Using Practice as a Site for Professional Learning for Teaching

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Overview

1. Professional learning for practice, and introduction to the Elementary Mathematics Laboratory

2. Three uses of the laboratory for deliberate professional learning

3. Next steps for research and development on using a laboratory as a context for professional learning
Goals and challenges for professional development

1. Working on actual teaching practice
2. Developing skill with specific practices
3. Connecting mathematics, equity, teaching practice
4. Linking to teachers’ own practice and contexts
5. Balancing the common with the contextual, the professional and the personal
What is the EML?

A live laboratory for the design and study of teaching:

- 10-day summer mathematics program for 5th grade students from Ypsilanti Community Schools
- Live setting for the study of teaching, learning, and mathematics by teacher and school district leaders, teacher candidates, teacher educators, researchers, mathematicians and other university faculty, the public
- Source of unusual records of practice
Why is it called a “laboratory”?

Laboratory:
A planned setting developed for real-time studies of the interplay of instructional design, teaching, and learning

Features of the laboratory:
- Teaching that is public, perceptible, and made studyable
- Careful documentation
- Experimentation and interdisciplinary study
A site for collective work on practice

- Opportunity to deliberate collectively about instructional decisions, and to develop and discuss experiments
- Diverse participants with varied interests, areas of expertise, and “lenses” for viewing practice lend different perspectives and expand the range of discussion
Participants’ daily schedule

8:30 – 9:30  Prebriefing meeting: discuss and adjust plans and viewing focus for day
9:45 – 12:00  Observe laboratory class in class or in remote viewing room
12:00 – 12:30  Study students’ work, make notes, prepare for debrief
1:30 – 4:00  Professional development work
Developing ways to use the EML as a context for professional development

How might the laboratory be used to support learning of:

1. Questioning practices to support mathematically complex work: Nicole Garcia

2. Leading mathematics discussions: Julie McNamara and Michaela O’Neill

3. Using mathematics in teaching: Hyman Bass
What we will show for each PD

- Brief description of participants, scope and goals, types of activities and work,
- Example of participants’ work
- Appraisal of affordances and challenges
DEVELOPING PRACTICES OF EXPLICIT QUESTIONING, NOT TELLING: SUPPORTING STUDENTS IN MAKING SENSE OF PROBLEMS AND PERSEVERING IN SOLVING THEM
Strategic questioning techniques

- Questioning is crucial for eliciting student thinking, building relationships with students, and checking for understanding
- Skill with questioning permeates the teaching of Common Core content (topics and practices)
- The laboratory afford a setting in which it is possible to observe students’ interactions and focus on only one aspect of teaching
Connecting to the Common Core

- Skill with questioning permeates the teaching of Common Core content

- Particular implications for CCSS MP.1 – Make sense of problems and persevere in solving them
  - Supporting and scaffolding students in making sense of problems
  - Giving students a tool for persevering (e.g. asking students if their work fits within the criteria of the problem)
  - Supporting and scaffolding students in persevering by asking questions that help them solidify their thinking
Overview of the professional development

- **Participants:** Practicing teachers and teacher educators
- **Duration:** Five 2.5-hour sessions
- **Focus:** Strategic questioning techniques
  - **Teachers:** Learn about and practice applying the techniques
  - **Teacher educators/coaches:** Practice observing and giving feedback to teachers on their use of the techniques
Day 1: Questioning framework

Based on the work of Enright and Ball (2013)
Demands of questions

High Cognitive Demand

Explicit

Implicit

Low Cognitive Demand

Demand of Questions

Setting of the Questioning

Enactment of Questioning

Strand of Questioning
- Domain of Instructional Work
- Purpose

Adapted from the work of Parks, 2010
Questioning strands

<table>
<thead>
<tr>
<th>Questioning to...</th>
<th>Learning a new norm, process, or practice</th>
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<tbody>
<tr>
<td></td>
<td>Reinforcing a norm, process, or practice</td>
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<tr>
<td>Learn to do something new</td>
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<td>Support mathematical</td>
<td>Focusing</td>
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<td>thinking and reasoning</td>
<td>Stimulating thinking and reasoning</td>
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<td>Explaining</td>
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<td>Tying together</td>
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<td>Presenting thinking in the public space</td>
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<td>Build metacognition</td>
<td>Building self-scaffolding</td>
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<td>Building self-monitoring</td>
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<td>Internalizing practices</td>
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<tr>
<td>Understand</td>
<td>Understanding student ideas</td>
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<td>Understanding student progress</td>
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</tbody>
</table>
Professional development process

