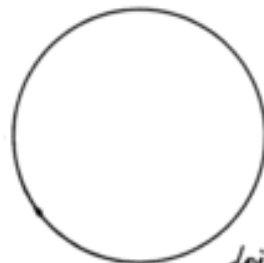# All–City Tutors: Helping Middle School Students Make Sense of Math

Jim Meyer
Curriculum Specialist
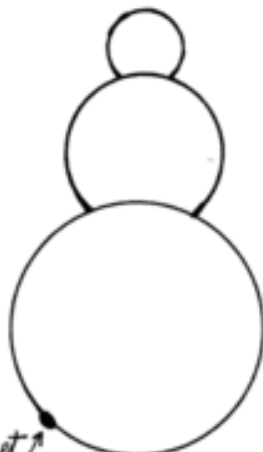**Seattle Public Schools**
kjmeyer@seattleschools.org

Goals:

◈ **How middle school students are experiencing instruction.**

◈ **Representations to model and make sense of problems.**

◈ **Support students' sense-making and growth mindset through questioning.**
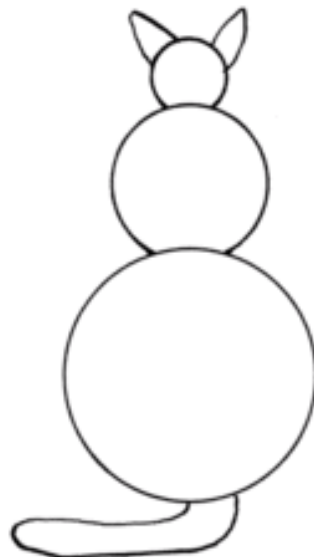
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How to draw a Qat
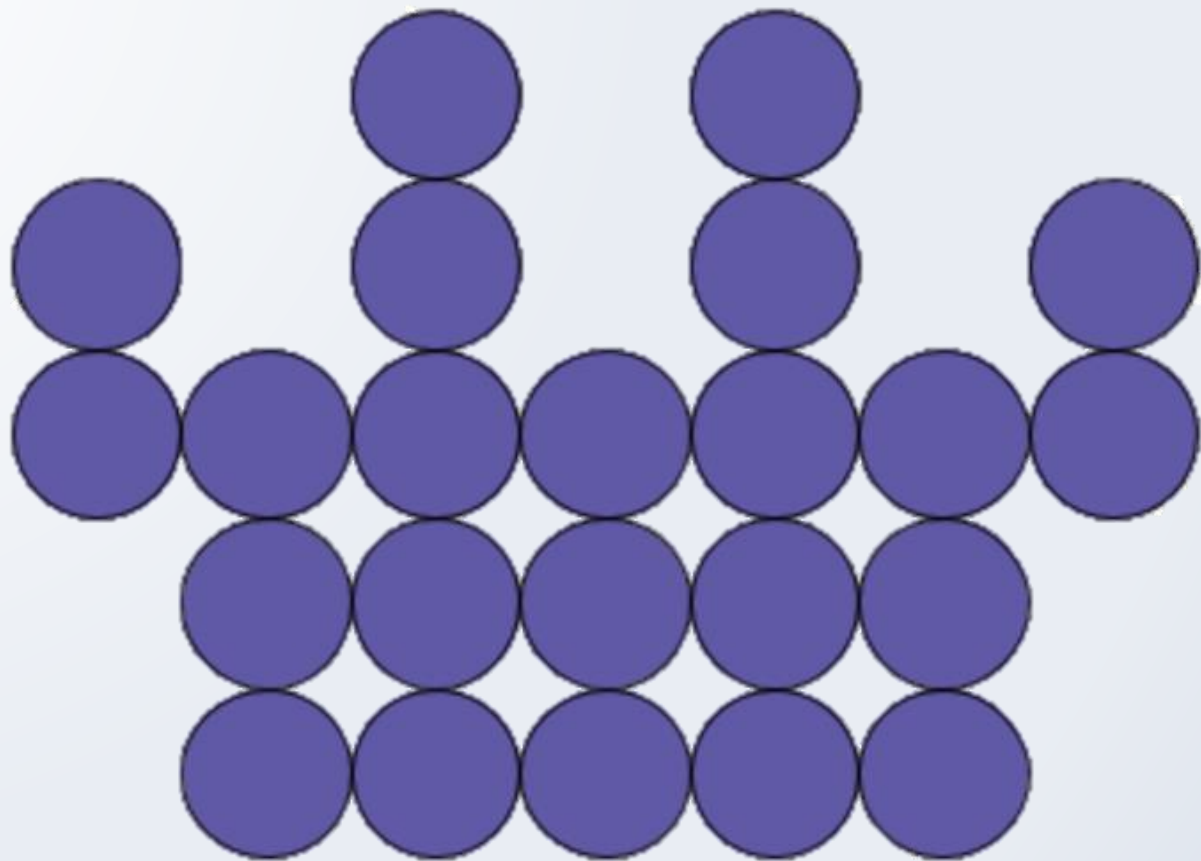
1. DRAW CIRCLE
2. DRAW TWO MORE CIRCLES
3. ADD EARS AND TAIL
4. TURN DRAWING AROUND AND THERE'S YOUR QAT!

