MARYLAND STATE DEPARTMENT OF EDUCATION

PREPARING WORLD CLASS STUDENTS

The Importance of Coherent Lessons in Elementary Mathematics

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TODAY'S OUTCOME

Participants will:

Explore in depth the "shift" of ***COHERENCE*** and its impact on mathematics **content**, **instruction**, and **assessment** of the MD CC-R standards .

Getting on Track with PARCC

- Provide daily instruction for students to learn the mathematics content based on *MD College and Career- Ready Standards* and using the progressions
- Develop the behaviors students need to demonstrate their knowledge and understanding of the content- Think and act like mathematicians.

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CCSS Shifts for Mathematics

- Focus: strongly teach the content focus of the standards using the mathematical progressions
- Coherence: think across grades, and link to major topics within each grade.
- Rigor: in major topics, pursue with equal intensity
  - Conceptual Understanding
  - Procedural Skill and fluency
  - Applications

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PARCC talks about the CCSS Shifts for Mathematics

- "Two major evidence based principles, on which the standards are based, are **focus** and **coherence**.
- Focus is necessary so that students have time to think, practice, and integrate new ideas into their growing knowledge structure." .(PARCC-Framework. Grades 3-11)

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PARCC- Coherence- Across Grades

- Some standards knit topics that are at a single grade
- Most topics, play out across two or more grades to form a progression of increasing knowledge, skill, or sophistication."
- Instruction at any given grade would benefit from being informed by the overall progression across grades.

From PARCC Frameworks, Grades 3-11

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Coherence: Think Across Grades, and Link to Major Topics Within Grades

- Carefully connect the learning within and across grades so that students can build new understanding on foundations built in previous years.
- Begin with solid conceptual understanding of core content and build on it. Each standard is not a new event, but an extension of previous learning.

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Coherence: *Think* Across Grades

Example: Fractions

"The **coherence** and sequential nature of mathematics dictate the foundational skills that are necessary for the learning of algebra.

The most important foundational skill not presently developed appears to be proficiency with fractions (including decimals, per cents, and negative fractions)"

The teaching of fractions must be acknowledged as critically important and improved before an increase in student achievement in algebra can be expected."

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Fractions Domain

- First, read through the document, Number and Operations- Fractions, grades 3-5.
- Second read
  - Circle Verbs

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Language of the Standards

Conceptual Understanding

- Understand
- Interpret
- Recognize
- Describe
- Explain

Procedural Skill

- Fluently
- Compute
- Convert
- Solve

- Modeling/Application
  - Use math flexibly
  - Problem solving context
  - Real world problems

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Fractions Domain

- First, read through the document, Number and Operations- Fractions, grades 3-5.
- Second read
  - Circle Verbs
  - Pay attention to the focus and coherence. Identify recurring themes, threads of learning.(label those A, B, etc)
  - *Any Important sections that stand out for you.
- Talk with the person near you to share your observations

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Grade-To-Grade Coherence

Grades 1 and 2

- Partition shapes (circles and rectangles
- Describe the shares using words halves, fourths, quarters

Grade 3 :

- Fractions as a Number-Unit Fractions
- Representing Fractions on a Number Line
- Equivalent Fractions
- Comparing Fractions

Grade 4

- Equivalent Fractions-unit fractions
- Comparing Fractions-unit fraction
- Adding and Subtracting like fractions (unit fractions)
- Multiplying a fraction by a whole number (unit fractions)
- Decimals

Grade 5

- Adding and Subtracting Fractions
- Multiplying and Dividing Fractions
- Multiplying as Scaling

Recurring Threads

- Unit fractions
- Representing fractions on the number line
- Importance of identifying the whole
- Describing the parts of the whole

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Coherence-Between the Content and Practice Standards

- Rigorous mathematical instruction and learning occur when content and the practices are joined together.
- SMP- Describe the attributes of mathematically proficient students and support the foundations of learning mathematics.

