

Building on Foundations

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Rev 7/19/23 (ce)

Opening

Building on Foundations



- Thomasenia Lott Adams, Editor of Mathematics Teacher



Sign in and make a name tag





Find participants who have the other pieces of the same graph. As a team, come up with a story that could be represented by your team's graph.







Building on Foundations



name@cpm.org



@CPMeducationalprogram



#MoreMathforMorePeople

Opening Housekeeping



- + Bathrooms
- + 8:00 AM 4:00 PM
- Breaks scheduled and as needed
- + Lunch
- Parking Lot Poster
- Supply/Resource Table



Opening Learning Event eBook Access



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Opening Outcomes



Participants will...

Consider how the mathematical storyline provides opportunities to foster curiosity, make connections, and deepen understanding.

Purposefully use the embedded resources to plan for sharing math authority with students.

Reflect on past year(s) of teaching CPM curriculum and consider ways to enhance your collaborative classroom.

Develop an action plan to support your ongoing professional learning.

Agenda Building on Foundations





Opening & Icebreaker
 Mathematical Storyline
 Sharing Math Authority
 Creating Collaborative Classrooms
 Closure

Opening Research Connections CPM Implementation Progress Tool



The three pillars represent researched best practice in math education around which the CPM program is designed.

Collaborative Learning

Research says students learn ideas more deeply when they discuss ideas with classmates.

Problem-Based Learning

Research says students learn ideas more usefully for other arenas when they learn by attacking problems.

Mixed, Spaced Practice

Research says students learn ideas more permanently when they are required to engage and re-engage with those ideas for months or even years.

Foundations for Implementation

Welcome Working Agreements



Be willing to take **risks**. Have a **visionary** mindset. Stay **engaged**. Explore and reflect on your **beliefs**. Give **grace** to others and yourself.

Change takes time, effort, and support!

Agenda Building on Foundations





Opening & Icebreaker
Mathematical Storyline
Sharing Math Authority
Creating Collaborative Classrooms
Closure

Icebreaker The Joy of Teaching





PERSONALIZE WITH PICTURES TO REPRESENT YOUR TEACHING STORY.

Icebreaker The Joy of Teaching

Team Task:

- 1. Introduce yourself to your team.
- 2. Share the story of how you became a teacher.





Agenda Building on Foundations



Mixed, Spaced Practice

Research says students learn ideas more permanently when they are required to engage and re-engage with those ideas for months or even years. Opening & Icebreaker
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Outcome: Consider how the mathematical storyline provides opportunities to foster curiosity, make connections, and deepen understanding.

Icebreaker: CPM Lesson

Team Task: (10 minutes)

Reflect over the last year, which CPM lesson did you and your students find engaging and joyful? Why?

Team Roles – Assigned alphabetically by first name.

Resource Manager – make sure everyone has an opportunity to share

Facilitator – start your team by being the first to share

Recorder/Reporter – look for commonalities and be prepared to share out

Task Manager – keep track of time and update your team as necessary



Does the sequence of events matter?



Think-Pair-Share

Think of a story using the illustrations.

Pair with your elbow partner to co-create a story.

Share stories as team and consider these questions:.

- + What if you took out cell C?
- + What if you removed the last cell in your story?
- + What would you draw to "end" the story?

Teacher

Resource Manager – get two envelopes and be sure the questions are discussed

Facilitator – lead and support the team's discussion

Recorder/Reporter – be sure both stories are shared

Task Manager – keep track of time

Does the sequence of events matter? - Debrief





(The Mathematics Teacher, Dietiker, November 2016) Used with permission from the publisher for CPM Learning Events. May not be reproduced or redistributed by others without permission. Mathematical Storyline Mathematical Story Defined



"Seeing how mathematics unfolds, connecting a beginning to an ending, so that somebody who is experiencing it can kind of sense a storyline and predict where it's going."



