Grade 6 Mathematics 2016-17

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Agenda

Math Activity

The Research Behind the Practice

MBUSD Math Pathways

6th Grade Math: Big Ideas

Positive Norms to Encourage In Math Class (PDF)

1. **Everyone can learn math to the highest levels** - *Encourage* students to believe in themselves. There is no such thing as a "**math person**."

2. **Mistakes are valuable** - Mistakes growth your brain! It is good to struggle and make mistakes. Brain *plasticity & synapses*.

3. **Questions are really important** - Ask yourself: Why does this make sense?

4. **Math is about creativity and making sense** - Math is a creative subject that is, at its core, about visualizing patterns and creating paths that other can see discuss, and critique.

5. **Math is about connections and communicating** - Math is a connected subject and a *form of communication*. Represent math in different forms and link them. Color code!

6. **Depth is more important than speed** - Top mathematicians, such as Laurent Schwartz, think slowly and deeply.
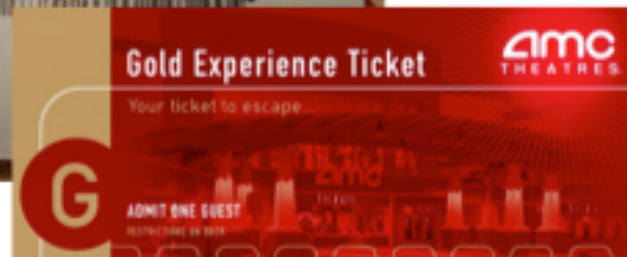
7. **Math is about learning, not performing** - Math is a growth subject, it takes time to learn and is all about effort!

Fun math activity

What do you notice?

What are you curious about?

SCREEN 01 14

TOWNE SQUARE 14
3/4/2016 8:58 P

ZOOTOPIA
9:30 PM Fri 3/4/20

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ADULT

Gold Experience Ticket

AMC
THEATRES

Your ticket to escape...

G

ADMIT ONE GUEST

Chad's birthday is coming up and he really likes to watch movies. Suppose you know the total cost of 3 gift cards and 4 movie tickets is $168, while 2 gift cards and 3 movie tickets cost $116.

How could you use this information to find the cost of 1 movie ticket and 1 gift card?

Systems of Linear Equations

What if we had done this?

SUBSTITUTION METHOD Solve the system using the substitution method.

3. $2x + 5y = 7$
   $x + 4y = 2$

4. $3x + y = 16$
   $2x - 3y = -4$

5. $6x - 2y = 5$
   $-3x + y = 7$

6. $x + 4y = 1$
   $3x + 2y = -12$

7. $3x - y = 2$
   $6x + 3y = 14$

8. $3x - 4y = -5$
   $-x + 3y = -5$

9. $3x + 2y = 6$
   $x - 4y = -12$

10. $6x - 3y = 15$
    $-2x + y = -5$

11. $3x + y = -1$
    $2x + 3y = 18$

12. $2x - y = 1$
    $8x + 4y = 6$

13. $3x + 7y = 13$
    $x + 3y = -7$

14. $2x + 5y = 10$
    $-3x + y = 36$

ELIMINATION METHOD Solve the system using the elimination method.

15. $2x + 6y = 17$
    $2x - 10y = 9$

16. $4x - 2y = -16$
    $-3x + 4y = 12$

17. $3x - 4y = -10$
    $6x + 3y = -42$

18. $4x - 3y = 10$
    $8x - 6y = 20$

19. $5x - 3y = -3$
    $2x + 6y = 0$

20. $10x - 2y = 16$
    $5x + 3y = -12$

21. $2x + 5y = 14$
    $3x - 2y = -36$

22. $7x + 2y = 11$
    $-2x + 3y = 29$

23. $3x + 4y = 18$
    $6x + 8y = 18$

24. $2x + 5y = 13$
    $6x + 2y = -13$

25. $4x - 5y = 13$
    $6x + 2y = 48$

26. $6x - 4y = 14$
    $2x + 8y = 21$

Jo Boaler - How to Learn Math?

