

Queens Elementary Module 3 WORKSHOP

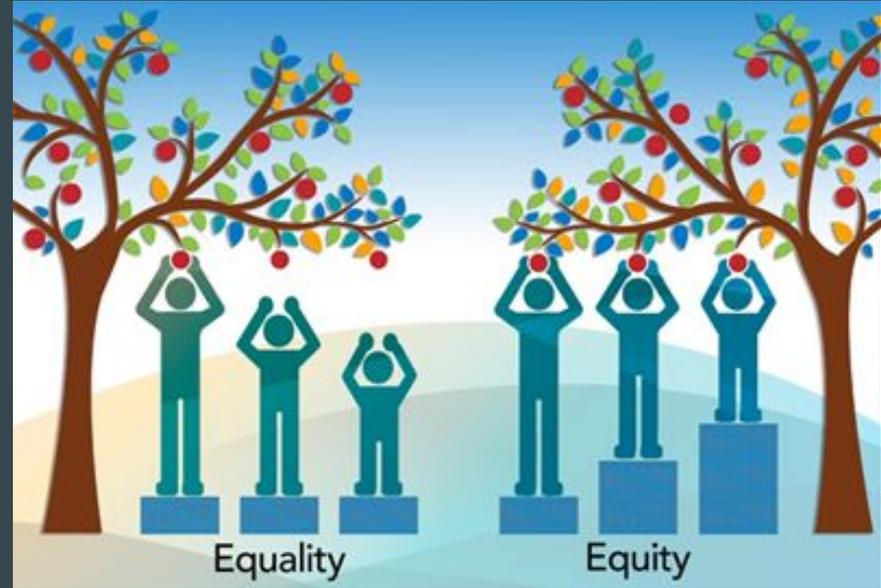


SUPPORTING MATH LEARNERS

Equity of Mathematics

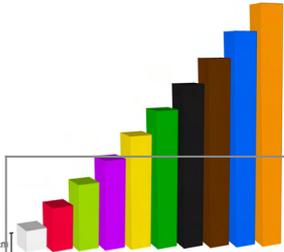
How to define Equity:

Equity is a difficult term to define! It is typically defined in contrast to equality, which means everyone receiving the same opportunity. Equity instead is dependent on each student's needs. Some students need more support, additional strategies or structures, or tools such as manipulatives or technology.



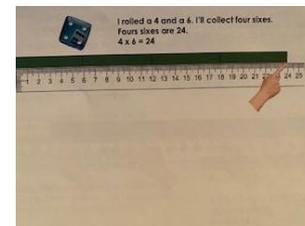
Everyone is provided the support they need!

Let's Play with Cuisenaire Rods



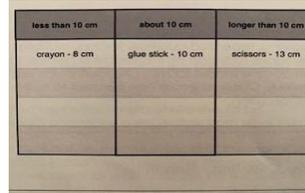
Multiplication

Activity: Roll and Multiply
Students roll a double die. The outside number tells how many rods to collect. The inside number says the length of each rods. Make a train with the rods and then record the multiplication equation. Check answer using a ruler.



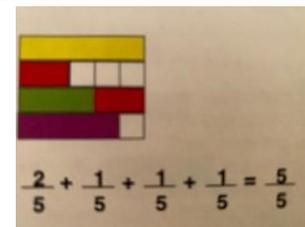
Measurement

Activity: Find Something (connecting non-standard to standard units)
Have students use their Cuisenaire rods as a measuring tool. Give each child an orange rod (10 cm). What can you find that is about the same length as an orange rod?



Fractional Thinking

Activity: Fractions of a Whole: How many ways?
Ask students: How many ways can you make a yellow? Tell students for this game, the yellow is the whole, or 1. If yellow is 1, what's the fractional name for a white? (1/5). Continue naming the other parts.



Source: Fullerton, C. (2015). *Remarkable Cuisenaire Rods: Mathematical Tasks for Primary Classrooms*. Mindfull Consulting.

