Developing Habits to Support the Standards for Mathematical Practice

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The Charlotte M. Murkland Elementary School

Number of Students	500
Teacher Student Ratio	14.1 to 1
First Language not English	53.6
Low-income	86.2
Special Education	11.0
African American	3.2
Asian	53.6
Hispanic	27.8
Native American	1.6
White	11.2
Multi-Race, Non-Hispanic	2.6

Goal: Dribble through the players and successfully shoot a layup.

- What do you notice about each student?
- How do the three students differ?
- Why do the students differ?

Turn and Talk

Goal: Dribble through the players and successfully shoot a layup.

- What do you notice about each student?
- How do the three students differ?
- Why do the students differ?

Working Memory has Capacity

- George Miller (1956) proposed the magic number 7
- We can only receive, process, and retrieve approximately 7 pieces of information at a time

  -Dribbling (Ket)

  -Setting up for a shot (Damien)

  -Shooting (Bellinie)

- Here are nine letters…can you remember them?

  IRSCIAFBI

- Chunking information makes tasks more manageable

  IRS CIA FBI

Long Term Memory (Habits)	Working Memory (In the Moment)
• An experience or piece of information that **"sticks"**	• Specific, immediate memories of a **sensory input**
• Stores **larger quantities** of information	• The **temporary recollection** of details from long term memories
• The journey to LTM is called consolidation and takes place after ***prolonged exposure to a piece of information or experience***	• The **conclusion and ideas** made in the past

Adapted from Gregory Kellett, a cognitive neuroscience researcher at SFSU and UCSF and science writer for Lumos Labs

The Importance of Recognizing the Development of Habits

A study of expert chess players demonstrated that experienced players perform well even in “blitz” games because they are not actually puzzling through each move. They have tens of thousands of board configurations, and the best move for each configuration, stored in long-term memory. Those configurations are learned by studying previous games for 10 years or more. **Experienced players can play well at a fast pace because all they are doing is recalling the best move – not figuring it out.**

-Bruce D. Burns, “*The Effects of Speed on Skilled Chess Performance*”

Developing Good Teaching Habits

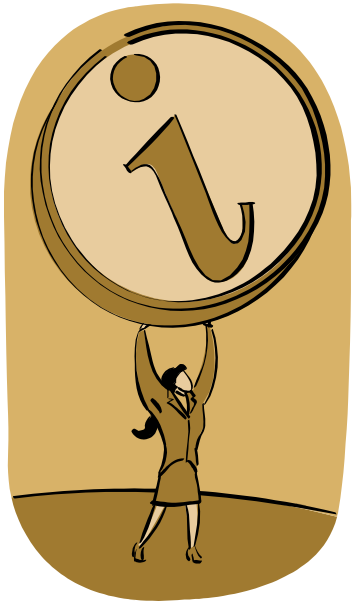
"Expert players can play well at a fast pace because all they are doing is recalling the best move – not figuring it out."

- And this is **PRECISELY** what we hope to see as educators effectively implement the mathematical practices
- We expect that a teacher can analyze a given classroom situation and have the skills to immediately apply the "best move"
- It's our role is to recognize where a teacher is on a continuum and support them on their journey

During this Session We will Recognize & Explore Well-Developed Teaching Habits in the Classroom

Including the Effective Use of:

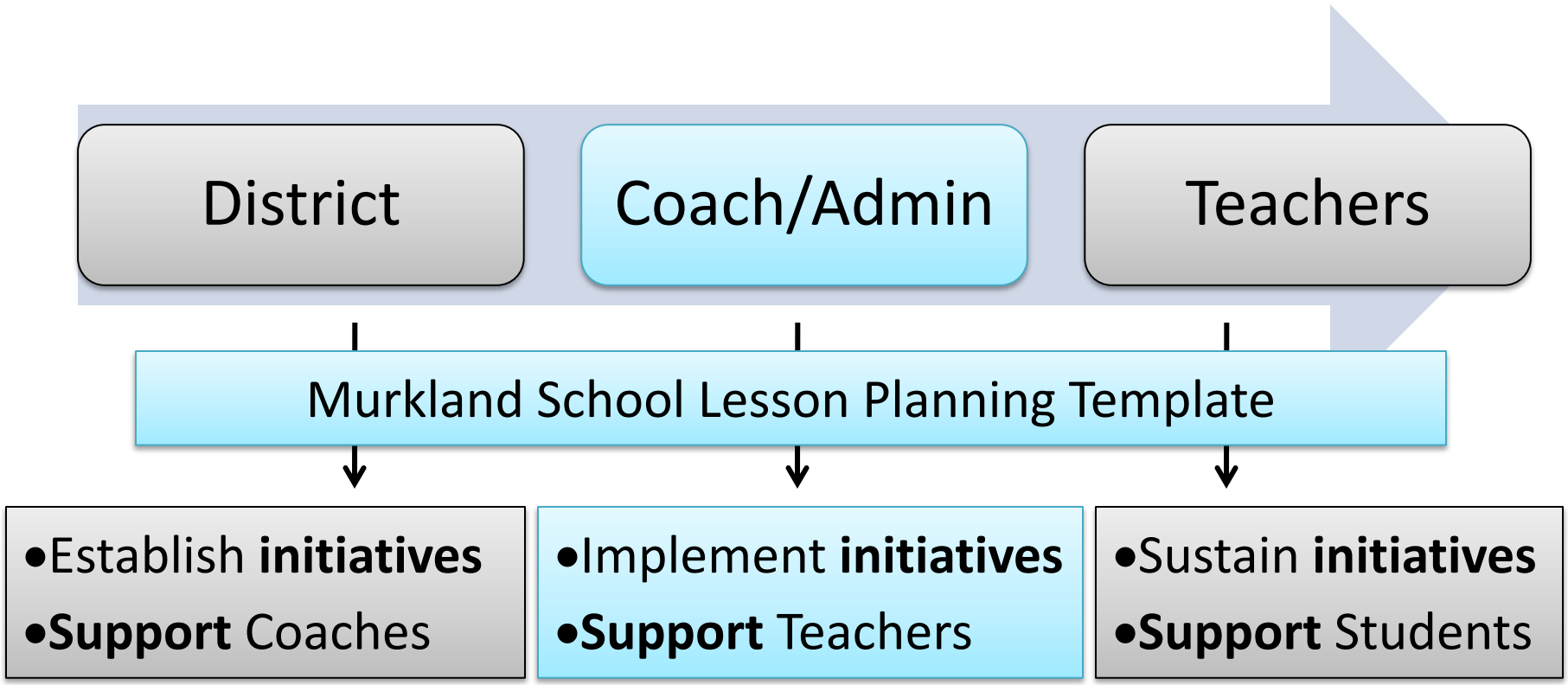
- Content Knowledge
- Pedagogical Content Knowledge
- Accountable Talk



"We are what we repeatedly do.
Excellence, then, is not an act but habit."

– Aristotle

Lowell Public Schools Throughline



Murkland Mathematics
Lesson Planning Template: Page 1

MA Standards	Objectives	Connections to Prior Knowledge
Lesson Overview: Launch, Explore, Summary	**Assessment Evidence of Learning**	**Vocabulary Tier 1 Tier 2 Tier 3**

Murkland Mathematics
Lesson Planning Template: Page 2

Continuum of Student Strategies (Concrete to Abstract)	**Questions for Promoting Rich Explanations and Higher Order Thinking**	**Differentiation - Sheltered English, Special Education, Learning Styles - Grouping**
Explicit Connections to be Made between Strategies	**Common Misconceptions and Strategies to Remedy**	**Student Talk Opportunities**

Results from Unpacking Standards

Big Idea # 5: Some real world problems **involving joining, separating, part-part-whole, or comparison** can be solved using addition and others can be solved using subtraction.
Big Idea #10: Letters are used in mathematics to represent generalized properties, **unknowns in equations**, and relationships between quantities.

Grade 1 Essential Questions

- Is this problem **joining, separating, or comparing**? How do you know?
- What is missing from the problem? How do you know?
- **Write an equation showing what is missing**. Convince me that this equation represents the problem. How will you solve for that variable?