Hint: Develop Your Student's Growth MindSet

PISA 2015

- The lowest achievers in the world are "memorizers"

- The highest achievers in the world are those who think about big ideas and connections

San Francisco USD moved to heterogeneous math classes in all grades through 10th **=** i*ncrease in overall test scores, especially for lower and higher quartile on standard deviation curve*

PISA
National Report

Fortune 500 Companies

1970

- Writing
- *Computational Skills*
- Reading Skills
- Goal Setting/Motivation
- Oral Communication
- Listening Skills
- Personal Career Development
- Creative Thinking
- Leadership
- **Teamwork**
- Organizational Effectiveness
- **Problem Solving**
- **Interpersonal Skills**

2000

- **Teamwork**
- **Problem Solving**
- **Interpersonal Skills**
- Oral Communication
- Creative Thinking
- Leadership
- Listening Skills
- Personal Career Development
- Goal Setting/Motivation
- Writing
- Organization Effectiveness
- *Computational Skills*
- Reading Skills
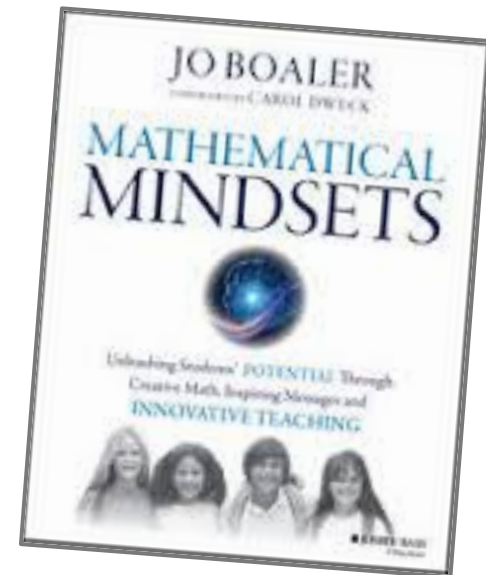
CCSS Modeling Standard
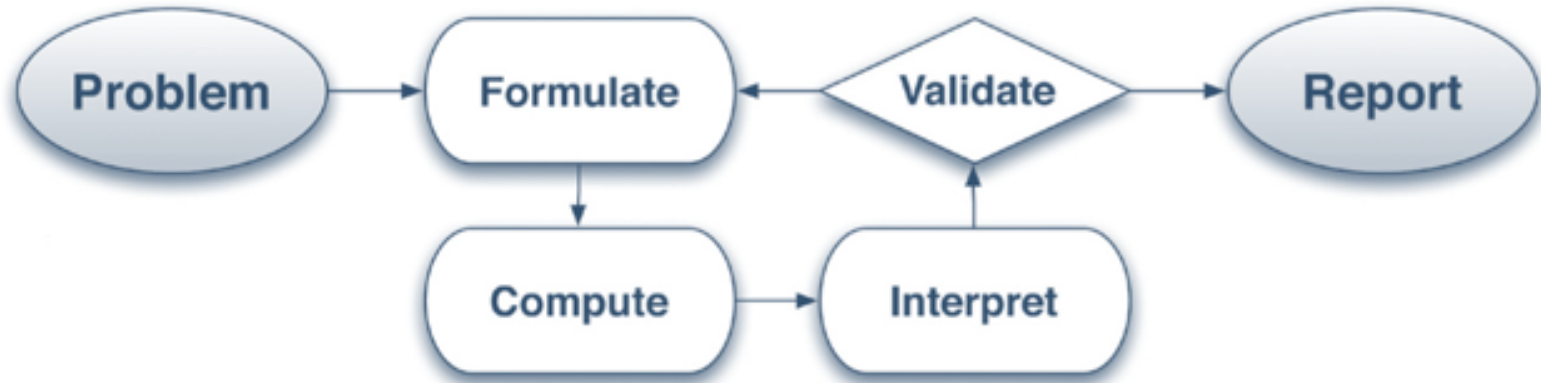
1. **Identify variables** in the situation; selecting those that represent essential features