Miller, M. (2011). *Playing with Cuisenaire Rods* | *Unschooling Conversations*. Unschooling Conversations.
<http://marcialmiller.com/wordpress/2011/01/playing-with-cuisenaire-rods/>

How to promote equity in the classroom

National council of teachers of Mathematics makes the following suggestions:

- Allow adequate time for students to learn
- Implement differentiated processes that broaden students' productive engagement
- Make strategic use of human and material resources
- Ensure that ALL students have access to high-quality instruction, challenging curriculum, innovative technology, and exciting extracurricular offerings



Picture Credit:
<https://nearpod.com/blog/creating-equitable-classrooms/>

Engaging Thinking Tasks

- Hook them in:
 - Start with a great question, visual or something they can't resist
 - Connect it to their world (relevance)
 - Choose tasks that are accessible (low floor, high ceiling, open middle)
 - Natural curiosity leads to extension of learning
- Keep them engaged:
 - Give them time to struggle
 - Encourage working together
 - Don't give the answer
- Try a 3 Act Task...

What do you notice?



Notice:

- 30 cubes of sugar in the small one
- small one is full but big has a gap
- white wall behind
- A+W RB looks off brand
- caps = different (big = white, small = brown)
- one looks glass, one plastic
- 2 bottles of Root Beer; right is bigger
- sticker on big bottle = higher
- small bottle sugar looks to be $\sim \frac{1}{3}$ to match high of big bottle
- big bottle is much thicker (wider)



Some of the things my class noticed and wondered

We chose the questions we wanted to solve from this list

What do you wonder?



Wonder:

- How many sugar cubes is in the big bottle?
- How big is the small one compared to the big one?
- Would the volume of the sugar fill the empty space @ top of big bottle?
- Why do they use so much sugar? What does it do to the taste?
- What is the width comparison (ratio) between the bottles?
- Did they use the same amount of sugar per amount of RB in the big bottle?
- Does the off brand make you burp?
- What is the sugar cube stack representing? How tall? How much in the drink?
- What does the A + W stand for?
- What happens if you put the sugar cubes in the big bottle?
- How many atoms in the big bottle?

How could we find solutions for some of our questions?

Alya Beacom

Use Play to bring joy

- “Play isn’t a Luxury. It’s a necessity.” (Maraz, Porcelli & Tyler 2016)
- “Almost all creativity involves purposeful play,” - Maslow
- “What books are to reading, play is to mathematics.” Daniel Finkel
- Math class needs to be positive and joyful.
- Incorporate games and play for students of all ages
- Provide a variety of play choices
 - Independent games
 - Partner games
 - Large group games
 - Active games

Amanda Younger

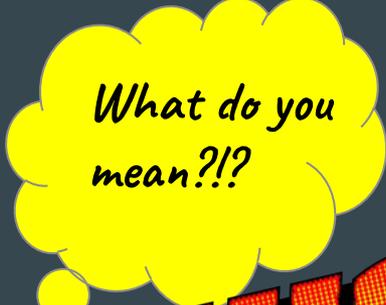
Building the Joy with Choice and Wonder

- Challenge by choice
 - Offer three levels of an activity
 - Let students choose which activity to complete that day
 - Students can change activity level on a daily or weekly basis
- Give opportunities for wonder
 - Ask questions that encourage students to think deeply
 - Use rich tasks
 - Have students create the questions

Vocabulary in Mathematics

“Mathematical language is crucial to children’s development of thinking. If children don’t have the vocabulary to talk about [mathematics], they cannot make progress in understanding mathematics.” (Mathematical Vocabulary Book)

- Mathematical vocabulary should be offered to students using a structured and context relevant approach.
- Use relevant objects, pictures and diagrams to root understanding within real world and classroom contexts.
- Draw attention to new words or symbols.
- Use vocabulary words and symbols often and encourage students to use them in conversation as well.
- Offer easy access references: word walls, student math dictionaries, etc.



