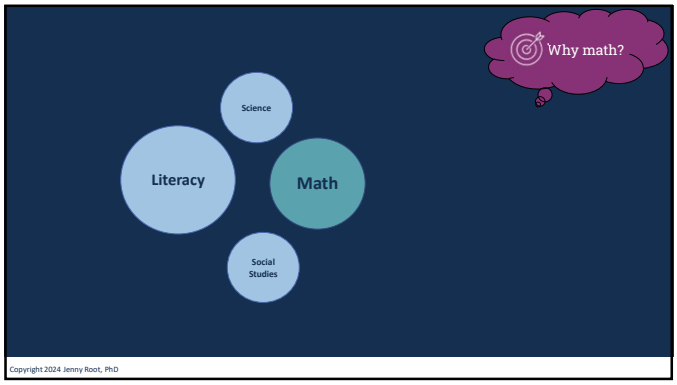
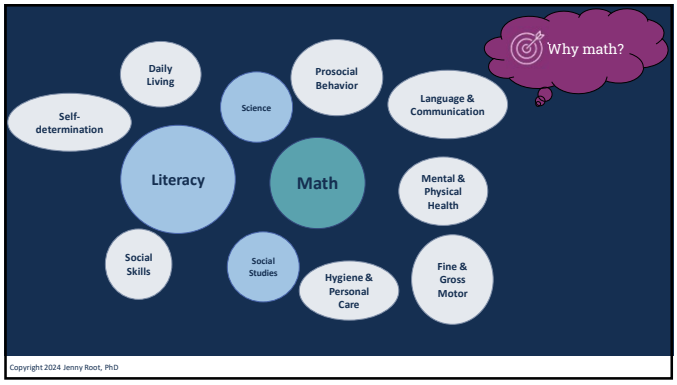
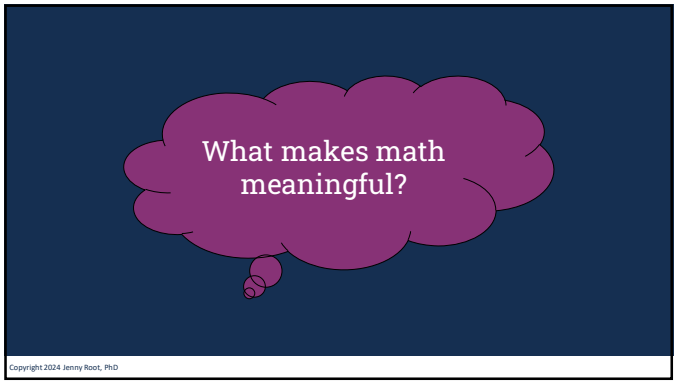
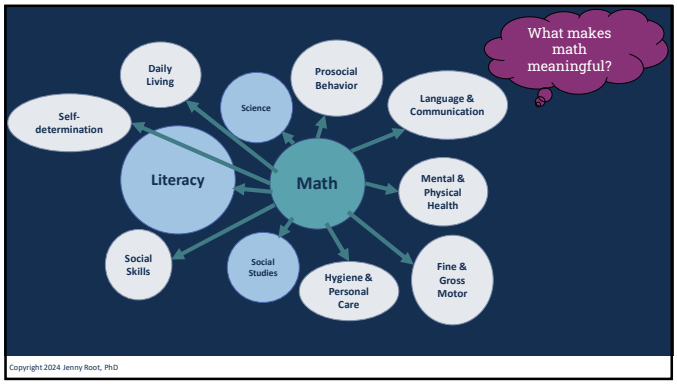
Making Math Meaningful for Autistic Students