Grade 3 Essential Questions

- Is this problem **joining, separating, or comparison**? How do you know?
- What is the role of a letter in an equation**? What is the role of a letter in this equation?** How will you solve for that letter?

Related Content Standards PreK-4

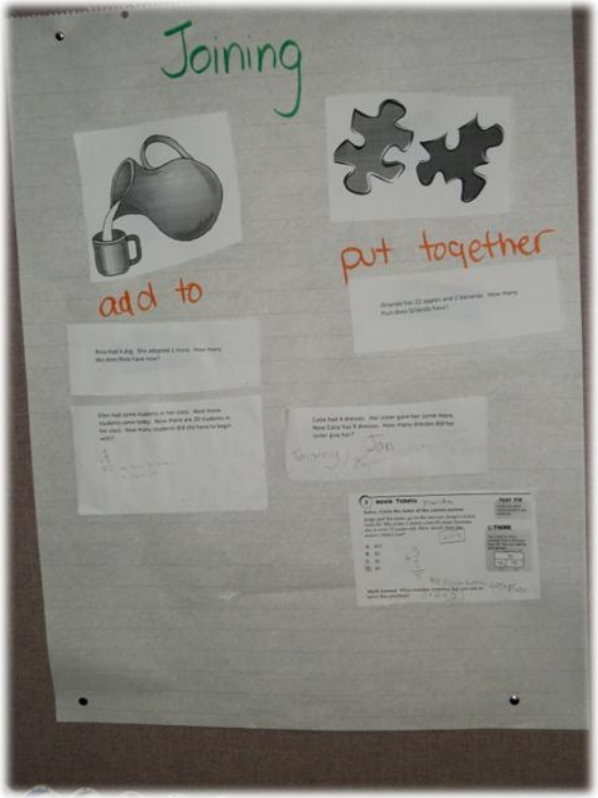
PreK	K	1	2	3	4
PK.OA.MA.1 **Use concrete objects** to **model real-world addition (putting together)** and **subtraction (taking away) problems up through five.**	**K.OA** **Understand** addition as **putting together** and **adding to**, and understand subtraction as **taking apart** and **taking from**. **K.OA.2** **Solve** addition and subtraction **word problems**, and add and subtract **within 10**, e.g., by using objects or **drawings** to represent the problem.	**1.OA.1** Use addition and subtraction **within 20** to solve word problems involving situations of adding to, taking from, putting together, taking apart, and **comparing**, with **unknowns in all positions**, e.g., by using objects, drawings, and **equations with a symbol for the unknown number** to represent the problem. **1.OA.2** Solve word problems that call for **addition of three whole numbers whose sum is less than or equal to 20**, e.g., by using objects, drawings, and equations with a symbol for the unknown number to represent the problem.	**2.OA.1** Use addition and subtraction **within 100** to solve one- and **two-step word problems** involving situations of adding to, taking from, putting together, taking apart, and comparing, with unknowns in all positions, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem.	**3.OA.3** Use **multiplication and division within 100** to solve word problems in situations involving **equal groups, arrays, and measurement quantities**, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem. **3.OA.8** Solve two-step word problems using the **four operations**. Represent these problems using equations with a **letter standing for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies, including rounding.**	**4.OA.2** Multiply or divide to solve word problems involving **multiplicative comparison**, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem, **distinguishing multiplicative comparison from additive comparison**. **4.OA.3.** Solve **multi-step word problems** posed with whole numbers and having whole-number answers using the four operations, including problems in which **remainders must be interpreted**. Represent these problems using equations with a letter standing for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies including rounding.