What do you mean?!?



HUH?



*Factorise?
Tally who?*

Let's talk math...



Offer opportunities for authentic oral, reading and writing practice.

- Mathematical discussion, reading and writing activities that include (but are not limited to) problem solving, hypothesise, predictions and justifications.
- Adapt where needed for ELL and students facing learning challenges.

Consider your questions.

- It is important to ask a question in different ways.
- Use the full range of questioning, allowing students to give more complex answers and explain their thinking.

Range of questions: recalling facts, applying facts, hypothesising/predicting, comparing procedures, interpreting results, & applying reasoning.

- “Open questions” give more opportunities for students to engage in higher mathematical thinking and discussion.
- Use questions to extend students’ thinking.

Targeting questions can: help students get started; check in with their progress; help those who get stuck.

Move to your Math

Adding kinesthetics to your Math lessons.



How does motion help our students learn Math?

- Researchers in Denmark found that when a child uses their whole body while learning, they improve at Math.

Ideas include:

- Bending bodies into number shapes
- whole class actively showing addition, subtraction, multiplication, division, fractions by...**USING THEIR BODIES**
- exercise breaks that include Math (ex: Do 4X3 jumping jacks)

For more great ideas check out :

<https://mathandmovement.com/>

Engaging Students in Mathematics in an Elementary Classroom

BUILD A "THINKING CLASSROOM"

- Using the research and techniques from B.C.'s own Peter Liljedahl , start with non-curricular focused "Rich Tasks" that start with a question for students to solve. As confidence builds, begin to move into a balance of non-curricular and curricular tasks

USE VISIBLE MIXED GROUPINGS

- Avoid building groups based on skill-level. Use visible mixed groupings- the students are shown that the groups are random, so that they have the opportunity to work with a variety of skill sets.

TRY VERTICAL, NON-PERMANENT SURFACES:

- Give students the opportunity to work on vertical surfaces that are non-permanent. Studies have shown that many students find vertical surfaces as more natural, and easier to use. Non-permanent surfaces can help students who are "At Risk" for success in mathematics. These surfaces give space for students to make errors, and try again.

ENSURE UNIVERSAL SUPPORTS FOR ALL LEARNERS

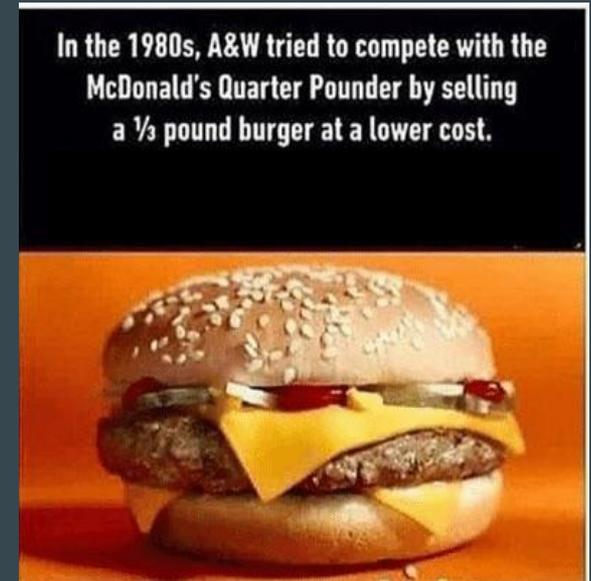
- Ensure that lessons are culturally inclusive, and that barriers are removed from students showing their learning. Ensure that students have the practice time to navigate through and develop tools for district assessments. Incorporate feedback from students so they can hold ownership over their learning.

Dan Finkel's Principle #1: Start with a question

Instead of explaining a math concept for students to memorize, start the lesson by posing a math question that will engage our learners.

For example: Display this image and read it to the class. Tell the students that this A&W burger failed and ask why they think it failed.