Episode 13: Where Joel and Misty Make a new friend with Dr. Leslie Dietiker and talk about Mathematical Storylines

Experience a Mathematical Story: CC1 Lesson 7.2.2

Method 1: Using diagrams





To divide any number by a fraction using a diagram, create a model of the situation using rectangles, a linear model, or some visual representation of it. Then break that model into the fractional parts named.

For example, to divide $\frac{7}{8} \div \frac{1}{2}$, you can draw the diagram at right to visualize how many $\frac{1}{2}$ -sized pieces fit into $\frac{7}{8}$. The diagram shows that one $\frac{1}{2}$ fits one time, with $\frac{3}{8}$ of a whole left. Since $\frac{3}{8}$ is $\frac{3}{4}$ of $\frac{1}{2}$, you can see that $1\frac{3}{4}$ $\frac{1}{2}$ -sized pieces fit into $\frac{7}{8}$, so $\frac{7}{8} \div \frac{1}{2} = 1\frac{3}{4}$.

Alternately, you could think of $\frac{7}{8}$ as the quantity that you have and $\frac{1}{2}$ as the size of the group that you want, such as having $\frac{7}{8}$ ounces of chocolate and needing $\frac{1}{2}$ ounce for each cake recipe. How many cakes could you make? In this case, the diagram at right might be useful. The diagram shows $\frac{7}{8}$ being divided into groups of $\frac{1}{2}$. The leftover $\frac{3}{8}$ ounces creates another $\frac{3}{4}$ of a group, so again, $\frac{7}{8} \div \frac{1}{2} = 1\frac{3}{4}$.

Method 2: Using Common Denominators

To divide a number by a fraction using common denominators, express both numbers as fractions with the same denominator. Then divide the first numerator by the second. An example is shown at right.

7-53. Calculate each of the following products. <u>Homework Help </u>

a.
$$\frac{1}{8} \cdot \frac{8}{1}$$
 b. $\frac{3}{4} \cdot \frac{4}{3}$ c. $\frac{2}{3} \cdot \frac{3}{2}$ d. $7 \cdot \frac{1}{7}$

e. What do the products in parts (a) through (d) have in common?









Mathematical Storyline Experience a Mathematical Story



7.2.3 How can I divide?

Division with Fractions and Decimals

This lesson will bring you more division strategies! You will continue your work with dividing fractions to include a new strategy for dividing by fractions. You will also extend your knowledge to division of decimals.

Mathematical Storyline Experience a Mathematical Story



Your Task:

- + **Examine** the problems and the mathematical storyline.
- + **Change** the order of the problems.
 - How does the sequence foster curiosity for students?
 - How does changing the sequence affect the story?

| Find the missing | Ma |
|------------------------|-----|
| number in each puzzle. | the |
| <i>i</i> 6· =1 | 5 ÷ |
| | Co |
| <i>II</i> . 4 · = 1 | an |
| <i>iii.</i> ⅔ · = 1 | |



Copy the expression and simplify it.

Cheryl used the problem ½ ÷ ¾.

Copy and complete Cheryl's calculation.

Experience a Mathematical Story: CC1 Lesson 7.2.3

Team Task: (15 minutes)

Complete 7-57 through 7-59. Discuss the following.

- + How does the authors' chosen sequence provide opportunities for surprise and intrigue?
- + What are the mathematical characters, settings, and actions?
- Where/What was the a-ha of this lesson? How does this connect to the lesson goal? How can you assess student understanding of the goal?

Student

Facilitator – lead the team discussion

Resource Manager – ensure two eBooks are open and everyone has access to the problems

Recorder/Reporter – make sure all voices are heard

Task Manager – make sure everyone stays together while working through the problems

Debrief the Storyline





Walk and Talk

How does the authors' chosen sequence provide opportunities for surprise and intrigue?

What are the mathematical characters, settings, and actions?

Where/What was the "a-ha" of this lesson? How does this connect to the lesson goal? How can you assess student understanding of the goal?









