

## Lesson Study Processes and Tools that Support Teacher Learning while Developing Leaders

East Metro Mathematics Leadership (EaMML) MSP  
National Council of Teachers of Mathematics  
April 7, 2017

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## Who is in the room?

- Classroom Teachers
- Mathematics Coaches/Specialists
- Principals/Building Administrators
- District Office Administrators
- State or Regional Coordinators
- Teacher Educators
- Who did we miss?

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## Who We Are

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## Agenda

- Opening
- Context for the work
- Our Lesson Study Model
  - 1st Grade
  - 4th Grade
- Our Learning
- Reflections and Implications

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## Learning Target



- **What:** Discuss a modified lesson study model that focuses on:
  - deepening students' mathematical understanding and discourse, and
  - improving mathematics teaching and learning.
- **How:** Examine the process, tools, and techniques that support teacher and leader learning.
- **Why:** Consider a professional learning design that
  - builds teacher leadership capacity, and
  - increases the potential for sustainability.

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## Meet Your Elbow Partner

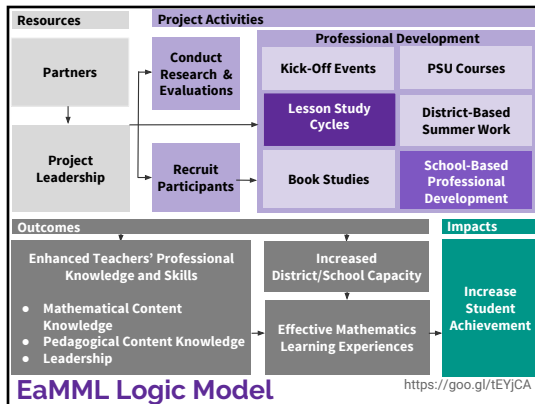


Find someone nearby to be your elbow partner.  
Introduce yourself and use a simile sentence frame.

Facilitating professional learning is like \_\_\_\_ because ...

**OR**

Facilitating professional learning is NOT like \_\_\_\_ because ...



## What is Lesson Study?

A community of teachers collaborates to develop a lesson which involves:

- aligning the lesson with goals,
- detailing possible teacher moves and questions, and
- predicting students' responses and/or typical misconceptions.

A teacher implements the lesson with others observing and collecting student-based data. Finally, the group meets to discuss the lesson and decide the extent to which the instructional goals were met. - Stepanek, Appel, Leong, Mangano, & Mitchell, 2007

A "comprehensive and well-articulated process for examining practice." - Fernandez, Cannon, & Chokshi, 2003, p. 171

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## What informs our Design?

### Tools:

- Task Analysis Guide
- Thinking Through a Lesson Protocol
- Bring-Do-Leave Instructional Planning Guide

- High Cognitive Demand Tasks
- Maintain the cognitive demand of the task that prompts student discourse
- Anticipate possible student responses, strategies, and misconceptions
- Intentionally plan teacher moves and questions to foster high level student discourse.

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## Lesson Study

### Goal:

Deepen understanding about student thinking (including common misconceptions) and learning trajectories.

### Pre-observation meeting

- Overview of Lesson Study Protocols
- Do the math of the lesson
- Analyze the cognitive demand
- Predict student thinking, refine to prompt high level discourse

### Observe the Lesson

### Post-observation meeting

- Lead Teacher Reflects on Lesson
- Student Discourse Coding
- Observations about the data
- Inference Dialogue
- Implications for classroom practice

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How could/do you use lesson study as a professional learning model in your setting?

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## Professional Learning Foci

### Principles to Actions' Mathematics Teaching Practices (NCTM, 2014)

- Designing and Implementing Problem-based Tasks
- Teacher Questioning
- Orchestrating Discourse

... to increase the quantity and quality of student mathematical discourse.

### Ambitious Teaching Practices and Intentional Talk (Kazemi & Hintz, 2014)

- Number Talks
- Lesson Launches (e.g., Three Reads; I notice, I wonder)

... as routines to deepen student mathematical discourse.



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## Designing and Implementing Problem-Based Tasks

“Effective teaching of mathematics engages students in solving and discussing tasks that promote mathematical reasoning and problem solving, and allow multiple entry points and varied solution strategies.”