don't forget the sloppy parts!!!

B Kliban ®

	Instructional Event	Suggested # of days*	Target Instructional Window
Semester 1	**Topic 1: Integers and Rational Numbers**	25	September 4 – October 16 (30 days)
	Topic 2: Analyze and Use Proportional Relationships	17	October 17 – November 13 (19 days)
	SPS Interim Window 1	1	October 21 – November 22
	Topic 3: Analyze and Solve Percent Problems	17	November 14 – December 11 (18 days)
	Topic 4: Generate Equivalent Expressions	21	December 12 – January 28 (23 days)
Semester 2	**SPS Interim Window 2**	1	February 3 – March 13
	Topic 5: Solve Problems Using Equations and Inequalities	19	January 30 – March 4 (20 days)
	Topic 8: Solving Problems Involving Geometry	23	March 5 – April 6 (23 days)
	SPS Interim Window 3 [Optional]	1	April 6 – June 12
	Topic 6: Use Sampling to Draw Inferences About Populations	13	April 7 – May 1 (14 days)
	Topic 7: Probability	19	May 4 – June 3 (22 days)
	Total number of days	154	169

2019 – 20 SPS Math 6 Scope and Sequence Year at a Glance

	Instructional Event	Suggested # of days*	Target Instructional Window
Semester 1	Topic 1: Use Positive Rational Numbers	19	September 4 – October 4 (23 days)
	Topic 2: Integers and Rational Numbers	17	October 7 – November 1 (19 days)
	SPS Interim Window 1	1	October 21 – November 22
	Topic 3: Numeric and Algebraic Exp...		
	Topic 4: Represent and Solve Equati...		
Semester 2	SPS Interim Window 2		
	Topic 5: Understand and Use Ratio...		
	Topic 8: Display, Describe, and Sum...		
	SPS Interim Window 3 [...		
	Topic 6: Understand and Use Percent...		
	Topic 7: Solve Area, Surface Area, a...		
	Total number of days		

	Instructional Event	Suggested # of days*	Target Instructional Window
Semester 1	Topic 1: Integers and Rational Numbers	25	September 4 – October 16 (30 days)
	Topic 2: Analyze and Use Proportional Relationships	17	October 17 – November 13 (19 days)
	SPS Interim Window 1		
	Topic 3: Analyze and Solve Percent Problems		
	Topic 4: Generate Equivalent Expressions		
Semester 2	SPS Interim Window 2		
	Topic 5: Solve Problems Using Equations and...		
	Topic 8: Solving Problems Involving Geometry		
	SPS Interim Window 3 [Optional]		
	Topic 6: Use Sampling to Draw Inferences About Populations		
	Topic 7: Probability		
	Total number of days		