This can be a question asked at the beginning of a fractions unit. Get students to ponder the question and explore why they think this burger did not succeed. Allow students time to problem solve and struggle with the question so they can tap into critical thinking!



- When students are faced with challenging and difficult questions they learn to persevere!
- The longer the student spend more time on a something are struggling with the more they engage in it allowing more thinking to take place.
- Result → Students eventually develop the ability and confidence to take a risk!



Dan Finkel's Principle #3: You Are Not The Answer Key!!!

As teachers, we want our students to succeed. How better to reach that by giving them the answer to the problem...

WRONG

Have the students show you how they came to their result - chances are they will be able to tell you whether they are correct. The more students are allowed to sit with a problem, the more likely they will truly understand it when they reach that solution!

Furthermore, teachers are also allowed to not know the answer. Organically work with your students to come to that solution!

Play is Key to Math

One of the key principles that bring thinking to math is PLAY!

- Allow students to play with numbers and theories of numbers
- This will allow students to take ownership over their work
- It will provide them with time and space to be creative
- Students will be able to explore what is possible

Play starts at home.

- Math language and game play at home introduces (pre-school) and reinforces (during school years) concepts taught at school
- Builds logical reasoning and communication
- Other, non-mathematical skills that are useful for math include
 - 1) Memory
 - 2) Inductive thinking
 - 3) Deductive thinking
 - 4) Spatial orientation/space organization
 - 5) Task Analysis

Play is Key to Math

Some example games that can be played at home and/or at school that involve math include:

- War
- Go Fish
- Games using dice
- Dominoes
- Battleship
- Checkers
- Bingo
- Snakes and Ladders
- Settlers of Catan
- <https://blog.mindresearch.org/blog/big-list-mathematical-board-games>

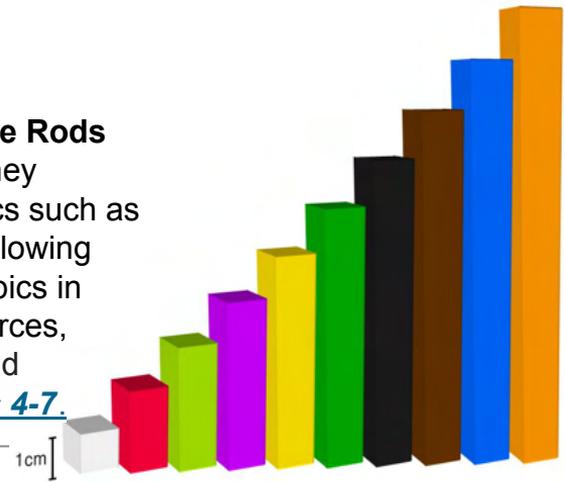
Invite Thinking into Your Classroom

- ★ START LESSONS WITH A LOW FLOOR, HIGH CEILING QUESTION TO PROMOTE THINKING.
- ★ ENCOURAGE EFFORT INSTEAD OF RESULTS.
- ★ GIVE STUDENTS A CHANCE TO EXPLAIN THEIR THINKING.
- ★ PROMOTE AUTONOMY BY DIRECTING STUDENTS TOWARDS THEIR PEERS FOR HELP OR EXTENSION.
- ★ LET LEARNERS KNOW THAT YOU ARE NOT THE ANSWER KEY
- ★ DEVELOP TENACITY AND PERSEVERANCE BY GIVING THEM TIME TO STRUGGLE.

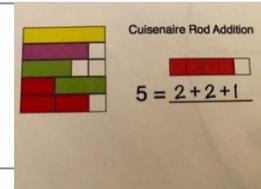
By saying yes to ideas, and encouraging investigation you bring adventure into your classroom.