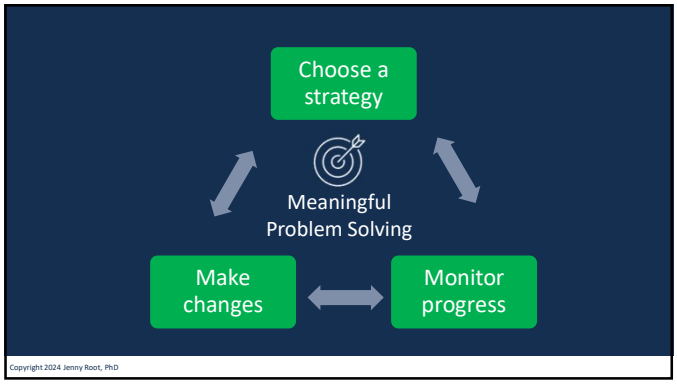
Jenny Root, PhD, BCBA
Associate Professor, Florida State University
Affiliate Faculty, Florida Center for Reading Research

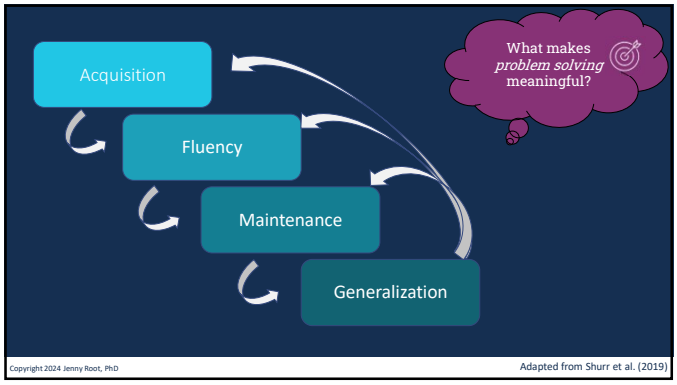





What makes math meaningful?
Copyright 2024 Jenny Root, PhD


What makes math meaningful?
Daily Living
Prosocial Behavior
Science
Language & Communication
Self-determination
Literacy
Math
Mental & Physical Health
Social Skills
Social Studies
Hygiene & Personal Care
Fine & Gross Motor
Copyright 2024 Jenny Root, PhD


Choose a strategy
Meaningful Problem Solving
Make changes
Monitor progress
Copyright 2024 Jenny Root, PhD


Acquisition
Fluency
Maintenance
Generalization
What makes *problem solving* meaningful?
Copyright 2024 Jenny Root, PhD
Adapted from Shurr et al. (2019)


Acquisition
Most basic stage of learning a new skill or concept
Students often make mistakes and will need a high level of support
Copyright 2024 Jenny Root, PhD


Fluency
• Learner can use skill with greater ease and efficiency
• Fluency is how learning **begins** to be useful!
• Don't build speed at the expense of accuracy
Copyright 2024 Jenny Root, PhD

Maintenance

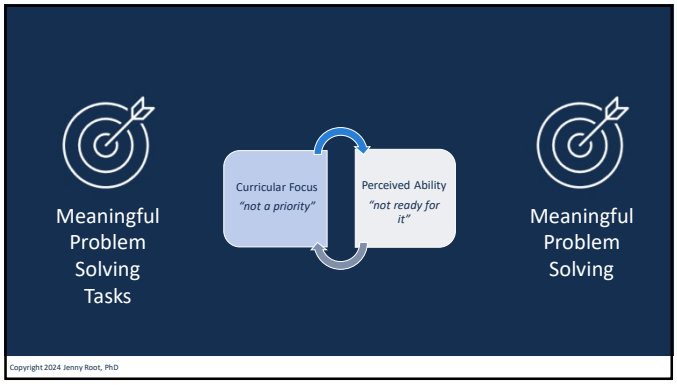
- Ability to perform a response over time without reteaching – the **bridge** to generalization
- Students who have achieved maintenance show signs of
  - Habit
  - Self-initiation
  - Independence
  - Accuracy
  - Consistency over time

Generalization

- Most important phase and primary purpose of learning
- Application of a skill in different settings, with different people, or different materials
- Consistently, accurately, and independently performing a skill under different conditions

What makes *problem solving* meaningful?