2019-20 SPS Math 8 Scope and Sequence Year at a Glance

	Instructional Event	Suggested # of days*	Target instructional window
Semester 1	Topic 1: Real Numbers	25	September 4 – October 16 (30 days)
	Topic 2: Analyze and Solve Linear Equations	23	October 17 – November 20 (24 days)
	SPS Interim Window 1	1	October 21 – November 22
	Topic 3: Use Functions to Model Relationships	17	November 21 – December 20 (20 days)
	Topic 4: Investigate Bivariate Data	15	January 6 – January 31 (18 days)
	SPS Interim Window 2	1	February 3 – March 13
Semester 2	Topic 5: Analyze and Solve Systems of Linear Equations	13	February 3 – February 28 (15 days)
	Topic 7: Understand and Apply the Pythagorean Theorem	13	March 2 – March 18 (13 days)
	Topic 8: Solve Problems Involving Surface Area and Volume	13	March 19 – April 6 (15 days)
	SPS Interim Window 3	1	March 25 – June 14
	Topic 6: Congruence and Similarity	25	April 7 – May 18 (25 days)
	Total number of days	150	158 days

What are the BIG ideas in middle school math?

1) Ratios and proportional reasoning
2) Operations on rational numbers
3) Solving equations

How do we support students in these areas?

Lesson structure in middle school math?
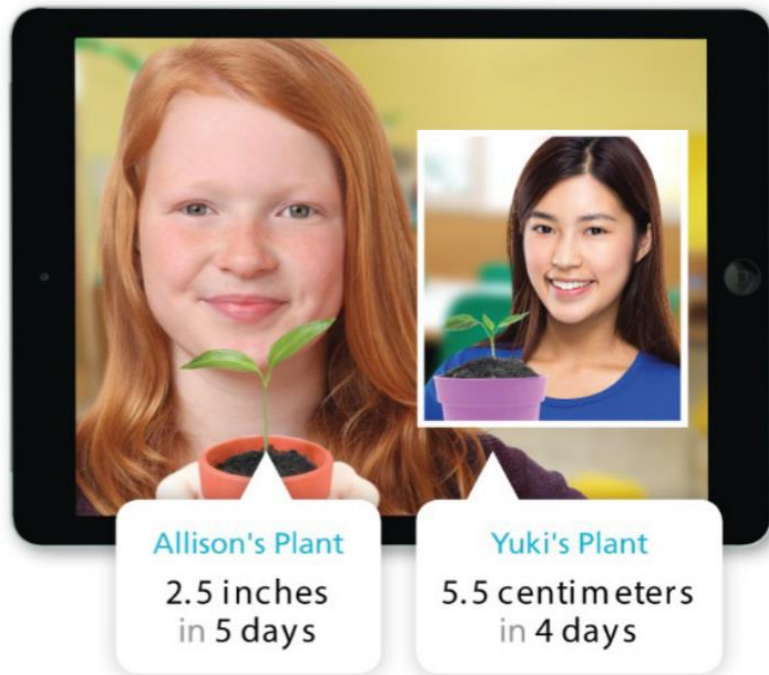
enVision 2.0

Lessons follow a common structure

You can refer to this student experience to support students.

"Solve and Discuss It"
(or "Explore It" or "Explain It")
- Open ended
- Multiple strategies can be used
- May not be solved
- May have multiple right answers

Solve & Discuss It!

Allison and her classmates planted bean seeds at the same time as Yuki and her classmates in Tokyo did. Allison is video-chatting with Yuki about their class seedlings. Assume that both plants will continue to grow at the same rate. Who should expect to have the taller plant at the end of the school year?

Allison's Plant
2.5 inches
in 5 days

Yuki's Plant
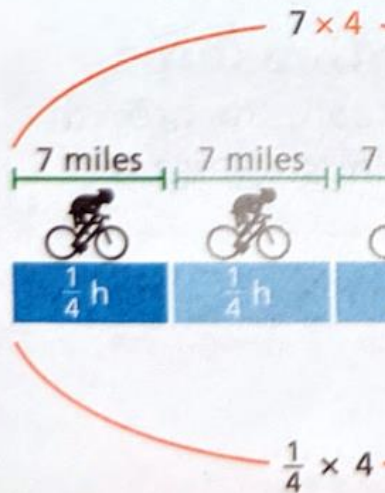5.5 centimeters
in 4 days

Example 1

- Teacher removes the scaffolds from the problem to promote multiple strategies being used by students.