- Viewing guide
- Observation
- Transfer to practice
- Debrief
- Focused work with small groups
Professional development process

Viewing guide

Transfer to practice

Observation

Focused work with small groups

Debrief

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Professional development process

- Viewing guide
- Observation
- Transfer to practice
- Focused work with small groups
- Debrief
Before working with students

- Work on the problem
- Demonstration
- Planning
- Paired rehearsal with feedback
Permutations of purple, yellow, green

What are all of the different trains you can make using exactly one purple rod, one yellow rod, and one light green rod? How do you know you have them all?

Solve the problem and consider how you would explain that you have all solutions.
Permutations of purple, yellow, green

What are all of the different trains you can make using exactly one purple rod, one yellow rod, and one light green rod? How do you know you have them all?

**THREE CONDITIONS**

1) Use only purple, yellow, and light green rods
2) Use one rod of each color
3) All solutions must be different

**WORK OF THE PROBLEM**

- Unpack the conditions of the problem
- Generate solutions
- Justify that a solution does or does not meet the conditions
- Explain how you know you have all of the solutions
<table>
<thead>
<tr>
<th>Time</th>
<th>Student Learning Goals</th>
<th>Details</th>
<th>Planned Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>3:40</td>
<td>Using materials in a way that supports learning</td>
<td>Introduce the problem: What are all of the different trains you can make using exactly one purple rod, one yellow rod, and one light green rod? How do you know you have them all?</td>
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<td>Presenting explanations to classmates</td>
<td>Possible script: Let’s take a look at the problem that we are going to work on today. Can someone read that for us? (student reads) So, who can restate what the problem is asking us? (student restates) Does everyone agree that is what the problem is asking? (check and keep probing if this is not right until the group comes up with the right interpretation) Can someone say what the conditions of the problem are? (student answers) ___ do you agree that those are the conditions? (student answers – probe as needed)</td>
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<td></td>
<td>Listening to, actively trying to understand, and responding to others’ ideas during small group</td>
<td>You may want to use some of the following questions as students work, depending on what work they share: ___ showed purple-yellow-lt green and ___ showed lt green – yellow – purple. Do we all think these meet the conditions of the problem? Which way of recording our work helps us to show other people that we found all of the answers?</td>
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<td></td>
<td>Using small groups as a resource to support learning</td>
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Professional development process

- Viewing guide
- Observation
- Focused work with small groups
- Debrief
- Transfer to practice
Key foci for each day

Day 1:
- Investigating one way of examining and planning for questioning for a particular purpose

Day 2, 3, and 4:
- Examining questioning in the class
- Planning for a problem solving session with students
- Working with students
- Analyzing own video and reflection

Day 5:
- Connecting to regular classroom practice
Affordances and challenges of using the lab to support this work

**AFFORDANCES**
- Close to practice
- Able to see impact of focused work on questioning in real time
- Possibility to test teacher moves
- Immediately challenging
- Changes the viewing of the laboratory
- Greater teacher buy-in

**CHALLENGES**
- Choosing material that does not interfere with the mathematics being worked on in the laboratory class
- Timing
- Lack of predictability
- Teachers’ concerns about their skills in this area
- Appeal to practicing teachers
Professional development in the EML

LEARNING TO IDENTIFY, ANALYZE, AND REASON ABOUT SPECIFIC INSTRUCTIONAL PRACTICES AND CONSIDERATIONS
Professional development session: Mathematically productive discussions

- **Participants:** Practicing teachers, mathematics coaches, and teacher educators
- **Duration:** Five 2.5 hour sessions
- **Focus:**
  - **Teachers:** Learning to lead discussions in their classrooms
  - **Mathematics coaches:** Learning to support teachers in leading discussions
  - **Teacher educators:** Supporting pre-service teachers in leading discussions
Why PD on leading discussions?