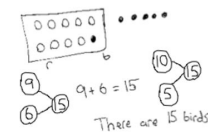
--Principles to Actions, p. 10

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## Original Problem as represented in the Curricular Materials

### Application Problem

There are 9 red birds and 6 blue birds in a tree. How many birds are in the tree? Use a ten-frame drawing and a number sentence. Write a number bond to match the story and a number bond to show the matching 10+ fact. Write a statement.



From Eureka Math: Grade 1, Module 2, Lesson 5 ©Great Minds, 2016

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## Problem-Based Task as Adapted by the Teacher

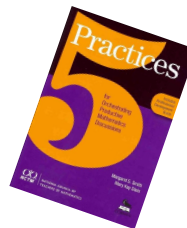
Mrs. Zielinski went bird watching with her daughters. They saw a tree with lots of birds. Izzy counted 9 red birds, and Maggie counted 6 blue birds. How many birds are in the tree?

Show how you got your answer.



## Five Practices for Orchestrating Productive Mathematical Discussions

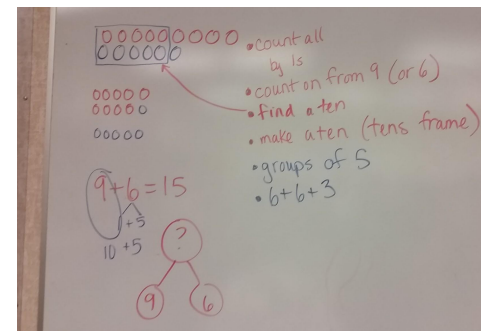
1. Anticipating
2. Monitoring
3. Selecting
4. Sequencing
5. Connecting



--Smith & Stein, 2011

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## Planning for Productive Discourse: Anticipating Student Approaches

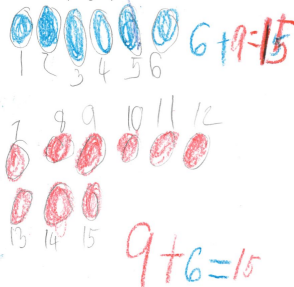


| Orchestrating Productive Mathematical Discourse   |  |          |         |   |
|---|--|----------|---------|---|
| Chart for Monitoring, Selecting, Sequencing, and Connecting Student Thinking                      |  |          |         |   |
| Strategies  | Work of Specific Students                    | Sequence | Compare |   |
| Column 1: Teachers <b>Anticipate</b> the strategies and approaches students may take.             | A. Count all by 1s (or by 2s)                |          |         | Column 3: Teachers <b>Sequence</b> the order in which selected student work will be shared.                         |
|   | B. Count on from 9 (or 6)                    |          |         |   |
| Column 2: Teachers <b>Monitor</b> the work of specific students. (during and/or after the lesson) | C. Find groups of 5                          |          |         |   |
|   | D. Make a ten and some more (picture model)  |          |         | Column 4: Teachers consider how to <b>Connect</b> the thinking of multiple students to draw out the big math ideas. |
| Column 2: Teachers <b>Select</b> which student work to highlight in a class discussion.           | E. Use a double fact (6 + 6 + 3 more)        |          |         |   |
|   | F. Decompose the 6 to make a ten (9 + 1 + 5) |          |         |   |

### Rona's Work

Mrs. Zielinski went bird watching with her daughters. They saw a tree with lots of birds. Izzy counted 9 red birds and Maggie counted 6 blue birds. How many birds are in the tree?

Show how you got your answer.



### Abi's Work

Mrs. Zielinski went bird watching with her daughters. They saw a tree with lots of birds. Izzy counted 9 red birds and Maggie counted 6 blue birds. How many birds are in the tree?

Show how you got your answer.



### The Lead Teacher Connecting Representations and Orchestrating Discourse



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### Orchestrating Discourse

"Effective teaching of mathematics facilitates discourse among students to build shared understanding of mathematical ideas by analyzing and comparing student approaches and arguments."

--Principles to Actions, p. 29

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How can lesson study support teachers' ability to design/adapt and implement problem-based tasks to support classroom discourse?