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Mathematical Storyline Definition



"Enacting a sequence so that it offers dramatic conflict can also offer students a memorable experience and, since it increases student attention, lead to more learning by students (Egan, 1989)."

Mathematics Teacher, NCTM, November 2016

Scenarios





Four Corners Jigsaw

Independently read the scenario and two questions. (2 min)

Discuss with your corner. Be prepared to share with your team. (6 min)



Mathematical Storyline Scenarios



Review team roles.

Consider the following questions.

- + What is the impact of modifying the storyline?
- + How does teacher facilitation affect the storyline?

Resource Manager – be prepared to share out your team's thinking

Facilitator – start the discussion by sharing Teacher A's scenario

Recorder/Reporter – ensure all team members record their thoughts

Task Manager – keep track of time and update your team as necessary



Mathematical Storyline Effects on the Mathematical Storyline



Mathematical Storyline Scenarios

| Teacher A | Teacher B | Teacher C | Teacher D |
|------------------------|-------------------------------|------------------------|------------------------|
| Productive Struggle | Structure and Organization | Incomplete Homework | Running out of Time |

How was this lesson affected by the modification?

Mathematical Storyline Reflection





It is important to develop this skill at the conceptual level because...

How will this concept come back in your course?

$$\frac{\frac{11}{8}}{\frac{3}{4}} \cdot \begin{bmatrix} \frac{4}{3} \\ \frac{3}{4} \\ \frac{4}{3} \end{bmatrix} = \frac{\frac{44}{24}}{1} = \frac{44}{24} = 1\frac{20}{24} = 1\frac{5}{6}$$

Mathematical Storyline Reflection



- + **Search** for "Giant One" in your eBook.
- + **Click** on the "Giant One" search results that occur in the Teacher Notes.
 - + Note: The CCG and Stats eBook do not contain the "Giant One" explicitly in the search results.
- + **Share** how the "Giant One" is incorporated in different courses.





| Teacher Notes | Matching Text |
|------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| 8.2.2 | 8-64 refers students to the Giant One that they were introduced to in does not change its value. Students will use this idea in problem 8-65 |
| <u>8.2.3</u> | 8-84 students use the Giant One to simplify expressions with negativ as the denominator of a fraction and then simplifying in problem 8-8 |
| <u>1.2.2</u> | Some teams may create an equivalent ratio by multiplying by a Gian factor relationship between the different lengths. Students may also s denominator. |

Research Connections CPM Implementation Progress Tool



SECTION ONE: The pillars that represent necessary first steps in any implementation.

Collaborative Learning

Students and teachers are aware of the purpose for and value of working in teams, and are familiar with team norms and roles.

Problem-Based Learning

Students and teachers share math authority as they value and engage in productive struggle. Teachers guide without taking over the thinking.

Mixed, Spaced Practice

Both individual lessons and chapters are followed, using suggested pacing. Review & Preview problems are assigned and valued as an essential part of learning.



Mathematical Story Defined





Episode 13: Where Joel and Misty make a new friend with Dr. Leslie Dietiker and talk about Mathematical Storylines

Mathematical Storyline Mathematical Story Defined



"Understanding how to read for mathematical stories across tasks enables teachers to read their own math curriculum materials for hidden opportunities of surprise or wonder and then capitalize on these opportunities in class. Taking advantage of these opportunities can trigger interest in students, which when repeated can lead to the development of their personal interest in mathematics (Hidi and Renninger 2006)."

Mathematics Teacher, NCTM, November 2016

Mathematical Storyline Planning Time



Collaborate with a course-alike partner, trio, or team.

Your Task:

- + **Reflect** on the course's recurring characters, themes, and settings.
- + Select a challenging lesson.
 - **Reflect** on the mathematical storyline of the lesson.
 - **Discuss** the lesson's launch, explore, and closure.

Consider how the structure of the lesson...