2. **Formulate a model** by creating and selecting geometric, graphical, tabular, algebraic, or statistical representations that describe relationships between variables,

3. Analyze and **compute operations** on these relationships to draw conclusions,

4. **Interpret the results** of the mathematics in terms of the original situation,

5. **Validate the conclusions** by comparing them with the situation, and then either improving the model or, if it is acceptable,
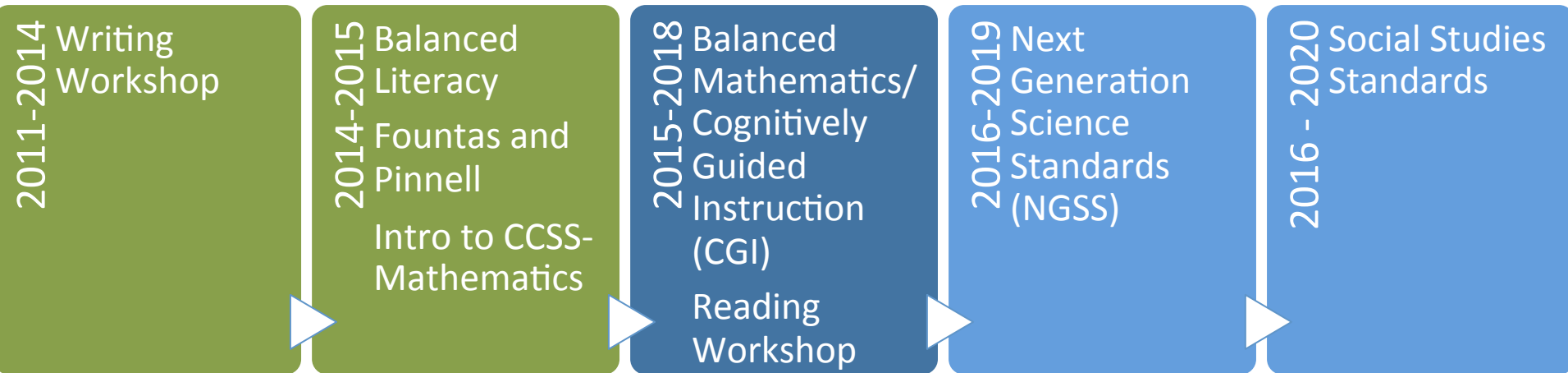
Opening Mathematics Tasks for Learning (p.90)

1. Open the task so that there are multiple methods, pathways, and representations

2. Include inquiry opportunities

3. Ask the problem before teaching the method

4. Add a visual component and ask students how they see the mathematics

5. Extend the task to make it lower floor and ceiling

6. Ask students to convince and reason; be skeptical

NCTM's The Art of Asking Questions

MBUSD Curriculum Timeline

2011-2014 Writing Workshop

2014-2015 Balanced Literacy

Fountas and Pinnell

Intro to CCSS-Mathematics

2015-2018 Balanced Mathematics/ Cognitively Guided Instruction (CGI)

Reading Workshop

2016-2019 Next Generation Science Standards (NGSS)

2016 - 2020 Social Studies Standards

Mathematical Content Domains (K–8) and Conceptual Categories (Higher Mathematics)

Conceptual Understanding Transitions

Grade	K	1	2	3	4	5	6	7	8	Higher Mathematics Conceptual Categories	
K–8 Domains	Counting and Cardinality (CC)						Ratios and Proportional Relationships (RP)	Functions (F)	Functions (F)	Functions (F)	Modeling (★)
	Operations and Algebraic Thinking (OA)						Expression and Equations (EE)			Algebra (A)	
	Number and Operations in Base Ten (NBT)						The Number System (NS)			Number and Quantity (N)	
				Number and Operations—Fractions (NF)							
	Measurement and Data (MD)						Statistics and Probability (SP)			Statistics and Probability (S)	
	Geometry (G)						Geometry (G)			Geometry (G)	

