other kids had known I was struggling in primary school. It was quite obvious when it came to doing maths. We would stand in a line with the teacher facing the front of the queue. The teacher would ask, "What's 9×12 ?" If you got it wrong you would go to the back of the queue and I was always there. I still can't remember my times tables. I can't quite place the information together. (Elliot, 17)

I was always labelled 'not good at maths' when this shouldn't have been the case. Schools put you in boxes and leave you there. (Charlie, 17)

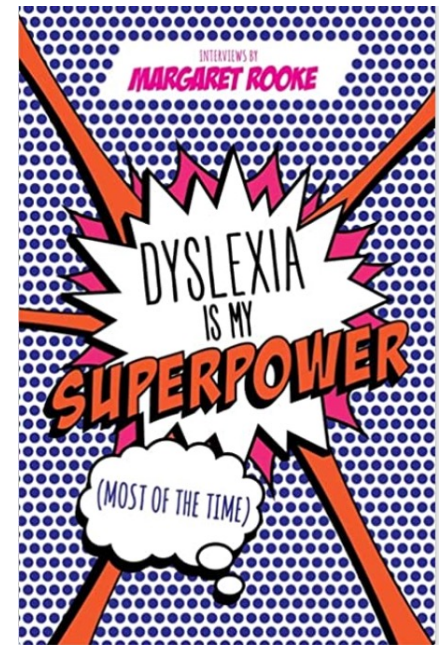
I'm very good at 3D, the hands-on stuff, and I'm quite good at science and the geometry side of Maths. (Max, 17)

I actually like maths. I like getting through it slowly and problem-solving. What I like is that there is more than one way to answer a question. If I can't do something I can get there another way (Fiona, 15)

In Maths they were really quick at sums that took me ages. (Elijah, 12)

In Maths I didn't know my times tables. I couldn't take them in. I only know my twos, threes, and tens. (Freddie, 10)

I solve maths problems in a different way. I visualise them. (Molly, 13)



Analyze across narratives:

What supports learning in math class?

What are barriers to learning in math class?

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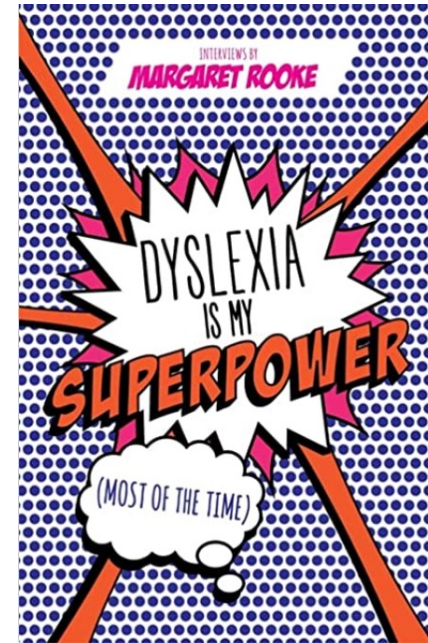
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If these kids were all in your math class

What would you stop doing?

Start doing?

Keep doing?