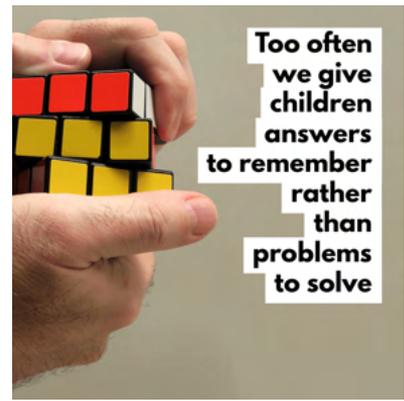
Cuisenaire rods are a great way to add play based activities and games. **Cuisenaire Rods** are rectangular **rods** of 10 colors, each color corresponding to a different length. They provide endless opportunities to introduce, investigate, and reinforce key math topics such as addition, subtraction, geometry, measurement, multiplication, and division. In the following chart you will find an example of how you can use Cuisenaire rods for 6 different topics in math. More ideas like this can be found in Carole Fullerton's Cuisenaire Rod resources, [*Remarkable Cuisenaire Rods: Mathematical Tasks for Primary Classrooms*](#) and [*Cuisenaire Rods Rock: Exploring Multiplication and Proportionality in Grades 4-7.*](#)



<p>Introducing primary students to the Rods</p>	<p>Activity: Play Based Explorations and Provocations</p> <p>Provide an image for students to explore and play with the rods. Students will begin to engage with the materials and start thinking about the relationships between them. Students will start to assign numbers to the colours.</p>
<p>Connecting Rods to Numbers (Subitizing)</p>	<p>Activity: Roll It, Find It</p> <p>Students roll a dice (6 sided to start and progress to 10 sided) and then find the corresponding rod in the pile. How do you know? After 10 rounds, students can make a design with their collected pieces.</p>
<p>Addition/ Subtraction</p>	<p>Activity: How Many Ways?, What's the Difference</p> <p>Ask: How many ways can you make the yellow rod? Make as many 'trains' as you can. Record equations.</p>



WHY IS CODING IMPORTANT FOR STUDENTS?



1. IMPROVES MATHEMATICAL THINKING (and IT'S FUN!)
2. IMPROVES PROBLEM SOLVING SKILLS
3. IMPROVES CRITICAL THINKING SKILLS
4. PROMOTES PERSEVERANCE
5. ENCOURAGES COLLABORATION
6. ENCOURAGES CREATIVITY
7. PROVIDES BETTER JOB OPPORTUNITIES
8. PREPARES STUDENTS FOR THE TECHNOLOGICAL WORLD

You don't even need a computer, coding can begin with a deck of cards! Try [An Hour of Code](#) activities or worksheets at school or home to get started!

WHY MATH GAMES?