Solely focusing on *what* to do and not *when* or *why* limits independence



"There's a lot of people right now who have been given permission to be innumerate because **society has deemed innumeracy as OK**. As long as you're not a math person, it's perfectly fine to fail math"

- Jose Vilson

Decade	Broad Instructional Focus
1970s	Developmental focus based on "mental age"
1980s	Criterion of ultimate functioning – functional curriculum
1990s	Promotion of **social** inclusion, self-determination & social skills training
2000s	Attempt to balance academics & functional skills despite lack of training & research
2010s	Grade-aligned academic standards, evidence-based practices
2020s	*?*

Browder, Spooner, Wakeman, Trela, and Baker (2006)

Meaningful Problem Solving Tasks

Curricular Focus
"not a priority"

Perceived Ability
"not ready for it"

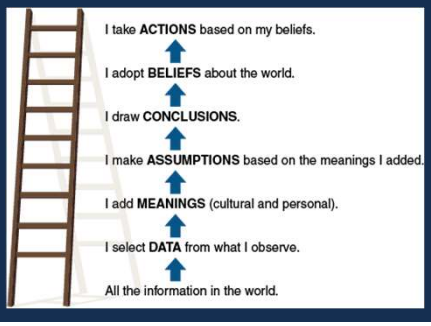
Meaningful Problem Solving

How would you describe your K-12 math experience?

"The ways students experience math instruction influences how they identify themselves as doers of mathematics"

-Thomas & Berry (2019)

Influence of Assumptions & Beliefs



Argyris (1970)

Demands of the Environment

Personal Competence

"Is the student able to_____?"

Demands of the Environment

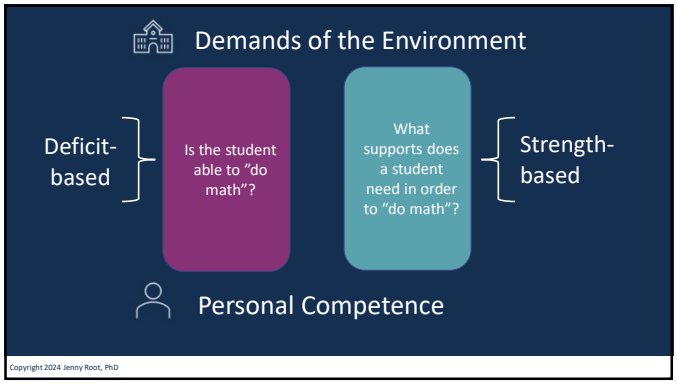
Personal Competence

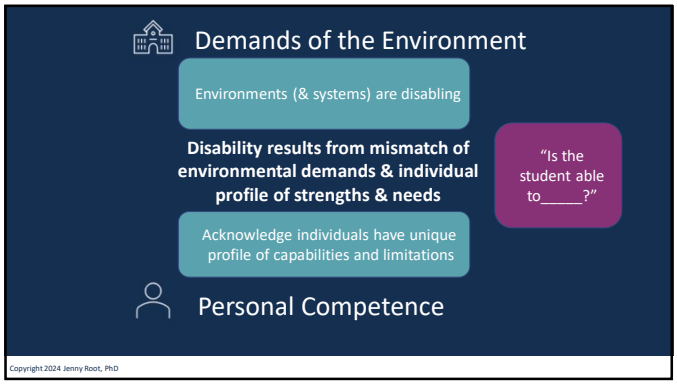
"Is the student able to_____?"

Demands of the Environment

Personal Competence

"Is the student able to_____?"