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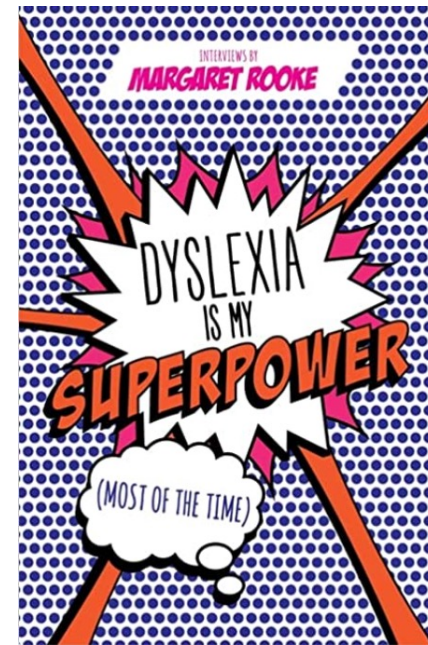
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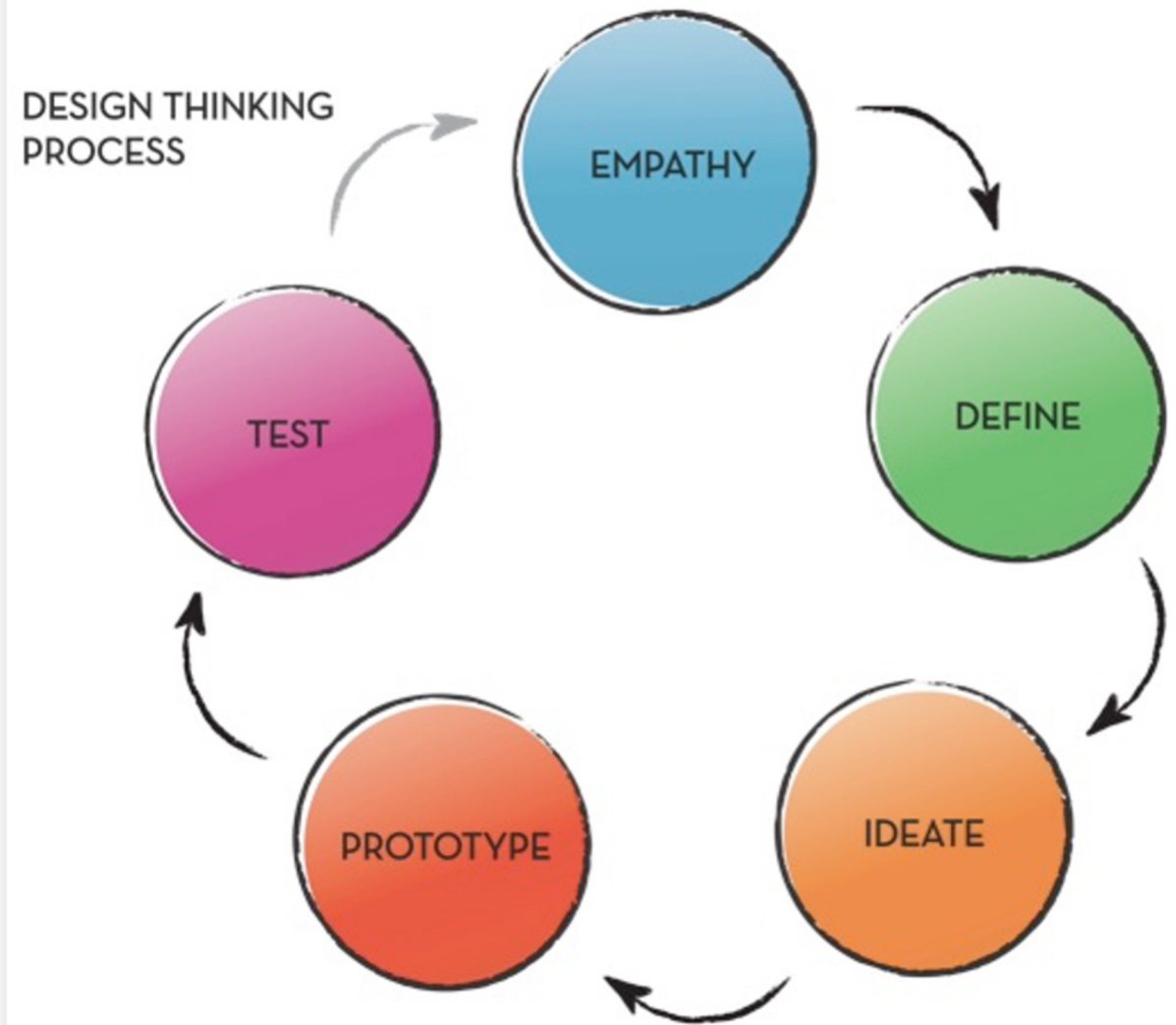
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UDL Math (Lambert 2020)

- To change our classrooms, we need to start with empathy.
- We need to build understanding of what our students are experiencing