Deeper, More Meaningful Learning

- **When mathematics is opened up and broader math is taught**—math that includes problem solving, reasoning, representing ideas in multiple forms, and question asking—**students perform at higher levels, more students take advanced mathematics, and achievement is more equitable**. (Jo Boaler, Youcubed, Stanford University)

- **What is important in mathematics is to deeply understand things and their relations to each other**. This is where intelligence lies. The fact of being quick or slow isn't really relevant. (Laurent Schwartz, Mathematician, Theory of Distribution)

- **There is a mismatch between the math that people need in the 21st century and the math they spend most of their time on in classrooms**: computing by hand. The Common Core helps to correct this problem by spending less time practicing isolated methods and more time solving applied problems that involve connecting different methods, using technology, understanding multiple representations of ideas, and justifying their thinking. (Conrad Wolfram, cofounder of Wolfram-Alpha)

Course Pathway Factors
Standards Mastery

- To have **geometry** in 8th grade, students will have to master 184 standards (227 including subsections) in three years.

- To have **Algebra** in 8th grade, students will have to master 131 standards (171 including subsections) in three years.

- To complete the CDE *recommended* **Math 8**, students would have to master 82 standards (112 including subsections) in three years.

- In addition to the above standards, students are expected to master the Standards for Mathematical Practice.

- By the time student graduate, they will have memorized over 1000 math procedures.

CA CCSSM do NOT overlap like the CA Math Content Standards from 1997. Compacted courses should include the same standards as non-compacted courses. (CDE: California Mathematics Framework, 2013)

Options to Accelerate
California Mathematics Frameworks (2013)

- Allow students to take *two mathematics courses simultaneously* (such as Geometry and Algebra I or Algebra II).

- Offer *summer courses for advancement*, such as Geometry or PreCalculus, that are designed to provide the equivalent experience of a full course, including attention to the Mathematical Practices.

- Create different *compaction ratios*, including four years of high school content into three years beginning in 9th grade.

- Create *honors-regular math course pathways* or *regular-college-prep math course pathways*.
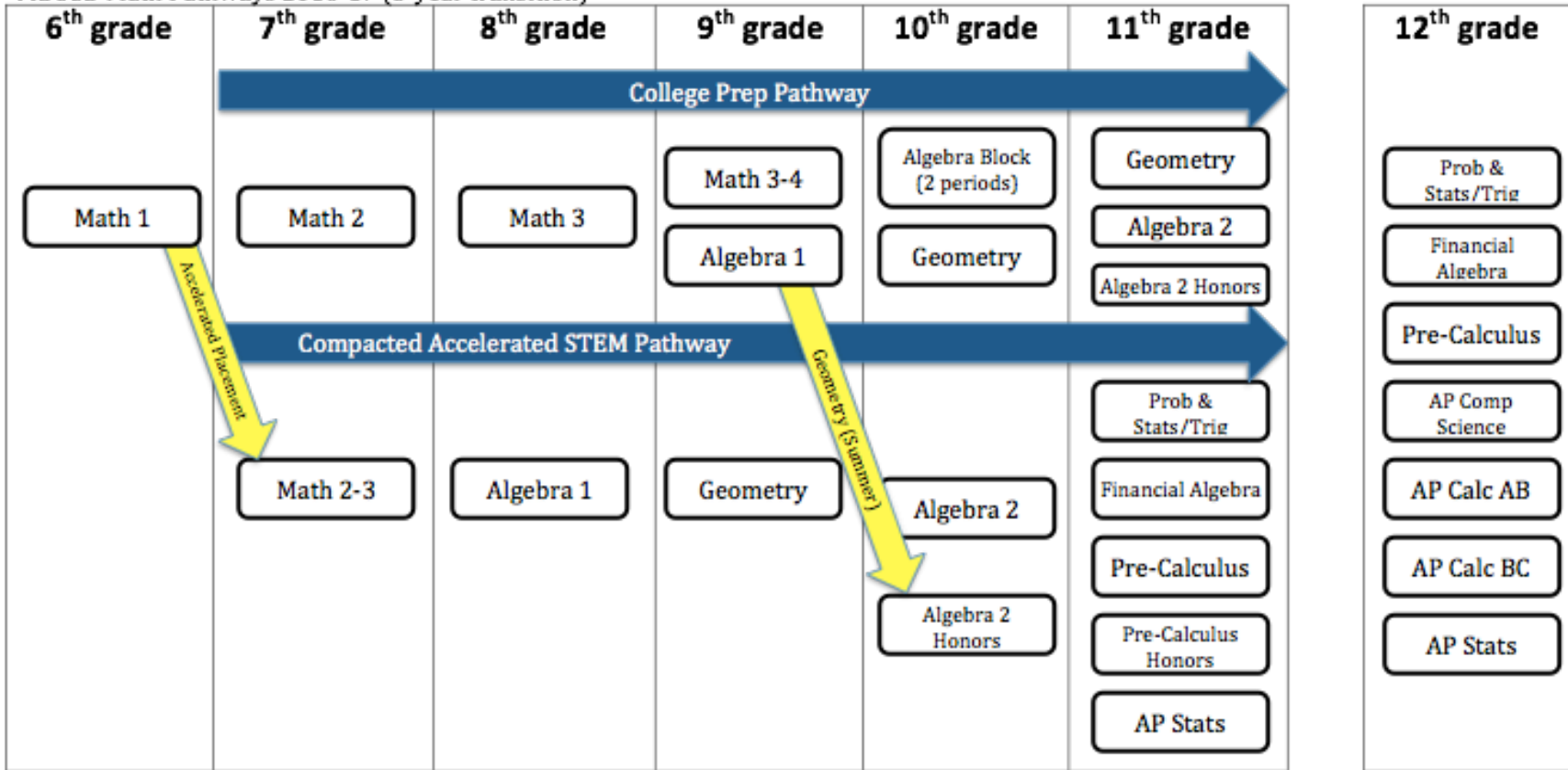
Course Pathway Factors