Demands of the Environment
Deficit-based
Is the student able to "do math"?
What supports does a student need in order to "do math"?
Strength-based
Personal Competence
Copyright 2024 Jenny Root, PhD


Demands of the Environment
Environments (& systems) are disabling
Disability results from mismatch of environmental demands & individual profile of strengths & needs
Acknowledge individuals have unique profile of capabilities and limitations
"Is the student able to_____?"
Personal Competence
Copyright 2024 Jenny Root, PhD


We signal our views through….
words
expectations
supports
Copyright 2024 Jenny Root, PhD

"Gen ed" v. "Special ed" students

Does not have the ability to learn to read or do math… So what is the point?

or

Students struggling in _____

Instruction isn't working – What might be the cause and what are some solutions?

"In addition to their collective diversity and need for lifelong supports, individuals with extensive support needs share a fundamental human trait – **the capacity to learn"**. -Snell (2003)

"He is obsessed with cars"

"He is very passionate and enthusiastic about cars"

"He has severe meltdowns"

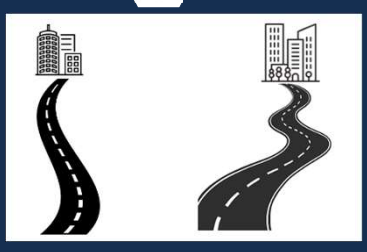
"He feels emotions intensely"

"He is rigid with routines"

"He prefers consistency and sameness"

"He is low-functioning"

"He needs a higher level of support"



Criterion of the Least Dangerous Assumption

*"In the **absence of conclusive data**, educational decisions ought to be **based on assumptions which, if incorrect, will have the least dangerous effect** on the likelihood that students will be able to have enviable adult lives."*

– Anne Donnellan (1984)
(my editorial change)

Belonging in Community

Meaningful Work

Fulfilling Relationships

Opportunities for Post-secondary Training

"If a student does not learn, the quality of the instruction *(as well as environmental demands & supports)* should be questioned before the student's ability to learn."

-*Cheryl Jorgensen*

(my editorial addition)

Variability:
A natural part of the human condition

Science of Reading

A **body of research** that relies on knowledge accrued across disciplines – including general education, special education, educational psychology, communication sciences, and neuroscience.

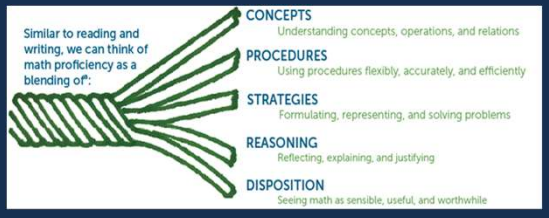
Focus is on how people learn to *access* and *comprehend* text

Science of Math

A **body of research** that relies on knowledge accrued across disciplines – including general education, special education, educational psychology, and neuroscience.

Focus is on how people learn to be *doers and thinkers* of math

Proficiency is the Expectation for All Learners

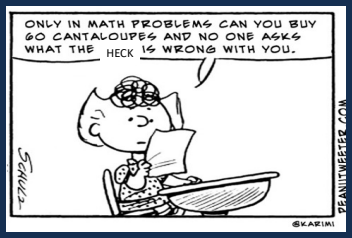


Powell et al. (2023)

Solely focusing on *what* to do and not *when* or *why* limits independence

Meaningful Problem Solving

Meaningful Problem Solving Tasks



Meaningful Problem Solving

Meaningful Problem Solving Tasks

Use a Real-World Context

Activities? Routines?

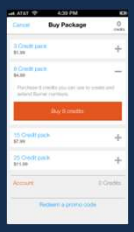
Relevant IEP goals?

More independence or opportunities?