Empathy Interviews

- Find a few kids on the margins, kids for whom math class isn't quite working

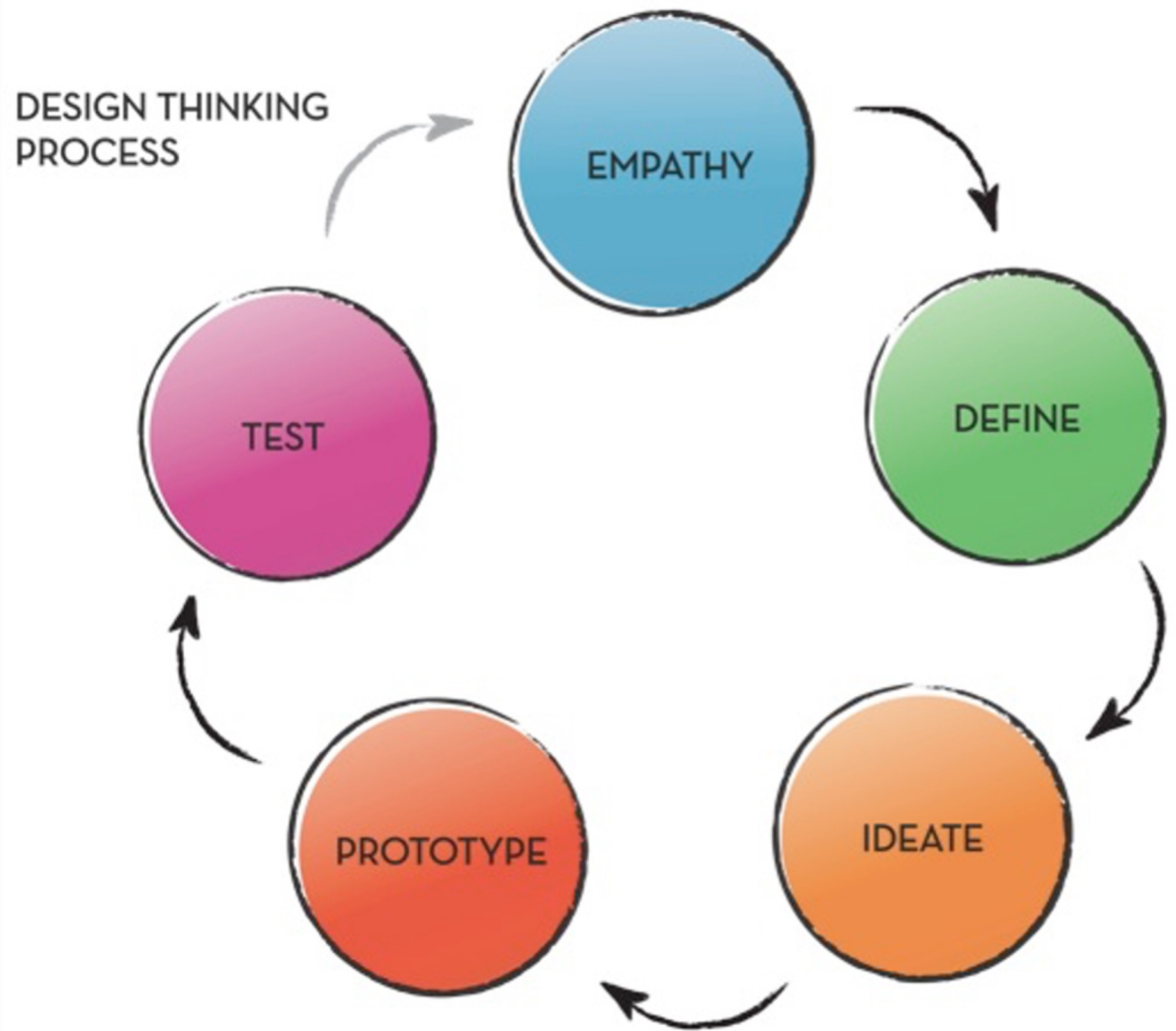
- Ask 1:1

“How is math class going?”

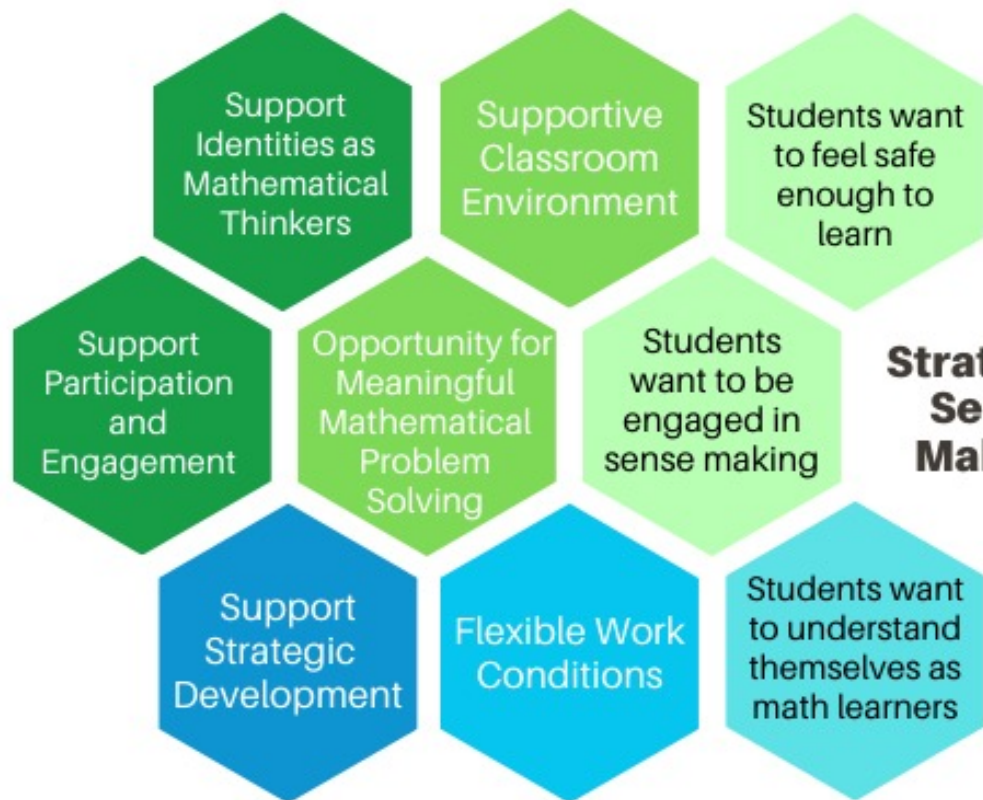
“Can you tell me about a time you felt great in math class?”