- Typically, there is only one right answer

EXAMPLE 1 👁 **Find a Unit Rate Involving Unit Fractions**

Sergio is training for a triathlon. His target speed is 25 miles per hour. Did he achieve his target speed for the first 7 miles of his ride?

7 miles

You know that 15 minutes is e Make a table of equivalent ratios to find the
Draw a diagram to show how unit rate.
bikes is related to the time he

7 × 4

Miles	7	28
Hour	$\frac{1}{4}$	1

×4

×4

7 miles 7 miles 7

$\frac{1}{4}$ h $\frac{1}{4}$ h

$\frac{1}{4}$ × 4

Sergio bikes $\frac{28 \text{ miles}}{1 \text{ hour}}$, or 28 miles per hour, so he has achieved, and exceeded, his target speed.

2

Example 2

- Typically, less open ended than Example 1
- Typically builds on Example 1, extending the ideas or going deeper
- Has one right answer
- Students begin to move toward more efficient strategies for getting right answers

EXAMPLE 2

Find and Apply a Unit Rate Involving Fractions

ACTIVITY   ASSESS

Bronwyn mows the lawn every other weekend. She can mow 12,000 ft² in $\frac{2}{3}$ hour. The lawn is 36,000 ft².

How long does it take her to mow the entire lawn?

Look for Relationships How do the operations used in the table relate to the operations used in the equations at the left? © MP.7

$$\frac{12,000}{\frac{2}{3}} = \frac{12,000 \times \frac{3}{2}}{\frac{2}{3} \times \frac{3}{2}} = \frac{18,000 \text{ ft}^2}{1 \text{ h}}$$

$$\frac{18,000 \times 2}{1 \times 2} = \frac{36,000}{2}$$

Multiply each term by 2 for the area of the entire lawn.

| | $\times\frac{3}{2}$ | $\times 2$ |
| | | |

Area (ft²)	12,000	18,000	36,000
Time (h)	$\frac{2}{3}$	$\frac{6}{6}$ or 1	2

$\times\frac{3}{2}$ $\times 2$

Bronwyn mows at a rate of 18,000 ft² per hour. It takes her 2 hours to mow the entire lawn.

Example 3

- Students apply efficient strategies to obtain the right answer

EXAMPLE 3

Solve Problems Using Unit Rates

Omar knows that his friend Chris lives $\frac{3}{5}$ mile away. How far is the school from his house?

$$\div \frac{3}{4}$$

$$\frac{\frac{3}{5} \text{ mi}}{\frac{3}{4} \text{ in.}} = \frac{\frac{3}{5} \times \frac{4}{3}}{\frac{3}{4} \times \frac{4}{3}} = \frac{\frac{4}{5} \text{ mi}}{1 \text{ in.}}$$

$$\div \frac{3}{4}$$

Divide both terms by $\frac{3}{4}$ to find the unit rate.

$$\frac{\frac{4}{5} \text{ mi} \times 2}{1 \text{ in.} \times 2} = \frac{\frac{8}{5} \text{ mi}}{2 \text{ in.}} = \frac{1\frac{3}{5} \text{ mi}}{2 \text{ in.}}$$

Multiply both terms of the unit rate by 2 to find an equivalent rate.

Omar's school is $1\frac{3}{5}$ miles from his house.
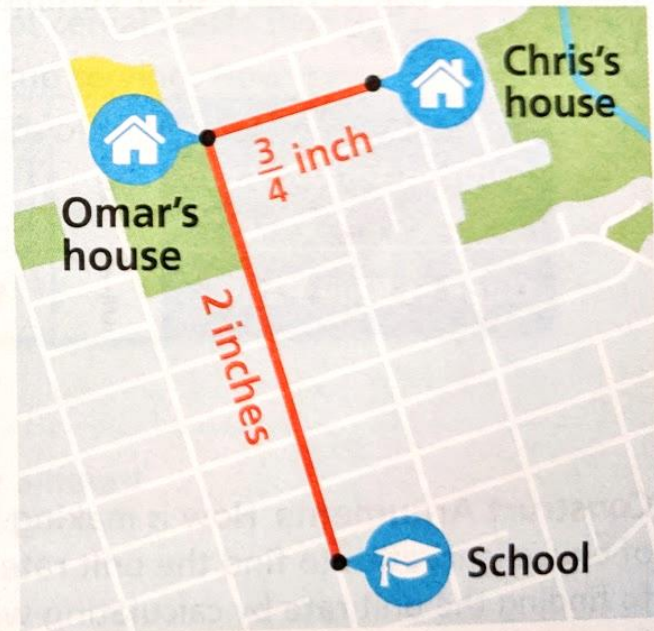
People value what makes sense.