Our Approach to Solving Situational Problems

Common Lesson Structure

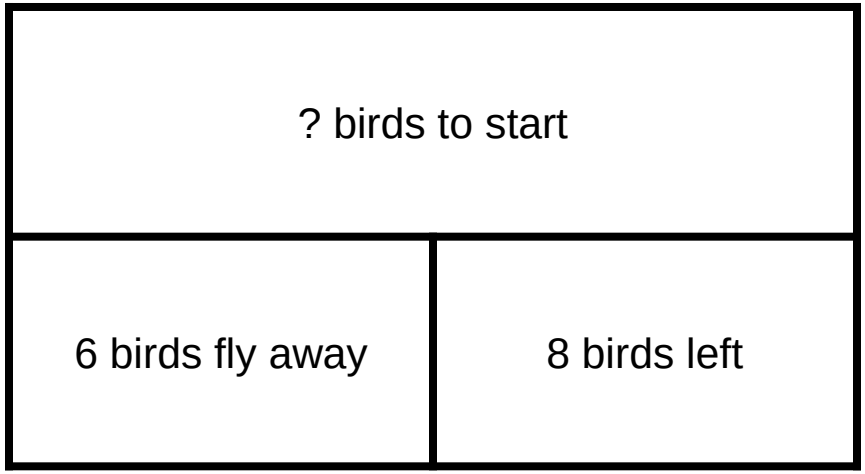
1. Read the problem. Stop and think!
2. Visualize the problem.
3. Decide what type of problem the story is.
4. Use the part-part-whole organize to decide what is missing.
5. Write equations with a variable.
6. Solve for the variable.
7. Write an answer statement.

Problem Structure Anchor Charts

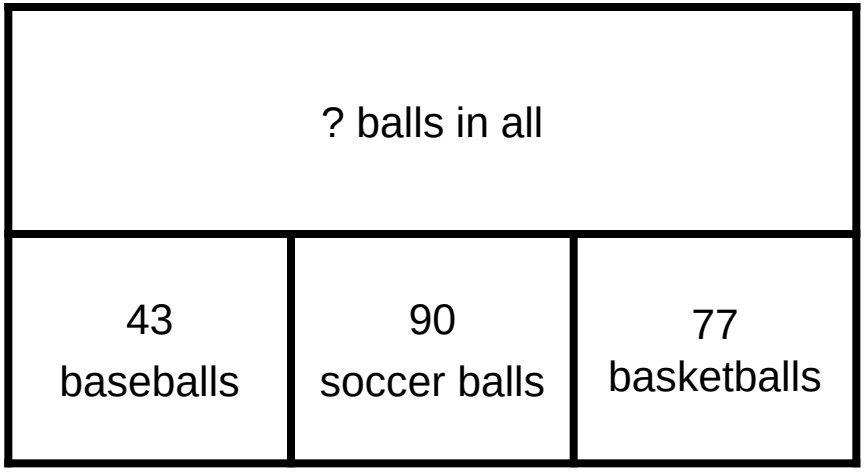


The Part-Part-Whole Organizer

Sam sees some birds sitting on a wire. Then 6 birds fly away. There are 8 birds left on the wire. How many birds were on the wire to start?



Donna was cleaning her closet. She found 43 baseballs, 90 soccer balls, and 77 basketballs. How many balls did she find?



While watching the video look for students who…

- 1 – Make sense of problems and persevere in solving them
- 2 – Reason abstractly and quantitatively
- 3 – Model with Mathematics
- 7 – Look for and Make Use of Structure

The Standards for Mathematical Practice

1 Make sense of problems and persevere in solving them	2 Reason abstractly and quantitatively	3 Model with Mathematics	4
5	6	7 Look for and Make Use of Structure	8

Student Misconception

Martha has 36 bags of apples. There are 12 apples in each bag. How many apples does Martha have altogether?

A	
36	12

While watching the video look for…

- 3 – Construct viable arguments and critique the reasoning of others
- 6 – Attend to precision

The Standards for Mathematical Practice

1	2	**3** Construct viable arguments and critique the reasoning of others	4
5	**6** Attend to precision	7	8

Next Steps

- Unpack Mathematical Practice Standards
- Provide explicit PD on effective implementation of the practices
- Develop vertical continuums to support/make implementation manageable
- Work with teachers to make connections from our Lesson Planning Template to the practices
- Continue to empower our experienced teachers to be teacher leaders

Take Aways

- Effective implementation requires deep content knowledge and pedagogical content knowledge
- Staff needs time and support to build habits that support the Standards for Mathematical Practice
- ***An experienced teacher instructs well at a fast because they can analyze a given situation and immediately respond with the "best move"***
- ***Student output is the essential indicator of successful implementation***