Calculation Support as a Gateway to Math Access for Students with Learning Disabilities

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Today's Focus

1 - UNDERSTANDING
What is a math disability?

How do they impact calculation?

2 - CONNECTING
How do calculation challenges impact thinking, learning, & problem solving?

3 - SUPPORTING
How can we make learning accessible for students with calculation challenges?

1 – UNDERSTANDING

Math Disabilities are Brain-Based

Students with math disabilities have difficulty learning and doing math because their **brains process information differently**.

Most real-time math struggles can be attributed to **five core challenges**.

One of those challenges is **Calculation**.

Students Struggle with Automaticity

The root of calculation challenges for many students with math disabilities is **math fact automaticity**.

5×6 4×9 3×7

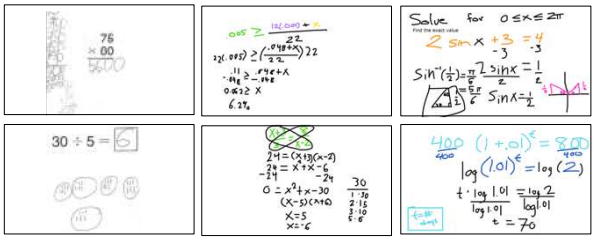
Students aren't able to make significant progress despite exposure, repetition, & practice.

Challenges persist into higher levels of math.

This makes pretty much all math thinking, learning, and problem solving more difficult.

But Great Math Thinking and Learning is Still Possible!

5th Grade ***Algebra II*** ***Precalculus***



2 – CONNECTING

How Calculation Challenges Make Math Harder

Calculation challenges create barriers that that can block learning, mathematical thinking, and problem solving,

1 - Micro calculations
2 - Conceptual learning
3 – Core mathematical thinking & problem solving
4 - Mathematical reasoning & applied problem solving
5 - Hidden math

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1 – Micro Calculations > Addition & Subtraction

Basic Facts

$4 + 5$

4 + 4 + 1
8 + 1
9

$9 - 3$

9 → 8 → 7 → 6

3 → 4 → 5 → 6 → 7 → 8 → 9

Integers

$-4 + 9$

9 + 4 = ?
9 - 4 = ?

13? -13? 5? -5?

1 – Micro Calculations > Multiplication(-related)

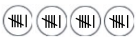
Basic Facts

4×6

6 + 6 + 6 + 6
12 + 12
10 + 10 + 2 + 2
20 + 4
24

Division & Roots

$24 \div 4$



$\sqrt{49}$

3 × 3 = ?
4 × 4 = ?
5 × 5 = ?
6 × 6 = ?
7 × 7 = ?

Multiples & Factors

$\frac{4}{9} + \frac{5}{6}$

9: 9, **18**, 27
6: 6, 12, **18**

18 ÷ 9 = ?
18 ÷ 6 = ?

4 × 2 = ?
5 × 3 = ?

$\frac{24}{32}$

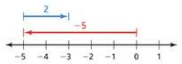


2 – Conceptual Learning Activities

Bricks	5		4	
Weight (pounds)	35	7		63

2,274 ÷ 3 = 758

	700 +	50 +	8	=
3	2,274	174	24	
	-2,100	- 150	- 24	
	174	24	0	



3 – Core Thinking & Problem Solving > Algebra

$(4x^2 - 3x + 2) + (-9x^2 + 7x - 5)$

4 - 9 =
-3 + 7 =
2 - 5 =

$x^2 - 5x + 24$

? × ? = 24
? + ? = -5

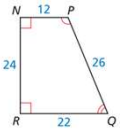
$(5x^3 - 2x^2 + 10)(x^3 - 3x^2 + 2x + 1)$

5 × 1 =	-2 × 1 =	10 × 1 =
5 × -3 =	-2 × -3 =	10 × -3 =
5 × 2 =	-2 × 2 =	10 × 2 =
5 × 1 =	-2 × 1 =	10 × 1 =

3 – Core Thinking & Problem Solving > Geometry









78 + 31 =
180 - 109 =

$x + 78 + 31 = 180$

12 ÷ 6 =
22 ÷ 2 =

$\frac{6}{12} = \frac{x}{22}$

$\pi \times 28^2 \times \frac{137}{360}$

4 – Reasoning & Applied Problem Solving

What number is 9 less than $\frac{3}{4}$ of 24?

24 ÷ 4 = ?
6 × 3 = ?
18 - 9 = ?

$\frac{3}{4} \times \frac{24}{1} - 9 =$

If 50% of a number equals 75, then 10% of the number equals what?

$.5x = 75$
$x = 150$
$.1 \times 150 = ?$

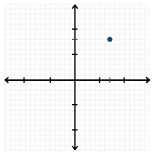
James and Lars shope at the same store and spend the exact same amount of money. James spends **$8.45** on cereal and buys **2.5 pounds** of bananas. Lars spends **$12.95** on cereal and buys **1.75 pounds** of bananas. What is the cost per pound of bananas?

$2.5x + 8.45 = 1.75x + 12.95$

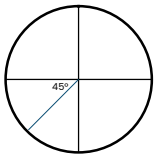
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5 – Hidden Math

(7, 8)



sin 225°



0 → 1 → 2 → 3 → 4 → 5 → 6 → 7

0 → 1 → 2 → 3 → 4 → 5 → 6 → 7 → 8

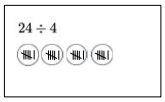
180 + 90 =

270 - 180 =

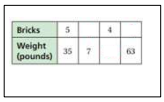
225 - 180 =

Calculation Challenges Make Math Harder

1 - Micro Calculations

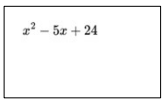


2 - Conceptual Learning Activities

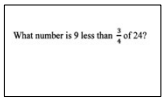


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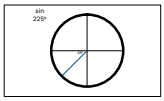
3 - Core Thinking & Problem Solving



4 - Mathematical Reasoning & Problem Solving



5 - Hidden Math



3 – SUPPORTING

How Can We Support Students

The goal: To help students to access learning and problem solving by helping them to **reduce** or **overcome calculation barriers**.