- Whole class discussions support student learning (Bakhtin, 1982; Chapin, O’Connor, and Anderson, 2009; and Lampert, 2001)

- Learning goal for students to construct viable arguments and critique the reasoning of others (CCSS MP. 3)

- In order to ensure that all students can benefit from whole class discussions and construct and critique arguments, we need to support teachers in the complex work of leading discussions
Professional learning in a laboratory setting

- Identify, analyze, and reason about specific instructional practices and considerations in real time
- Observe the development of students’ skills in engaging in discussions over time
- Explore complexities of practice
  - Interwoven practices over time
  - Understand the teacher’s decision making and instructional choices through the pre- and debrief
Session foci

1. Observe and analyze the use of discussions in an elementary elementary classroom.

2. Engage in mathematics discussions with colleagues

Through these experiences, participants:

• Examine and apply guidelines for determining discussion-worthy tasks.

• Identify the different purposes and types of discussions most frequently encountered in mathematics classrooms.

• Build a toolbox of teacher moves to support students in mathematics discussion.
Professional development process

- Viewing guide
  - Observation
  - Debrief
  - Engage in and analyze discussions
  - Transfer to practice
Professional development process

- Viewing guide
  - Observation
  - Debrief
  - Engage in and analyze discussions
  - Transfer to practice
Professional development process

- Viewing guide
- Observation
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- Debrief
- Engage in and analyze discussions
Professional development process

- Viewing guide
  - Observation
  - Debrief
  - Transfer to practice
  - Engage in and analyze discussions
Professional development process

1. Viewing guide
2. Observation
3. Debrief
4. Engage in and analyze discussions
5. Transfer to practice
Classroom video context

What fraction of the rectangle below is shaded gray?

What fraction of the rectangle below is shaded gray?

- Viewing focus: What is the teacher doing to support students in participating in the mathematics discussion? What else could the teacher do?
Video
Debrief

Viewing focus:

- What is the teacher doing to support students in participating in the mathematics discussion, including understanding the ideas that are being shared and building on them?

- What else could the teacher do?
Talk moves

- Revoicing
- Repeating
- Reasoning
- Adding on
- Waiting

Other teacher considerations

- Questioning
- Calling on students
- Strategies for encouraging student participation
- Insuring equity
- Making student thinking public
  - Representations and the public space
Transfer to practice

Math Coaches

Teachers

Teacher educators

Students

Observe

Transfer to practice

Debrief

Engage in and analyze discussions

Viewing guide
Affordances and challenges of using the laboratory to support this work

**AFFORDANCES**
- Utilizing a rich set of resources including detailed lesson plans and video archive with transcripts
- Observing student engagement in discussions over time
- Identifying, analyzing, and reasoning about teaching practices specific to discussions
- Engaging in discussions with colleagues

**CHALLENGES**
- Responding to the opportunities presented in the laboratory in real time
- Helping participants focus on the teaching and not the teacher
- Supporting teachers’ efforts to envision this work in their own school and classroom contexts

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Professional development in the EML

DEVELOPING MATHEMATICAL KNOWLEDGE FOR TEACHING: A FOCUS ON THE CCSS MATHEMATICAL PRACTICES
Professional development context

- **Participants:** A mix of K-12 teachers, coaches, and teacher educators
- **Duration:** Five 2.5 hour sessions
- **Focus:** Common Core mathematical practice
  - **Teachers:** Study what the mathematical practices look like in action and learn ways to support students’ development of skill with them
  - **Teacher educators, coaches:** Study what the mathematical practices look like in an elementary classroom and consider ways to support teachers’ learning to focus on them explicitly
The Common Core Standards for Mathematical Practices

Mathematically proficient students:

MP1. Make sense of problems and persevere in solving them.

MP2. Reason abstractly and quantitatively.

MP3. Construct viable arguments and critique the reasoning of others.

MP4. Model with mathematics.

MP5. Use appropriate tools strategically.

MP6. Attend to precision.

MP7. Look for and make use of structure.