Our number 1 standard of Math Practice is: Make sense of problems and preserver in solving them.

Mario's family put $120 dollars in a bank account when they were born. 13 years later Mario has learned that the account has been earning interest.
It is now worth 135% of the original value.

How much money is in the account now?

Make Sense of a Problem and Persevere in solving them. (SMP 1)

Read three times.

- What is the problem about ? What is happening? Understand the story and context

- Read again looking for just the question – what is the purpose of our problem solving.

- Read a third time looking for mathematically relevant information.

Identify Quantities and Relationships (SMP 2)

Sara has 7 cookies

Catherine has 7 fewer cookies than Sara

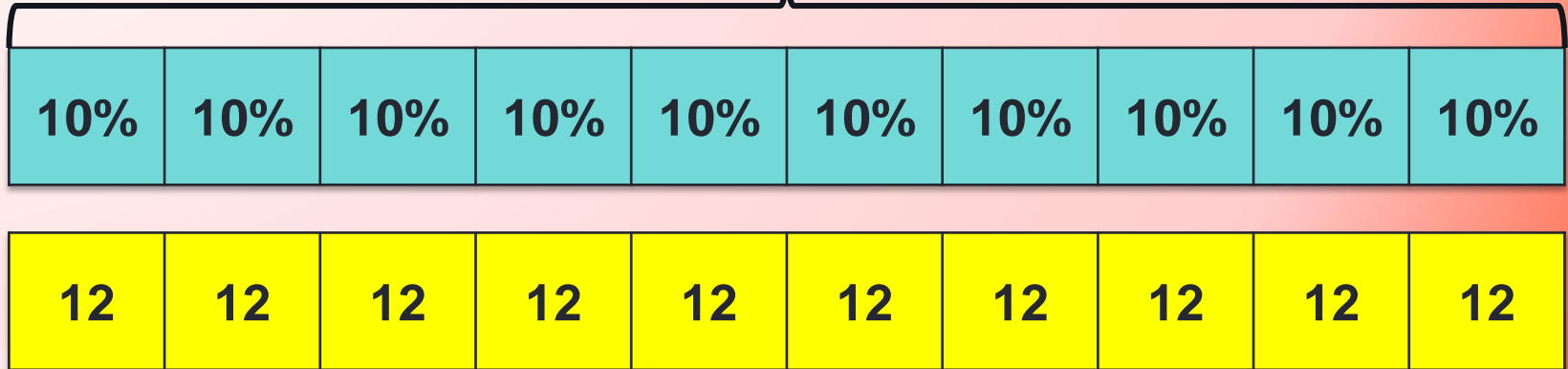Jeff ran $\frac{1}{2}$ mile.

Jim ran $\frac{1}{2}$ as far as Jeff.

Understand the Structure of a problem (SMP 7)

Have I seen a problem that acts like this before... What is happening in this problem.

Understand the Structure of a problem

$120

| 10% | 10% | 10% | 10% | 10% | 10% | 10% | 10% | 10% | 10% |

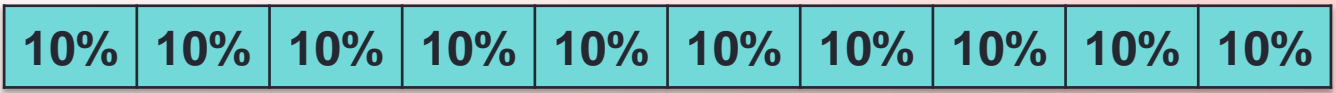| 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |

Look for regularity and repeated reasoning (SMP 8)
Think about what you are doing over and over to establish procedure

