**Closing the Achievement Gap
in Middle School Mathematics
through High Expectations and Rigor**

2023
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OBJECTIVES

- TEACHERS WILL REFLECT ON THEIR TEACHING PRACTICE AND HOW IT IMPACTS THE EXPECTATIONS AND RIGOR IN THEIR CLASSROOM

- TEACHERS WILL LOOK AT WAYS TO SCAFFOLD MATERIAL TO ALLOW ALL STUDENTS ACCESS TO HIGHER RIGOR

- TEACHERS WILL GAIN STRATEGIES AND RESOURCES TO USE FOR INCREASING RIGOR WITHIN THEIR CLASSROOM

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HIGH EXPECTATIONS

CONSISTENCY IS KEY

- WHAT DOES HIGH EXPECTATIONS MEAN TO YOU?

- DO YOU IMPLEMENT ROUTINES AND PROCEDURES FROM THE FIRST MINUTE STUDENTS WALK IN THE CLASSROOM?

- HAVE YOU EVER ADJUSTED YOUR EXPECTATIONS BASED ON STUDENTS' PERFORMANCE?

- Excuses stop at the door
- Follow 3B's
  - Be Prepared
  - Be Responsible
  - Be Respectful
- Math is completed in pencil
- No Work No Credit
- Proper units are required
- No personal Extra Credit
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- No opt out policy

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ACCESS AND EQUITY

An excellent mathematics program requires that all students have access to a high-quality mathematics curriculum, effective teaching and learning, high expectations, and the support and resources needed to maximize their learning potential.

Principles to Actions (NCTM 2014, p. 5)

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DEPTH OF KNOWLEDGE (DOK) IN TERMS OF MATHEMATICS

Level 1 (Recall) includes the recall of information such as a fact, definition, term, or a **simple** procedure, as well as performing a **simple** algorithm or applying a formula.

Level 2 (Skill/Concept) includes the engagement of some mental processing beyond a habitual response. A Level 2 assessment item requires students to **make some decisions** as to how to approach the problem or activity, whereas a Level 1 requires students to demonstrate a rote response, perform a well-known algorithm, follow a set procedure (like a recipe), or perform a clearly defined series of steps.

Webb, N. L. (2002). *Depth-of-knowledge levels for four content areas.*

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DEPTH OF KNOWLEDGE (DOK) IN TERMS OF MATHEMATICS

Level 3 (Strategic Thinking) requires **reasoning, planning,** using evidence, and a higher level of thinking than the previous two levels. In most instances, requiring students to **explain their thinking** is a Level 3. Activities that require students to **make conjectures** are also at this level.

Level 4 (Extended Thinking) requires **complex reasoning, planning, developing,** and thinking most likely over an extended period. The extended time is not a distinguishing factor if the required work is only repetitive and does not require applying significant conceptual understanding and higher-order thinking.

Webb, N. L. (2002). *Depth-of-knowledge levels for four content areas.*

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SOLVING EQUATIONS WITH VARIABLES ON BOTH SIDES

1) $-2a - 9 = 6a + 15$

2) $\frac{2}{3}y + 1 = \frac{1}{6}y + 8$

3) Dana and Lisa are playing games at the arcade. Dana starts with $15, and the machine she is playing costs $0.75 per game. Lisa starts with $13, and her machine costs $0.50 per game. After how many games will the two friends have the same amount of money remaining? Let g represent the number of games.

4) A student wrote the equation $22 + 4 = 6s + 12s$ to represent the problem shown at the right. Find his mistake and correct it.

Darnell and Emma are college students. Darnell currently has 22 credits and he plans on taking 6 credits per semester. Emma has 4 credits and plans to take 12 credits per semester. After how many semesters, s, will Darnell and Emma have the same number of credits?

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SOLVING EQUATIONS WITH VARIABLES ON BOTH SIDES

5) Madison is putting up a fence in the shape of a triangle in her backyard. The fence has side lengths as shown, where x represents the number of feet in each fence section. The perimeter of the fence can be covered using 8 total fence sections represented by the expression $8x$. If fencing costs $6.50 a foot, what would be the total cost of the fence?

$(2x + 4)$ ft $(3x + 7)$ ft $(2x + 4)$ ft
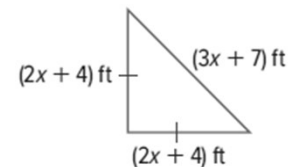
6) The table shows the prices of items at a concession stand. A group of 7 people each bought a bottle of water and a hot dog. A group of 11 people each bought a box of candy and a box of popcorn. The group of 7 people paid the same amount as the group of 11 people. What is the cost of each item at the concession stand?