- + maintains the cognitive demands of the task
- + supports students' ability to take charge of their learning and become more independent
- + allows students to summarize their learning and assess their understanding
- + creates opportunities for surprise or wonder

Sharing Math Authority Building on Foundations



Problem-Based Learning

Research says students learn ideas more usefully for other arenas when they learn by attacking problems. Opening & Icebreaker
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 Closure

Outcome: Purposefully use the embedded resources to plan for sharing math authority with students.

Sharing Math Authority The Elements



"The implications are clear. Curriculum matters, but how teachers use curriculum matters even more."

The Elements: Transforming Teaching through Curriculum-Based Professional Learning -Carnegie Corporation of New York, 2020

Sharing Math Authority

Research Connections - Why?

Proximity Dyad

How do the practices provide the opportunity for you to co-create the mathematical story with your students?



Effective Mathematics Teaching Practices

- 1. Establish mathematics goals to focus learning.
- 2. Implement **tasks** that promote reasoning and problem solving.
- 3. Use and connect mathematical representations.
- 4. Facilitate meaningful mathematical discourse.
- 5. Pose purposeful questions.
- 6. Build procedural **fluency** from conceptual **understanding**.
- 7. Support productive **struggle** in learning mathematics.
- 8. Elicit and use **evidence** of student thinking.



Sharing Math Authority CPM Course Design





Taking Action: Implementing Effective Mathematics Teaching Practices in Grades 9-12, 2017

Sharing Math Authority Looks Like, Sounds Like, Feels Like Y-chart

Facilitator – make sure everyone is heard
Resource Manager – get materials for activity
Recorder/Reporter – start with the marker and be sure it rotates after 2 minutes

Task Manager – keep track of time







Sharing Math Authority



Sharing Math Authority

An Upside Down Approach



Notice & Wonder

TEACHER CENTERED LECTURE-BASED LEARNING

CPM: STUDENT CENTERED PROBLEM-BASED LEARNING

All students discuss a new problem or concept (explore) Formal Teacher asks questions to support owbitious reactions definition and focus student learning Teacher lecture Students and teacher and examples of summarize basic problems Clarifications and Students engage via whole formal class discussion definitions Students work on their own and problems increase in difficulty



Sharing Math Authority Desmos Reflection





Source: NCTM, Navigating the Uncertainty of Sharing Mathematical Authority

Sharing Math Authority

Share Your Experience







Team Task: Each team member will select one prompt to answer.

- + Share a specific example of sharing the math authority with students.
- + Share how your students respond when you shared the math authority.
- + Share how it feels to share the math authority.
- + Share what is challenging about sharing the math authority.
- + Share what expectations might be helpful when sharing math authority.

Sharing Math Authority

Research Connections CPM Implementation Progress Tool



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Mixed, Spaced Practice

Both individual lessons and chapters are followed, using suggested pacing. Review & Preview problems are assigned and valued as an essential part of learning.



Lunch Time

Return by:







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Opening



CPM's Equity Principles

The goal of teaching is to help all students transition from dependent to independent learners.

Relationships are of vital importance. Student uniqueness is an asset, not a deficit.

Reflection is a crucial part of growth.

Sharing Math Authority

Research Connection CPM Implementation Progress Tool

SECTION TWO: Features of desired student learning when the pillars are in place.

| Collaborative Learning | Problem-Based Learning | Mixed, Spaced Practice |
|----------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|
| Students read and make sense of problems together. | Student thinking at varied depths of conceptual understanding are openly shared and valued. | Students work through lessons at an appropriate pace. |
| Students are able to listen to the ideas of others and communicate their own ideas both in teams and during whole class discussions. | Students demonstrate and value both conceptual and procedural knowledge. | Students understand that mastery takes time, effort, and support. |
| Students listen carefully to the thinking of others and respond with clarifying questions or extensions of their own. | Students look for, compare, and connect multiple models and solution strategies. | Students are aware of learning targets and periodically self-assess their progress towards those targets. |
| Students engage in productive mathematical discourse, justifying answers, creating viable arguments, and critiquing the reasoning of others. | Students recognize that incorrect work can be a stepping stone to learning and are willing to share and investigate their thinking. | Students solidify learning as they work on Review & Preview problem sets daily as intended. |



Which student actions are evident when you share the math authority?