**IMPROVES
MEMORY**

RELAXING

INCREASES VOCABULARY

INSPIRES

ONE TO ONE CORRESPONDENCE **IT'S NATURAL TO PLAY**

DEVELOPS STRATEGIC THINKING **PATTERN RECOGNITION**

MOTIVATES

ENCOURAGES CRITICAL THINKING SKILLS

Positive

**FOLLOWING
DIRECTIONS**

ENCOURAGES NUMBER TALK

PRACTICES SKILLS

IMPROVES DEDUCTIVE AND INDUCTIVE THINKING

IMPROVES ESTIMATION SKILLS

DEVELOPS LANGUAGE SKILLS

SPATIAL REASONING

**ORDERING AND
SEQUENCING**

PROMOTES GROWTH MINDSET

REDUCES ANXIETY

SPATIAL ORIENTATION

*IMPROVES
VISUALIZATION*

INCLUDES ALL

ENGAGES

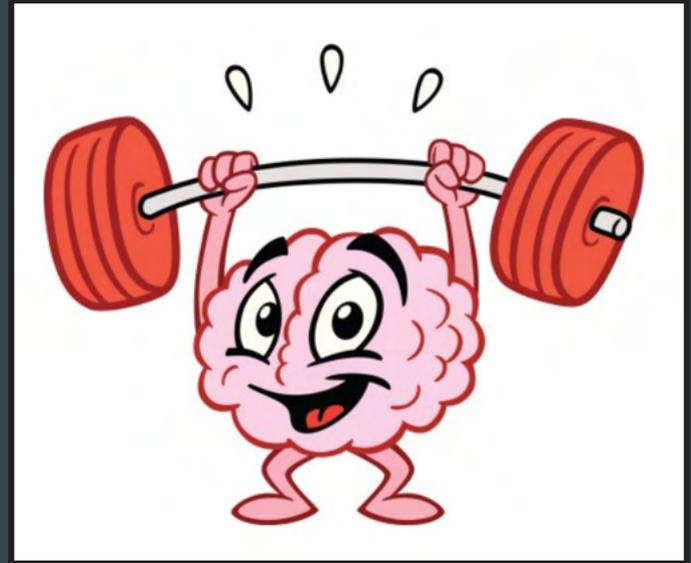
ENGAGES THE BRAIN

IT'S FUN

STUDENTS

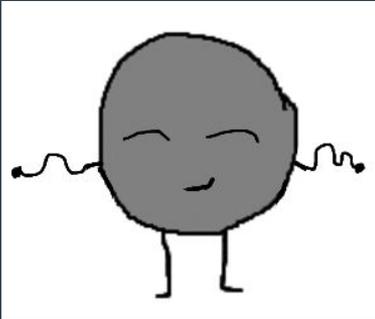
Growth Mindset

- Ability and competence grow with **effort**
- Students with **growth mindsets** have better math grades and test scores than students with fixed mindsets.
- A **teacher's** mindset also impacts students' mindsets
- The brain is a like **muscle**, it can get stronger
- Give formative **feedback**, not grades!



Math and Movement

It's important for teachers to teach with the brain in mind because movement is a natural part of a child's school day and that movement can influence students' brains and their learning (Jensen, 2005)



By: Kaleigh Stratton

- **Movement:** increases blood and oxygen flow, which positively affects cognitive development
- Get the blood pumping and minds engaged!
- **Ways To Incorporate Movement into Math Lessons:**
 - **Task Card Scavenger Hunt:** students find hidden cards to solve different math problems
 - **Carousel Stations:** give students a clipboard and pencil and have them rotate through various math stations around the room (great for measurement)
 - **Human patterns and graphs**
 - **Nature Walk** (estimating, pattern making, measuring, exploring, counting)



FIND THE BEAUTY IN MATH

Math is an Art – We need to give our students the opportunity to express themselves in MATH; just like we would in Music or Art (Lockhart)

When we give our students the opportunity to explore math, we are giving them the opportunity to achieve their full potential

Students need time to struggle with a question; when we give our students this opportunity it leads to understanding and creates debate and discussion in the classroom (Principles)

Math is... “Wondering, playing, and amusing yourself with your imagination” (Lockhart)

When we play games with our students, we are helping them develop a strong understanding of the basics and students are learning without realizing that they are learning new skills

Playing games equates Math with Fun

Play boardgames, card games and moving games in the classroom to increase learning (Math and Learning)

Students can have Fun and Learn at the same time

If we make math fun for our students, it reduces anxieties they have towards math and helps to create a positive mindset

The role of play in math is to have students engage in learning

Games should be based on strategy not luck, last 10-15 minutes, develop at least one prerequisite skill, and be used as a learning tool (Sharma)

[A Mathematician's Lament](https://www.maa.org/external_archive/devlin/lockhartslament.pdf), by Paul Lockhart. Retrieved from: https://www.maa.org/external_archive/devlin/lockhartslament.pdf

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Prerequisite Skills and Mathematical Learning. (2015) Mahesh Sharma. Retrieved from <https://reading.superintendentsfiles.wordpress.com/2016/03/maheshsharma-prerequisite-skills-math-learning.pdf>