Meaningful Problem Solving Tasks

Use a Real-World Context

- ✓Provides background information
- ✓Makes learning truly "functional"
- ✓Makes instruction meaningful & **personally relevant**
- ✓Opportunity to address ***multiple priorities***



Meaningful Problem Solving Tasks

Use a Real-World Context

Video problems

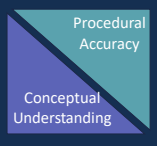
Video anchors

Word problems

Meaningful Problem Solving Tasks

Proactively Support Independence

Simply knowing *what* to do without *when* or *why* is insufficient



Meaningful Problem Solving Tasks

Proactively Support Independence

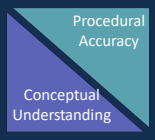
Potential Barriers to Anticipate

Numeracy: math facts, place value, number ID, rote counting forward and backward, cardinality, counting with 1:1 correspondence

Literacy: syntax, vocabulary, decoding, background knowledge

Executive Functioning: working memory, shifting attention, mental flexibility

Communication, Metacognition, Gross & Fine Motor Skills



Meaningful Problem Solving Tasks

Proactively Support Independence

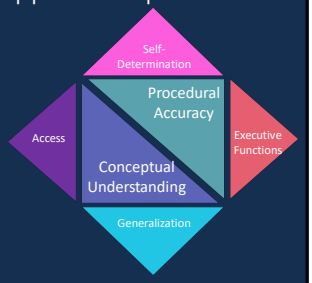
Potential Barriers to Anticipate

Numeracy: math facts, place value, number ID, rote counting forward and backward, cardinality, counting with 1:1 correspondence

Literacy: syntax, vocabulary, decoding, background knowledge

Executive Functioning: working memory, shifting attention, mental flexibility

Communication, Metacognition, Gross & Fine Motor Skills

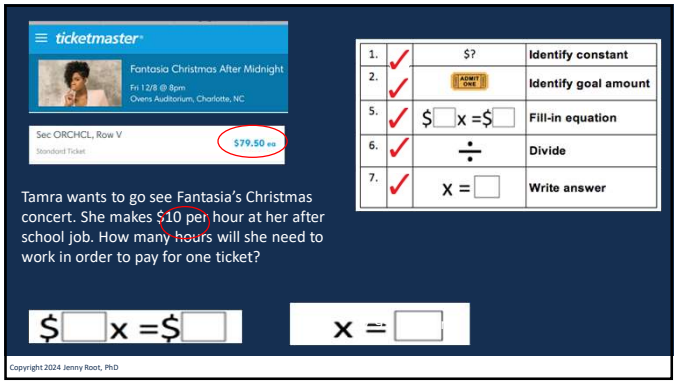


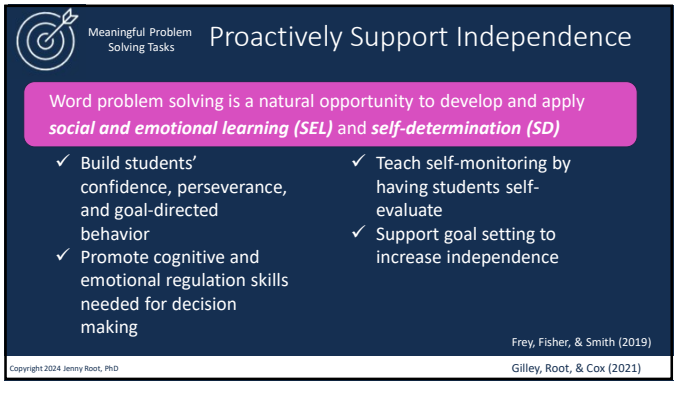
Meaningful Problem Solving Tasks

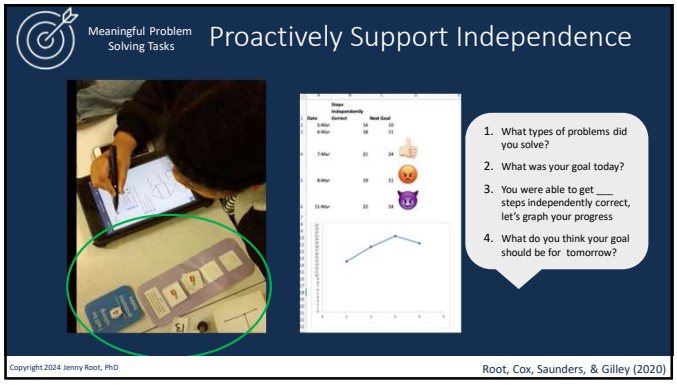
Proactively Support Independence

Evidence-based Practice	Phase of Learning			
	A	F	M	G
Task Analysis				
Modeling				
Visual Supports				
Massed Trials (Blocked Practice)				
Incremental Rehearsal				
Distributed Trials (Interleaving)				
Overlearning				
Gradual Release				
Self-Management				