What actions are happening in your classroom?



Sharing Math Authority Self Reflection



Two Stars and a Wish

What is going well?

What is a challenge?



Sharing Math Authority

Resources Concept Map

Explore your assigned resources. (10 min) As a team, create a concept map with the theme of Sharing Math Authority. (20 min)



Facilitator: Universal Access, Pocket Questions, Suggested Lesson Plan, Lesson Plan Structure: Launch



Resource Manager: Chapter Opening, Skill Builders (Supplemental Resources), Math Notes, Lesson Plan Structure: Explore



Recorder/Reporter: Lesson Mathcast, Teambuilders/ Icebreakers, Lesson Plan Structure: Closure, Homework Help



Task Manager: Team Roles, Classroom/Team Expectations, Chapter Closure, Checkpoints



How do these resources support sharing math authority? What connections do you see to the Mathematical Teaching Practices?



Sharing Math Authority

Resources Concept Map



Hosted Gallery Walk

Consider how these resources might support you and your students.

Record ideas/resources to add to your action plan.



Recorder/Reporter:

Share your team's connections. What embedded CPM resources support sharing math authority?





Sharing Math Authority Debrief



Embedded CPM Resources

Suggested Lesson Plan Study Team & Teaching Strategies Pocket Questions Mathcast Universal Access Lesson Plan Structure: (Launch, Explore, Closure) Learning Logs

Team Roles Classroom/Team Expectations Chapter Opening Chapter Closure Homework Help Math Notes Checkpoint Problems Skillbuilders









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Building on Foundations



Collaborative Learning

Research says students learn ideas more deeply when they discuss ideas with classmates. Opening & Icebreaker
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Outcome: Reflect on past year(s) of teaching CPM curriculum and consider ways to enhance your collaborative classroom.

Teambuilder: Let's Make Squares

Team task: 10-15 minutes

Use all 12 strips each time you make 1, 2, 3, ...12 squares.

No Cuts or Bends: Strips must lay flat on the table.

No Stacking: Strips can cross any other strips, but they cannot lay on top of, or cover up, one another lengthwise.

No Touching: Strips cannot lay side by side with edges touching.

Teambuilders/Icebreakers (Teacher tab \rightarrow Team Support \rightarrow Team Resources \rightarrow under Team Strategies)





Four Squares



Collaborative Classrooms Let's Make Squares - Debrief



Reflect on your team's collaboration.



What does collaboration <u>not</u> look like?



What does collaboration look like?

Create a Collaboration Rubric Idea from Building Thinking Classrooms

Visibly Random Teams



Let's practice collaboration with new teams!



https://pickerwheel.com/tools/random-team-generator/

Collaborative Classrooms Team Roles



Assign team roles: Alphabetically by first name

Facilitator – Alphabetically first



Resource Manager – Alphabetically second



Recorder/Reporter – Alphabetically third

Task Manager – Alphabetically fourth

Collaborative Classrooms Icebreaker



Team Task: On the VNPS, each person will draw something joyful.



Collaborative Classrooms Vertical, Non-Permanent Surface





Suggested Expectations:

- + Only write the ideas of others.
- + Only erase your own ideas.
- + When the timer sounds, the marker passes to a different person.

Just because sitting and writing in the notebook is the obvious place for some activities, it does not have to be the workspace for all activities. –Peter Liljedahl

Mathematical Storyline









Quadratic Functions





Collaborative Classrooms Mathematical Storyline: Section 8.1, Factored Form





In this section, students develop a method to change a quadratic equation written as a sum into its product form (also called its factored form).