"The implementation of the Common Core State Standards in Math (CCSSM) requires rethinking not only course content, but also course sequencing."

- Research base on course-taking patterns is substantial: *misplacement in math is common*, with **significant consequences for students throughout middle and high school**, and beyond.

- When creating new CCSS-aligned math course pathways, courses cannot be viewed as taught in the past, but instead with the **lens of a balanced math approach** (problem solving, reasoning, procedural fluency).

Center for the Future of Teaching & Learning at WestEd

MBUSD Mathematics Pathways

MBUSD Math Pathways 2016-17 (3-year transition)

2016-2017
Secondary Math Courses

6th grade	7th grade	8th grade	9th grade	10th grade	11th grade
Math 1	Math 2 Pre-Algebra 2 Algebra	Math 3 Algebra 1 Geometry	Algebra CD Algebra 1 Geometry Algebra 2 Algebra 2 w/Trig	Algebra Block Geometry Algebra 2 Algebra 2 w/Trig Pre-Calculus	Geometry Algebra 2 Prob/Stats & Trig Financial Algebra Algebra 2 w/Trig Pre-Calculus AP Calculus AB AP Calculus BC AP Stats

2017-2018
Secondary Math Courses

6th grade	7th grade	8th grade	9th grade	10th grade	11th grade
Math 1	Math 2 Math 2-3	Math 3 Algebra 1 Geometry	Math 3-4 Algebra 1 Geometry Algebra 2 Algebra 2 Honors	Algebra Block Geometry Algebra 2 Algebra 2 Honors Pre-Calculus Pre-Calc Honors	Geometry Algebra 2 Prob/Stats & Trig Financial Algebra Algebra 2 Honors Pre-Calculus Pre-Calc Honors AP Calculus AB AP Calculus BC AP Stats

2018-2019
Secondary Math Courses

6th grade	7th grade	8th grade	9th grade	10th grade	11th grade
Math 1	Math 2 Math 2-3	Math 3 Algebra 1	Math 3-4 Algebra 1 Geometry Algebra 2 Algebra 2 Honors	Algebra Block Geometry Algebra 2 Algebra 2 Honors Pre-Calculus Pre-Calc Honors	Geometry Algebra 2 Prob/Stats & Trig Financial Algebra Algebra 2 Honors Pre-Calculus Pre-Calc Honors AP Calculus AB AP Calculus BC AP Stats