Look for repeated reasoning

$120

| 10% | 10% | 10% | 10% | 10% | 10% | 10% | 10% | 10% | 10% |

| 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | ? |

100%

10% 10% 10% 5%

Look for regularity and repeated reasoning (SMP 8)

Think about what you are doing over and over to establish procedure
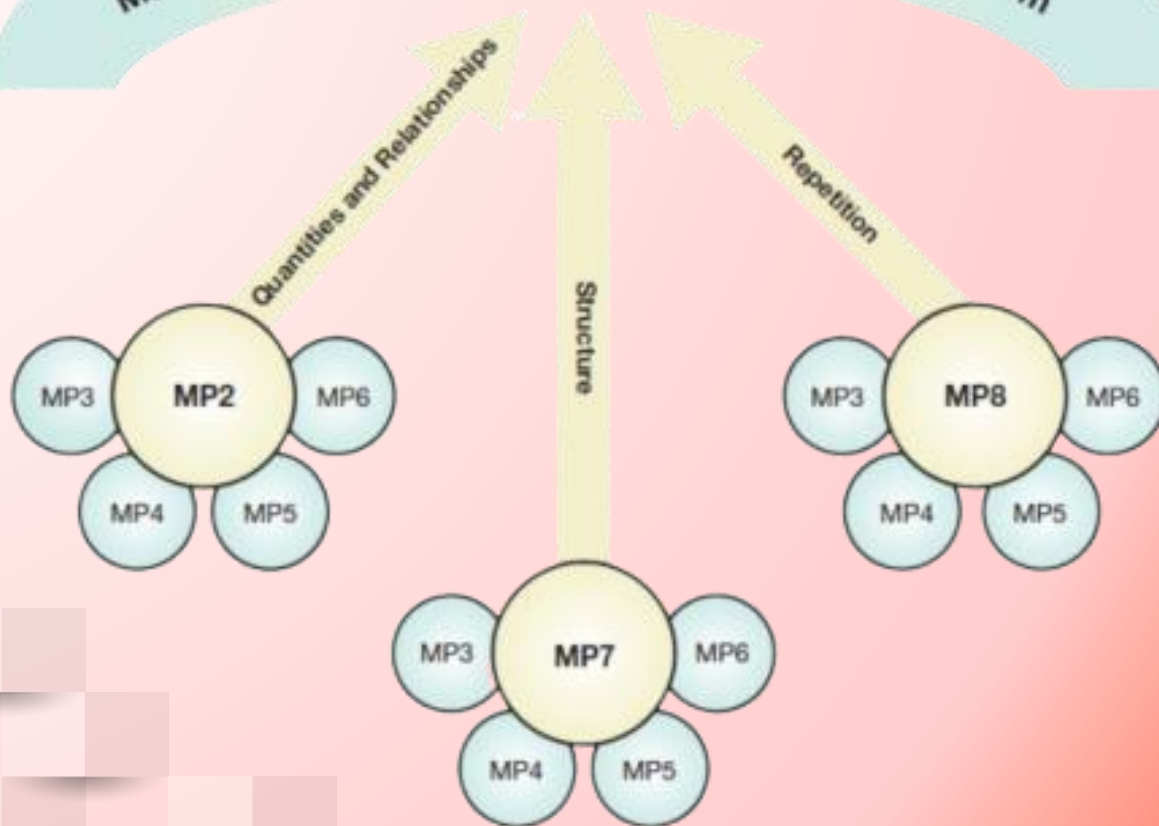
$$2+2+2+2+2 = 10$$

$$\frac{3}{8} + \frac{2}{4} = ?$$

$$\frac{3}{8} = \frac{1}{8} + \frac{1}{8} + \frac{1}{8}$$

$$\frac{1}{8} + \frac{1}{8} + \frac{1}{8} = \frac{3}{24}$$

2 x 5 =

What are the BIG ideas in middle school math?

1) Ratios and proportional reasoning
2) Operations on rational numbers
3) Solving equations

Can be supported by bar models a and double number lines.

Percent on the double number line

Manuel found a wrecked Trans-Am that he could fix. He bought the car for 65% of the original price of $7200. What did he pay for the car?