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Standards of Mathematical Practice

Reasoning and Explaining

2. Reason abstractly and quantitatively

3.Construct viable arguments and critique the reasoning of others

Modeling and Using Tools

4.Model with mathematics

5. Use appropriate tools strategically.

Seeing Structure and Generalizing

7. Look for and make use of structure

8. Look for and express regularity in repeated reasoning.

Overarching Habits of the Mind

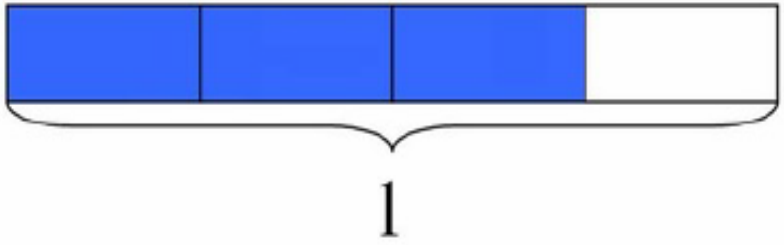
1.Make sense of problems and persevere in solving them.

5. Attend to precision.

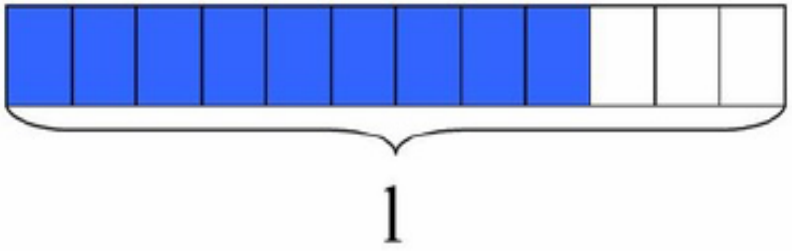
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Explaining Fraction Equivalence with Pictures

a. The rectangle below has length 1. What fraction does the shaded part represent?



b. The rectangle below has the same length as the rectangle above. What fraction does the shaded part represent?



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Grade- To- Grade Coherence

Reflection and Discussion

1. How is coherence a part of the content for this task?
2. What behaviors do students need to demonstrate to solve this task?
3. What are the implications for instruction for teachers/ students?
4. How is understanding grade-to- grade coherence helpful for planning and teaching daily lessons ?

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Grade 4	from Domain to Domain
OA.A	Use the four operations with whole numbers to solve problems
NF.A	Build fractions from unit fractions by applying and extending previous understanding of operations of whole numbers. **Extend the understanding of fraction equivalence and ordering** Explain why a fraction a/b is equivalent to a fraction (n x a)/(n x b) by using visual fraction models…
MD.A	Solve problems involving measurement and conversions of measurement from a larger to smaller unit. (use four operations to solve problems including problems involving fractions and decimals

Mrs. Russell's Problem

"Mrs. Russell wants to have ribbons on each corner of her garden identifying the various crops.

She determined 2/3 of a yard was the perfect length for each ribbon.