“Can you tell me a time that felt less than great in math class?”

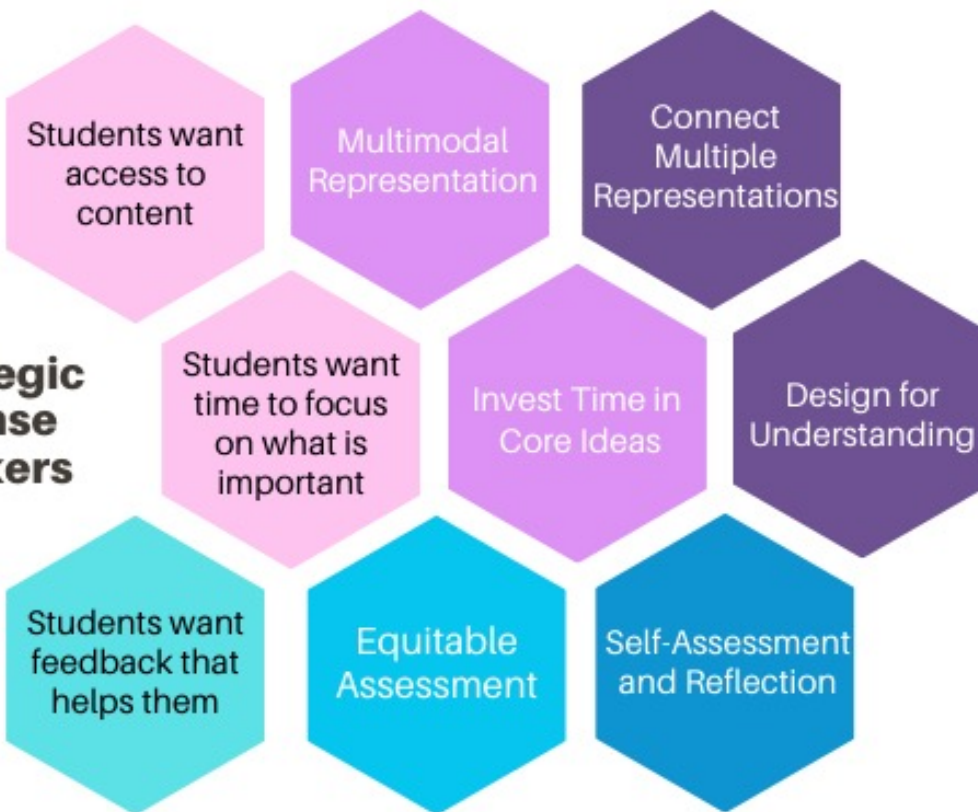
“If you had a magic wand, what would you change about math class?”



ENGAGEMENT



REPRESENTATION



Strategic Sense Makers

STRATEGIC ACTION

Deficit thinking



The False Deficit Binary Binds our Thinking

“my low kids”

Explicit
Instruction
Procedures
Must Master
Basics!

“my high kids”

Inquiry
Instruction
Concepts
Fun stuff!
Math!

Neurodiversity + Dyslexia/LD

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Memory for facts and procedures
Working memory
Executive functioning

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School math

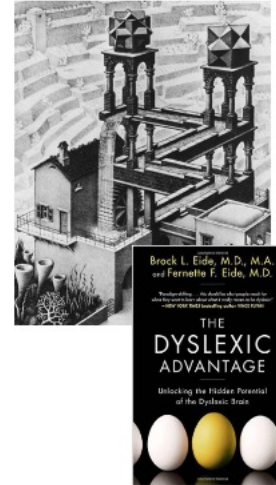
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Narrative thinking

↑
Real math



Following

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Questions?

Playlist

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