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| BRING • DO • LEAVE<br>Instructional Planning Guide, Part 2   |   |  |
|--|---|--|
| DO - Classroom Actions and Interactions  | What questions assess student understanding?  | LEAVE - How will I monitor and document their understanding?   |
| <b>Launch</b><br><b>At the beginning:</b><br>What moves/questions will help students understand the problem?<br>3 glasses are filled different amounts and used to fill up one another. Notice and Wonder launch strategy. Ideas to be brought out. <ul style="list-style-type: none"> <li>• Vocab such as half, full, empty, more, less.</li> <li>• I wonder how much water you poured from that cup to that one?</li> <li>• I wonder how much is left in that cup</li> <li>• These will allow us to discuss liquid measurement and fractions. If these don't come up I will be looking for a door in someone's thinking to introduce measurement and fractions to the discussion.</li> </ul> | How would you describe this?<br><br>What would have to happen for the glass to be full? | Listening for targeted vocab as well as measurement/fraction concepts.<br><br>Use talk moves to have students revoice. |
| <b>What moves/questions help students consider possible strategies and math tools/resources without taking away students' opportunities to make decisions as a mathematician?</b><br><br>Display this modified task:<br>You fill 8 drinking glasses part of the way full. How many of those glasses could you have filled to the top instead?<br><br>Notice and Wonder Think/Pair/Share  | How does the discussion we just had help us think about this new task?                  | Written down notice and wonderings paired with an exit ticket.   |

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|--|---|--|
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You fill 8 drinking glasses part of the way full. How many of those glasses could you have filled to the top instead?

I notice...

4 because  $8 \div 2 = 4$  and one half plus another half would make one whole, when you do that four times you'll have four full cups and four empty.

I notice...

"4 because  $8 \div 2 = 4$  and one half plus another half would make one whole, when you do that four times you'll have four full cups and four empty"

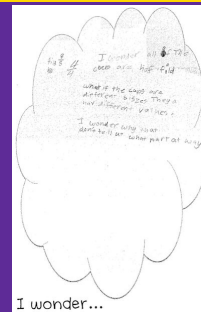
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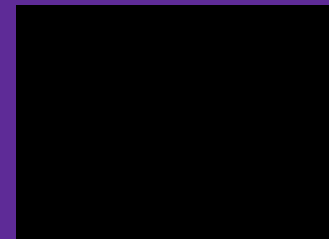
"I wonder all of the cups are half filled

What if the cups are different sizes. They'd have different values.

I wonder why that don't tell us what part of way is."



You fill 8 drinking glasses part of the way full. How many of those glasses could you have filled to the top instead?

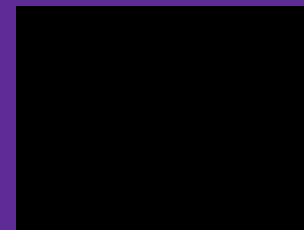


|           |  |  |                |
|-----------|--|--|----------------|
| Explore   | <p><b>While students are working:</b><br/> <b>What moves support students in monitoring and controlling their own progress?</b></p> <p>Students will work with a partner to solve the following</p> <p><i>You fill 8 drinking glasses <math>\frac{3}{4}</math> full. How many of those glasses could you have filled to the top instead?</i></p> | <p>How do you know?</p> <p>Use this record sheet to record your thinking</p> <p>What if you had started with ____ rather than ____?</p>          | Record sheets. |
| Summarize | <p><b>When students are finished, to facilitate a productive math discussion:</b><br/> <b>What questions advance student understanding?</b></p> <p>Find students who represent different strategies and ask them to present and explain their thinking.</p>  | <p>Which noticings and wonderings were really important to solving the task?</p> <p>Were there noticing and wonderings we didn't really use?</p> |                |
|           | <p><b>What moves support students in making connections/extensions?</b><br/>         Choice 2: You fill some drinking glasses <math>\frac{3}{4}</math> full. If you rearrange the water, you could have filled whole glasses instead with nothing left over. How many glasses could have been <math>\frac{3}{4}</math> full?</p>                 | <p>Did we get stuck because we missed something?</p>   |                |

Without using paper and pencil, turn to a partner and say how you could represent and solve this task.

You fill 8 drinking glasses  $\frac{3}{4}$  of the way full. How many of those glasses could you have filled to the top instead?

You fill 8 drinking glasses  $\frac{3}{4}$  of the way full. How many of those glasses could you have filled to the top instead?