1 - Build strong **foundational concepts & skills**

2 - Create **accessible problems**

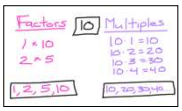
3 - Teach **strategies** for specific problem-types

4 - Provide appropriate **accommodations**

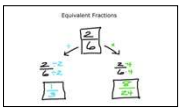
5 – Provide **psychoeducation** & establish **inclusive classroom norms**

1 - Build Strong Foundational Concepts & Skills

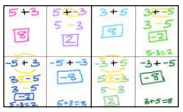
Factors & Multiples

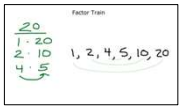


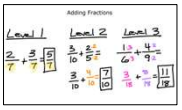
Fraction Math

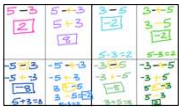


Integer Calculations









2 – Create Accessible Problems

$-4 + 9$

↓

$-1 + 9$



$\pi \times 28^2 \times \frac{137}{360}$

↓

$x^2 - 5x + 24$

↓

$x^2 + 8x + 7$



$\pi \times 6^2 \times \frac{90}{360}$

$\pi \times 36 \times \frac{1}{4}$

$\pi \times \frac{36}{1} \times \frac{90}{360}$

James and Lars shope at the same store and spend the exact same amount of money. James spends **$8.45** on cereal and buys **2.75 pounds** of bananas. Lars spends **$12.95** on cereal and buys **1.25 pounds** of bananas. What is the cost per pound of bananas?

$2.5x + 8.45 = 1.75x + 12.95$

↓

James spends **$9** on cereal and buys **3 pounds** of bananas. Lars spends **$12** on cereal and buys **2 pounds** of bananas. What is the cost per pound of bananas?

$3x + 9 = 2x + 12$

3 – Teach Strategies for Specific Problem Types

$(4x^2 - 3x + 2) + (-9x^2 + 7x - 5)$

$4x^2 - 3x + 2 - 9x^2 + 7x - 5$

$4x^2 - 9x^2 \quad -3x + 7x \quad +2 - 5$

$-5x^2 \quad +4x \quad -3$

$x^2 + 11x + 24$

24

1 · 24 = 25

2 · 12 = 14

3 · 8 = 11

4 · 6 = 10

$(x + 3)(x + 8)$

$(5x^3 - 2x^2 + 10)(x^3 - 3x^2 + 2x + 1)$

$5x^6 - 15x^5 + 10x^4 - 5x^3$

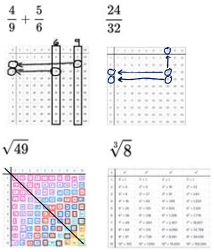
$-2x^5 + 6x^4 - 4x^3 - 2x^2$

$10x^3 - 30x^2 + 20x - 10$

$5x^6 - 17x^5 + 16x^4 + x^3 - 32x^2 + 20x - 10$

4 – Provide Appropriate Accommodations

Calculation Tables



Calculators

4-function calculator
- For single calculations



Human calculator
- For single calculations only
- Make sure they are doing all of the important thinking

Environmental

Extra space
- To write out and keep track of their calculations and thinking

Extra time
- To do the extra work and employ the strategies they need to compensate for lack of automaticity

Breaks
- To alleviate the cognitive overload and fatigue that comes with compensating for calculation challenges

5 – Provide Psychoeducation & Establish Inclusive Norms

Take your time



Write it down

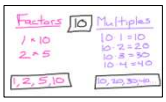


Use your tools

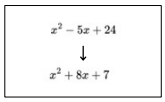


There Are LOTS of Ways to Create Access

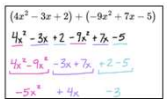
1 - Build Strong Foundational Skills



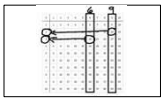
2 - Create Accessible Problems



3 - Teach Strategies for Specific Problem-Types



4 - Provide Appropriate Accommodations



5 – Provide Psychoeducation & Establish Inclusive Norms



Summary

1 - UNDERSTANDING

Math disabilities are brain-based.

Challenges with math fact automaticity persist over time and make everything more difficult.

Despite these challenges, students have the potential to be great math thinkers and problem solvers!

2 - CONNECTING

Calculation challenges show up everywhere in math from micro calculations to conceptual learning activities to reasoning and problem solving.

These challenges block students' ability to reach their full learning potential.

3 - SUPPORTING

Teachers can use strategies that help students to mitigate calculation barriers so students can access learning.

Appropriate supports give students with calculation challenges the opportunity to thrive in math.

Applying This To Your Classroom

Your Students

Who are the students in your class who may be impacted by calculation challenges?

How can you identify them?

Your Curriculum

Where are the calculation demands in your curriculum?

Where in your content are students with calculation challenges likely to struggle?

Your Lessons

What are strategies you'd like to explore or experiment with in your classes?

What could additional support look like in your classroom / school?

Your Practice

What would you like to learn more about?

What would support you as you explore these ideas?

Thank You!

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Session Materials
- Session slides & reflection questions
- Guides & tools

Session Feedback
- I'd love to hear from you!

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