2019-2020
Secondary Math Courses

6th grade	7th grade	8th grade	9th grade	10th grade	11th grade
Math 1	Math 2 Math 2-3	Math 3 Algebra 1	Math 3-4 Algebra 1 Geometry	Algebra Block Geometry Algebra 2 Algebra 2 Honors	Geometry Algebra 2 Algebra 2 Honors Prob/Stats & Trig Financial Algebra Pre-Calculus Pre-Calc Honors AP Stats

Shifts in Math

Two sets of math standards in the Common Core State Standards:

Mathematical Practices – describe a set of skills and processes that all students should develop as part of their study of math

Content Standards – the mathematics students are expected to learn

1. **Focus** strongly where the Standards focus

2. **Coherence**: think across grades and link to major topics within grades

3. **Rigor**: in major topics, pursue:

   - Conceptual understanding

   - Procedural skill and fluency, and

   - Application with equal intensity

Math Rigor Pie

Balanced Mathematics

SBAC = 50% procedural/50% conceptual & application

Math Practice #1
Make Sense of Problems and Persevere in Solving Them

What this looks like in the classroom:

When given a problem, students can *create a plan*, demonstrate their learning using *multiple strategies and methods* with a range of DOK level problems over that take extended time to solve.

Lessons begin with a conceptual or application problem, possibly from later part of the textbook homework problems, that provides connection and *purpose*, pre-assessment of knowledge, allows for ***student talk***, *multiple entry points*, and *productive struggle*.

Teachers are *focused on what is learned* rather than what is taught such that formal explanation and eventually algorithms, are integrated after engagement and exploration. 5E Lesson Model

Math Practice #3

Construct Viable Arguments and Critique the Reasoning of Others

What this looks like in the classroom:

When given a problem, students *justify* and communicate their *reasoning*, compare *arguments*, analyze errors, and *ask clarifying questions* of other student's work to advance their own thinking.

When posing a problem or asking a question, teachers give students time to read and annotate problems independently prior to collaborative student talk time.

Teachers utilize instructional practices such as *pair-share/group talk* and
[5 Practices to Orchestrate Productive Mathematical Discussions](#)
that increase active learning and decrease passive learning.

Standards for Mathematical Practices

1. Make sense of problems and persevere in solving them
2. Reason abstractly and quantitatively
3. Construct viable arguments and critique the reasoning of others
4. Model with mathematics
5. Use appropriate tools strategically
6. Attend to precision
7. Look for and make use of structure
8. Look for and express regularity in repeated reasoning

SMP's focus on problem solving & communication skills with critiquing the reasoning

Four Critical Areas for 6th grade CCSS Math

Instructional time should focus on four critical areas:

1. Connecting **ratio and rate** to whole number multiplication and division, and using concepts of ratio and rate to solve problems

2. Completing understanding of **division of fractions** and extending the notion of number to the system of **rational numbers**, which includes negative numbers

3. Writing, interpreting, and using **expressions and equations**

4. Developing understanding of **statistical thinking**

(CDE: California Mathematics Framework, 2013)

Sixth Grade Math Classes:

Introduction Lessons: Hook Activity like 3-Act Math, Mathalicious.

Whole Group Lesson: Adapted notes and practice as whole group and small group practice.

Math Labs: Hands-On Investigations to reinforce the skills practiced together.

Assessments: Individual learning tasks for students to explain their reasoning based on skills covered during class.

Suggested Lesson Structure

■ Fluency Practice	(15 minutes)	
■ Concept Development	(30 minutes)	
■ Application Problems	(5 minutes)	
■ Student Debrief	(10 minutes)	
Total Time	**(60 minutes)**	

Team Teaching in Grade 6

- MBEF Funded

- One section per day per teacher

- Trained in CGI

- High levels of collaboration

- Job-embedded professional development

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