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| Question types                             | Description   | Examples   |
|--|---|--|
| 1 Gathering information                    | Students recall facts, definitions, or procedures.  | <ul style="list-style-type: none"> <li>I notice you have tiny numbers here, what are those?</li> <li>Why did you put x's on these?</li> <li>So you are saying these 6 right here that she crossed off are the same as when they took the pieces apart?</li> <li>So you put that this was the same as the <math>\frac{1}{4}</math> below it?</li> </ul>                       |
| 2 Probing Thinking                         | Students explain, elaborate, or clarify their thinking, including articulating the steps in solution methods or the completion of a task. | <ul style="list-style-type: none"> <li>Where did they go? How did they get empty?</li> <li>How did you know this is <math>\frac{1}{4}</math> because I see different fraction pieces?</li> <li>Then what did you do?</li> </ul>  |
| 3 Making the mathematics visible           | Students discuss mathematical structures and make connections among mathematical ideas and relationships.                                 | <ul style="list-style-type: none"> <li>Do you see something similar to these 4 being together in Yitta's picture?</li> <li>Is there a place where there are 4 things in Yitta's picture?</li> <li>Do you notice anything that happened in the unifix cubes that also happened in the picture?</li> <li>So you moved the ones from over here down so they were...?</li> </ul> |
| 4 Encouraging reflection and justification | Students reveal deeper understanding of their reasoning and actions, including making an argument for the validity of their work.         | <ul style="list-style-type: none"> <li>How many of you thought about it this way?</li> <li>Was that the only way to think about it?</li> </ul>   |

Adapted from Boaler and Brodie, 2004; Chapin and O'Connor 2004 in *Principles to Actions*, NCTM, 2014.

Explain how you solved this task:

*so I made 8 cups out of unifix cubes. I took two of those (pretend cups) and broke two of those rows into six (cups). Then I took each one & then added them to the other six (cups, unifix cubes). so I could fill six of those cups. so it is 4/4*

Word Bank

Because  
Decompose  
Compose  
Whole  
Quarter  
Fourth  
Fraction strip  
Full  
Accurate  
Strategy  
Add  
Subtract  
Multiply  
Divide

Snap Cubes

Explain how you solved this task:

*Because I used a graph paper, I drew 3 rows in each 8 cups and after that, I crossed off the squares in each row to make four fourths and then when I ended up at seven it was all empty like cup & so I stopped at 6. so that's how I got my answer on my graph paper.*

Word Bank

Because  
Decompose  
Compose  
Whole  
Quarter  
Fourth  
Fraction strip  
Full  
Accurate  
Strategy  
Add  
Subtract  
Multiply  
Divide

Graph Paper

Explain how you solved this task:

I knew there was 8 cups  
filled up to  $\frac{3}{4}$  and then I  
looked those fraction strips,  
then I made 8 groups  
of them then I took the  
oh from the top and took  
those and moved them up  
to the other ones and  
made four eighths and 6  
groups.

Word Bank

Because  
Decompose  
Compose  
Whole  
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Full  
Accurate  
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Add  
Subtract  
Multiply  
Divide

## Fraction Bars

How might a focus on  
lesson launches and/or  
teacher questioning  
support teacher learning in  
lesson study?

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## Lesson Study Learning

## Teacher Learning

Let's listen to what a few teacher  
participants have to say . . .



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What was your main takeaway  
from lesson study and how are  
you applying it?

"The importance of using manipulatives, using other  
visual models, asking the right questions, and allowing  
students to collaborate, explore, and play. When this is  
done right, having this culture of equity maximizes the  
learning potential of all students because they are more  
curious, confident, and courageous."

## Lesson Study Learning

## Facilitator Learning

- "Where [Principles to Actions] was philosophical for teachers last spring they now see it as a tool to apply to their classroom practice."
- "It takes time and effort plan lessons in this way. We need to meet teachers where they are in the same way we expect them to meet students where they are. Our mantra is 'gentle, relentless pressure.'"
- I invited the district ELL coach to join us in lesson study and loved hearing her insights through her lens of expertise. I think sharing the work we're doing with district leaders is important for finding convergence in our work with teachers.

As you consider what you have  
heard today, what aspects seem  
most critical to

- ... teacher learning?
- ... teacher leader development?

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## Contact Information

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## Resources

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