Jimenez et al. (2022)


ticketmaster
Fantasia Christmas After Midnight
Fri 12/8 @ 8pm
Ovens Auditorium, Charlotte, NC
Sec ORCHCL, Row V
Standard Ticket
$79.50 ea
Tamra wants to go see Fantasia's Christmas concert. She makes $10 per hour at her after school job. How many hours will she need to work in order to pay for one ticket?
$ x =$
x =
1. $? Identify constant
2. ADMIT ONE Identify goal amount
5. $ x =$ Fill-in equation
6. ÷ Divide
7. x = Write answer
Copyright 2024 Jenny Root, PhD


Meaningful Problem Solving Tasks
Proactively Support Independence
Word problem solving is a natural opportunity to develop and apply social and emotional learning (SEL) and self-determination (SD)
✓ Build students' confidence, perseverance, and goal-directed behavior
✓ Promote cognitive and emotional regulation skills needed for decision making
✓ Teach self-monitoring by having students self-evaluate
✓ Support goal setting to increase independence
Frey, Fisher, & Smith (2019)
Copyright 2024 Jenny Root, PhD
Gilley, Root, & Cox (2021)

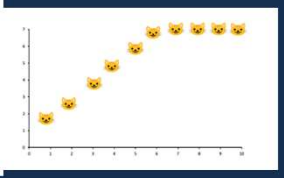

Meaningful Problem Solving Tasks
Proactively Support Independence
1. What types of problems did you solve?
2. What was your goal today?
3. You were able to get ___ steps independently correct, let's graph your progress
4. What do you think your goal should be for tomorrow?
Copyright 2024 Jenny Root, PhD
Root, Cox, Saunders, & Gilley (2020)

Meaningful Problem Solving Tasks

Proactively Support Independence

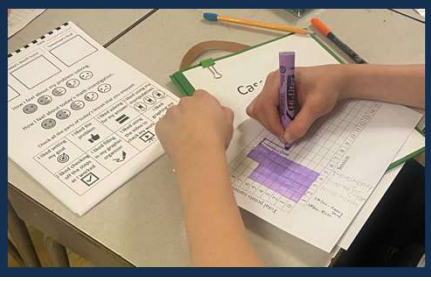
My Math Goals

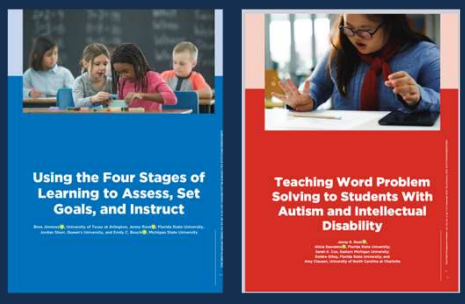
Date	# Steps Correct	Right Answer?	Time	Next goal:
3/5	2	No	-	3
3/6	3	No	-	4
3/7	4	No	-	5
3/8	5	Yes	-	6
3/9	6	No	-	8
3/12	7	Yes	4:00	3:50
3/13	7	Yes	3:45	3:40
3/14	7	Yes	3:30	3:30
3/15	7	Yes	3:30	3:20



Meaningful Problem Solving Tasks

Proactively Support Independence





Keep in Touch!

Dr. Jenny Root
jrroot@fsu.edu
Twitter: @Dr_Jenny_Root
Instagram: @DrJennyRoot

Link to resources: https://bit.ly/3VSUUZR