Bottle of Water	$2.00
Box of Candy	$\frac{1}{2}x$
Box of Popcorn	$1\frac{1}{4}x$
Hot dog	$1\frac{3}{4}x$

box of candy: $_____

box of popcorn: $_____

hot dog: $_____

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OPEN ENDED

Directions: Using the digits 1 to 9 at most one time each, place a digit in each box to create an equation with a solution that's as close to zero as possible.

$$\Box x + \Box = \Box x + \Box$$

Directions: Using the digits 1 to 9, at most one time each, create an equation where x has the smallest (or greatest) possible value.

$$\frac{\Box}{\Box}\left(\Box x + \Box\right) + \Box x = \Box x + \Box$$

www.openmiddle.com

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PROBLEM SOLVING: <u>THE WHEEL SHOP</u>

- Scaffolding performance task
- Differentiated instructions if necessary
- Challenge higher level students
- Collaborative learning

Level A: 3.OA.A2
Level B: 4.OA.A.3 / 8.EE.C.8b
Level C: A-REI.C.6
Level D: A-REI.C.6
Level E: S-CP.A.1 / A.REI.D.12

www.insidemathematics.org

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MATH TRICKS VS UNDERSTANDING

Trick

1) $\sqrt{25}$
   $5+2=7$
   $7-2=\boxed{5}$

2) $\sqrt{04}$
   $0+4=4$
   $4-2=\boxed{2}$

3) $\sqrt{64}$
   $6+4=10$
   $10-2=\boxed{8}$

Counter

4) $\sqrt{09}$
   $0+9=9$
   $9-2=7 \times$

5) $\sqrt{16}$
   $1+6=7$
   $7-2=5 \times$

Square Root is side length of a square

Teach

6) $\sqrt{16}$
   $\boxed{4}$

Square with area of 15 has side length $\sqrt{15}$

7) $\sqrt{60}$
   $\sqrt{60}$
   $\sqrt{4 \cdot 15}$
   $2\sqrt{15}$

15	15
15	15

$\sqrt{15}$ $\sqrt{15}$
$2\sqrt{15}$

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MATH TRICKS VS UNDERSTANDING

Division

1) $30 \div 3$

| 10 | 10 |

| 10 |

30 split evenly among 3 wholes

2) $\frac{1}{10} \div \frac{1}{2}$

| $\frac{1}{10}$ |
| $\frac{1}{10}$ |

$\frac{1}{10} \div \frac{1}{2}$
$\frac{1}{10} \times \frac{2}{1}$
$\frac{2}{10} = \boxed{\frac{1}{5}}$

Create the whole $\frac{1}{10} + \frac{1}{10} = \frac{2}{10} \Rightarrow \boxed{\frac{1}{5}}$

3) $\frac{1}{2} \div \frac{1}{10}$
   $\frac{1}{2} \times \frac{10}{1} \Rightarrow \frac{10}{2} = 5$

| $\frac{1}{2}$ | $\frac{1}{2}$ | $\frac{1}{2}$ | $\frac{1}{2}$ | $\frac{1}{2}$ | $\frac{1}{2}$ | $\frac{1}{2}$ | $\frac{1}{2}$ | $\frac{1}{2}$ | $\frac{1}{2}$ |

$\boxed{5}$

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Multiplication

ex) $2 \times \dfrac{4}{5}$

| $\frac{1}{5}$ | $\frac{1}{5}$ | $\frac{1}{5}$ | $\frac{1}{5}$ | |

Shading
$\dfrac{8}{5} = 1\dfrac{3}{5}$

| $\frac{1}{5}$ | $\frac{1}{5}$ | $\frac{1}{5}$ | $\frac{1}{5}$ | |

ex) $\dfrac{2}{3} \times \dfrac{6}{7}$

1	2	3	4	5	6	13
7	8	9	10	11	12	14
15	16	17	18	19	20	21

Solve algebraically
$\dfrac{2}{3} \times \dfrac{6}{7}$
$\dfrac{12}{21}$

yellow $\frac{2}{3}$ highlighted
blue $\frac{6}{7}$ highlighted
Green overlap (answer) $\dfrac{12}{21}$

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SUGGESTIONS TO INCREASE RIGOR

- Every lesson needs to include word problems

- Productive struggle is NECESSARY

- Give students a problem to solve that is different than what you did for direct instruction (after a guided problem)

- Finding error problems cause critical thinking

- As applicable, students need to see all types of rational numbers within a concept

- Give at least 1 multiple choice and 1 multi-select on assessments

- Teach Math for learning and not because it is on a test

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