Solving an equation using a number line

$$13 - 2x = x + 1$$

Growth Mindset and Identity

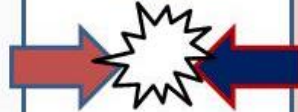How can we help young people see themselves as capable mathematicians?

Take one minutes to write down what you know or have heard about the idea of "growth mindset."

Fostering a Growth Mindset

Fixed Mindset
intelligence is static
- **Challenges** ... avoid
- **Obstacles** ... give up
- **Effort** ... no point
- **Criticism** ... deflect
- **Success of others** ... feel threatened

Growth Mindset
intelligence is developing
- **Challenges**... embraces
- **Obstacles** ... fortitude
- **Effort** ... work hard
- **Criticism** ... learns
- **Success of others** ... celebrates

Growth Mindset for Mentors

60 minute online module

www.mindsetkit.org

Changing Mindset:
## Questions & Feedback

- ❑ **Questions support students in sense-making**
- ❑ **Feedback prompts to support students when they**
  - ❑ **Struggle**
  - ❑ **Are making progress**
  - ❑ **Succeed**

Using Growth Mindset Language and Fostering Math Practices

You and a partner will work on a math problem. One partner plays the student, and the other plays the tutor.

Use the last three pages to determine the situation and develop a response

Students have not yet developed a growth mindset, so the tutor will help the student reframe things in growth mindset language. Use your handouts to help you!
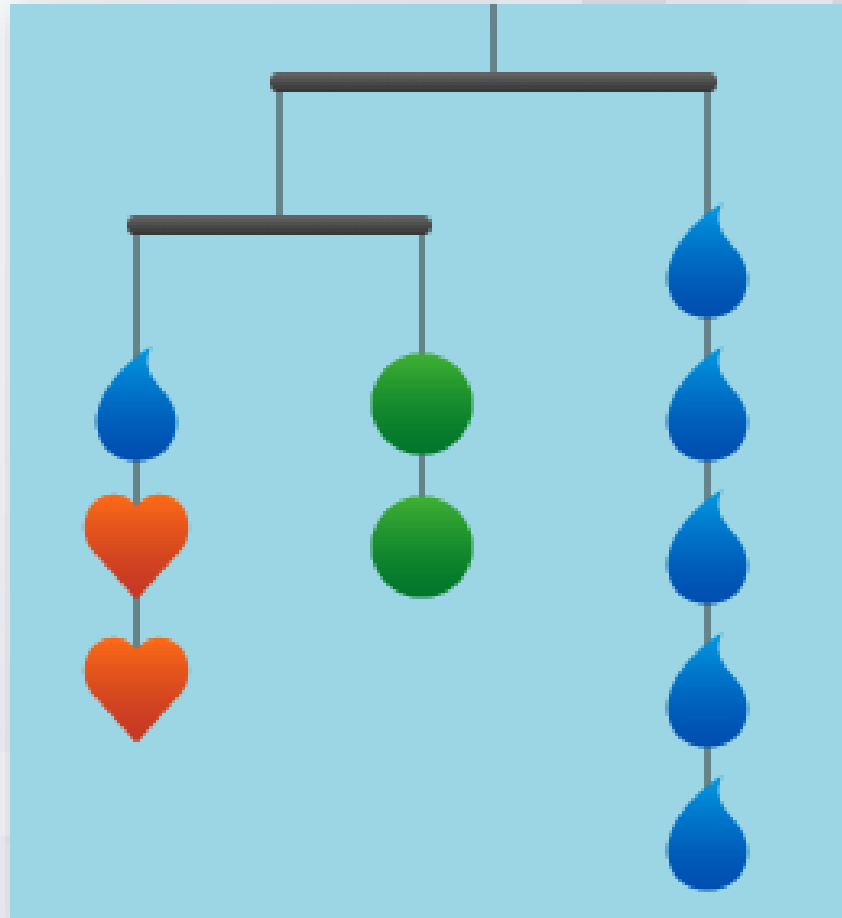
Questions?

Thank you for coming!

Jim Meyer

Math Curriculum Specialist

kjmeyer@seattleschools.org