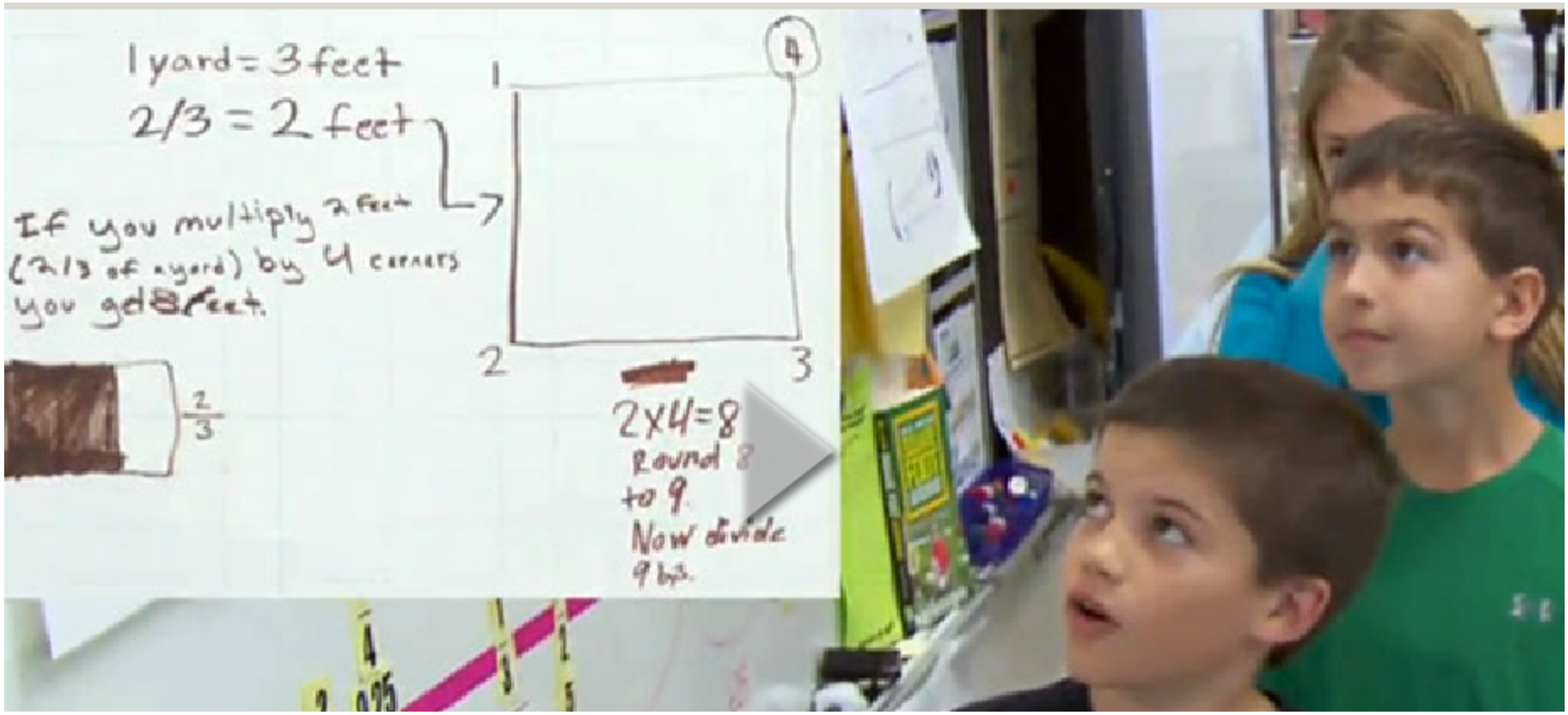
Since ribbon is sold by the yard, how much should be purchased for all four corners ?"

Create a representation to justify your thinking.

Teacher Amy Spies Voulusia County, FL The Teaching Channel Lesson

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Within-Grade Coherence



https://www.teachingchannel.org/videos/multiplying-fractions-by-whole-numbers-lesson

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Within-Grade Coherence

- Watch the video "*Multiplying Fractions By Whole Numbers*".
- Use the note taking form to record evidence of within-grade coherence and any between grade coherence.
- Reflect- What do you notice about this lessons' reliance on COHERENCE?

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Group Discussion

1. What concepts from previous grades did students need to know to be successful with this task?
2. What on-grade level standards did students need to know?
3. Which SMP were evident?
4. What are the implications for instruction?

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Coherence In Assessment

Evidence of **Coherence** in assessment is not tremendously different from evidence of **coherence** in classroom instruction.

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PARCC Items

- Solve problems involving the Major work of the grade with connections to the practice standards;
- Solve problems involving the Additional and Supporting work of the grade with connections to the practice standards;
- Express mathematical reasoning by constructing mathematical arguments and critiques;
- Solve real-world problems by engaging particularly in the modeling practice; and
- Demonstrate fluency in the areas set for in the content standards for Grades 3 – 6

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Task Types

- Type I- assesses concepts, skills, and procedures. Tasks are a balance of all three parts of rigor and any of the math practice.
- Type II- assesses expressing mathematical reasoning. Tasks call for written arguments/justifications, critique of reasoning or precision in mathematical statements.
- Type III- assesses modeling/application in real world context or scenario and can also involve other mathematical practice standards.

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COHERENCE- PARCC ASSESSMENT

Mr. Edmund's Pencil Box

Mr. Edmunds shared 12 pencils among his four sons as follows:

- Alan received $\frac{1}{3}$ of the pencils.
- Bill received $\frac{1}{4}$ of the pencils.
- Carl received more than 1 pencil.
- David received more pencils than Carl.

PARCC - Reflect and Discuss

- What evidence of coherence did you find?
  - Grade to Grade Coherence
  - Within Grade Coherence
- Which Standards for Mathematical Practice are assessed in this task?
- What does this mean for instruction in your classroom?

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