0



Area as a Sum: $6x^2 + 17x + 5$

Area as a Product: (3x + 1)(2x + 5)

| (- 1 | 2x | 5 |
|------------------|--------|-----|
| | $6x^2$ | 15x |
| | 10 | ~) |

(2x + 5)

Mathematical Storyline: Section 8.1, Factoring Process



Students use the generic rectangle to factor quadratic equations.





Collaborative Classrooms Mathematical Storyline: Section 8.2





Students generate each representation of a quadratic function (rule, graph, table, and situation). They also develop a method to find the *x*-intercepts of a parabola using the Zero Product Property and use square roots to find the *x*-intercepts.

Finally, they "complete the square."



Collaborative Classrooms CCA Lesson 8.2.5 Completing the Square





Math Goal:

Learn how to convert the equation of a parabola into graphing form.



Team Goal:

Utilize your VNPS to make your team's thinking visible. Use the collaboration rubric to guide your teamwork.

| Team number | Lesson 8.2.5 | 8-101 (Algebra Tiles) | 8-102 (VNPS) | 8-103 (VNPS) | 8-104 (VNPS) | 8-105 🧠 |
|----------------|-----------------|---------------------------------|-----------------|-----------------|-----------------|------------|
| 1 | | | | | | |
| 2 | | | | | | |
| 3 | | | | | | |
| 4 | | | | | | |
| 5 | | | | | | |
| 6 | | | | | | |
| 7 | | | | | | |
| 8 | | | | | | |

Debrief CCA Lesson 8.2.5





Independent Reflection

Review the CCA Lesson 8.2.5 Teacher Notes (eBook).

Compare the Teacher Notes with the Launch–Explore–Closure Lesson Plan.

Reflect using the Implementation Progress Tool.



- + What did I do, as the teacher, while you were working?
- + What was your experience on the role of the student?

Additional Challenge:

How do you see these math concepts appear in the CPM courses' storyline?

Debrief CCA Lesson 8.2.5 Think-Ink-Pair-Share





Think-Ink-Pair-Share

- + How was your experience as a student during that lesson?
- + How did the lesson compare to the Teacher Notes?
- + What teacher moves supported your collaboration and engagement?

Research Connections CPM Implementation Progress Tool



SECTION ONE: The pillars that represent necessary first steps in any implementation.

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Mixed, Spaced Practice

Both individual lessons and chapters are followed, using suggested pacing. Review & Preview problems are assigned and valued as an essential part of learning.



Collaborative Classrooms Planning Time



Collaborate with a course-alike partner, trio, or team.

Your Task:

- + **Select** a lesson from your course.
- + **Reflect** on how you will share math authority and encourage collaboration during the lesson.
- + **Discuss** the launch, explore, and closure of your lesson.

Consider how your lesson plan will:

- + incorporate embedded CPM resources
- + assess the effectiveness of collaboration of your teams
- + support students' ability to take charge of their learning and become more independent

Closure

Building on Foundations





Opening & Icebreaker
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Outcome: Develop an action plan to support your ongoing professional learning.

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|----|-------|-----|
| Οι | utcon | nes |



Participants...

Consider how the mathematical storyline provides opportunities to foster curiosity, make connections, and deepen understanding.

Purposefully use the embedded resources to plan for sharing math authority with students.

Reflect on past year(s) of teaching CPM curriculum and consider ways to enhance your collaborative classroom.

Develop an action plan to support your ongoing professional learning.

Closure **Professional Learning Portal**

Continue your story...

Enroll in the On-Demand Module

- \rightarrow On-Demand Modules
- \rightarrow Additional Teacher Resources
- \rightarrow Building on Foundations On-Demand Module

 \rightarrow Connections to Foundations for Implementation



Closure

- + Parking Lot
- + Attendance & Feedback

Either scan the QR code OR Enter passcode in the Portal XXXXXX





+ Continuing Education Credit