MP8. Look for and express regularity in repeated reasoning.
## Lab Class Observation Chart

<table>
<thead>
<tr>
<th>Time</th>
<th>Format</th>
<th>Activity and math content</th>
<th>MPs</th>
<th>Questions/comments</th>
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PD instructional activities

- Identify a lab class episode and analyze it from the point of view of mathematical practices being taught and/or learned.
- Use particular mathematical practices as a viewing focus for lab class observation and discussion.
- Track on one or more individual students and their development of mathematical practices.
- How does the class collectively develop mathematical practices?
- Analyze features of mathematical tasks that support the teaching and learning of mathematical practices.
- Work on mathematical tasks (the same and extended ones) in order to examine and develop teachers/teacher educators’ mathematical practices.
A closer look at one activity sequence:  
Using an episode from class 
to study mathematical practices
What fraction of the rectangle is shaded blue? How could you construct the mathematical argument?
Context for the video

- Students have been working on identifying the shaded fraction of figures that have been partitioned unequally.
- The mathematical task asks the students to evaluate another “student’s” work: “... critique the arguments of others” (MP.3)
- Students are asked to evaluate whether the “student’s” answer is correct, and also to appraise the quality of the explanation.
Mathematical task

What fraction of the big rectangle is shaded blue?

\[
\frac{5}{12}
\]

Explain.

I made a line and then counted.

a) Is this student’s answer right? Why or why not?
b) Is this student’s explanation good?
Aleecia’s work

C. What fraction of the big rectangle is shaded blue?  \[
\frac{5}{12}
\]

Explain.

I made a line and then I counted.

\( \text{a) IS THIS STUDENT’S ANSWER RIGHT? WHY OR WHY NOT?} \)
Video clip viewing focus

- How are students working on constructing mathematical arguments and critiquing the mathematical arguments of others?
- Is there work on other mathematical practices? Be specific.
- In each case, identify the work of the teacher to support student work on these mathematical practices.
Video
Discuss

- How are students working on constructing mathematical arguments and critiquing the mathematical arguments of others?
- Is there work on other mathematical practices? Be specific.
- In each case, identify specific aspects of teaching that support students’ learning of mathematical practices.
Affordances and challenges of using the lab to support this work

AFFORDANCES

- Rich instructional context
- Supports that help to make the mathematics visible
- Opportunities to identify and analyze mathematical practices and what is entailed in teaching them

CHALLENGES

- Helping participants hear the mathematics involved in teacher and student talk
- Making the teaching visible
- Unpacking the knowledge and skill demands of the instruction
MOVING FORWARD: CHALLENGES TO SITUATING PROFESSIONAL LEARNING IN PRACTICE AND WHAT WE NEED TO KNOW
Situationing professional learning in practice

How can a shared live ongoing classroom be harnessed as a context for deliberate professional learning of:

- Mathematics-specific instructional practices
- Mathematics used in teaching
What are participants learning? How? Why?

This is the best professional development I have EVER participated in.

I’m coming back again next year and bringing more people from my school.

The EML has really changed what I do in my own classroom.

Working on specific teaching moves has been so important.
Learning about participants’ learning

1. How are participants viewing and using the laboratory class? What are they attending to, noting, and interpreting? What does this professional observing have to do with practice?

2. How are viewing and analyzing related to practicing? In each of the PDs, what are participants learning to do?

3. What (if anything) does the summer experience in the laboratory and PD have to do with participants’ practice in the fall, and in the coming year?
1. Participants’ use of the laboratory class itself

- Interviewing participants about what they are noticing, noting, thinking about
- Tracking whether and how they attend to and learn from the mathematics in action
- Learning what aspects of teaching are more or less difficult to see
- Probing how participants’ orientations to diversity and social justice shape and are shaped by their observation of the class
2. How study and doing connect

- In what ways do participants’ involvements provide opportunities to learn to do?
- What do participants seek to learn to do? How are their entering purposes related to their use of the professional context?
- How does their involvement in the laboratory class observation and their PD affect any aspect of their practice? Some possibilities:
  - Their language and precision for teaching?
  - Their practice-based knowing of mathematics?
  - Their moves, manner, voice, physical presence, use of tasks, skills in specific practices?
3. Participants’ own practice

- Does experience in the EML and the PD affect participants’ practice in following year?
- Are there patterns across participants?
- Is there unexpected impact, and is it positive or problematic?
- Does participation shape learning to practice as well as practice? *e.g., what participants try to work on or develop?
Thoughts about method

- Known methods for pre and post follow-up: surveys, observation, MKT, Goffney instrument
- Problems of selection bias and lack of comparison groups
- Lack of method to study actual learning of participants (what are they doing while in the EML/PD)?
- Use of logs to track participants’ engagement and learning
- How to get past verbal reports
- How to overcome positive bias
- Comparing learning with other forms of PD
- Student learning?