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Examining and Developing Practice Through Live Laboratory Teaching

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What great teachers often say about teaching

"Teaching has always come naturally to me."

"I have learned what I do from experience; I like to pass on what I know to student teachers."

"I can't explain what I do –- teaching is really an art and you have to follow your intuition a lot."

"I have developed my way of doing things that works for me and my style."

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What's wrong with this?

1. Undermines the idea that teaching is a profession that can be developed through careful unpacking of the practice and a common technical language
2. Perpetuates the belief that teaching is individual and tacit
3. Reinforces the predominance of "style" over skill

If teaching is individual and must be figured out by each person on the job, then there is little hope of ensuring that all young people receive skillful instruction.

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The work of teaching and the challenge for professional development

1. Unpacking practice into explicitly learnable elements
2. Developing explict and useful language for practice
3. Accessing and using examples of actual practice

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Overview

① Using of a laboratory context to work on the improvement of teaching: A focus on explicit teaching

② Teachers' learning in the Elementary Mathematics Laboratory (EML)

③ Using resources to design professional learning opportunities

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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



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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

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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





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What are we studying in the EML?

Ways to unpack and name specific teaching practices with respect to:

- What is involved in teaching specific aspects of the Common Core in mathematics?
- How can students be challenged mathematically with complex mathematical work while also filling in "gaps" in their past learning?
- What is involved in teaching mathematics with a deliberate focus on equity?

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Enhancing teachers' learning

THE IMPORTANCE OF PUBLIC TEACHING

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Why engage in public teaching?

- Most teaching occurs behind closed doors
- Teachers report learning "on the job" and on their own from experience most of what they do
- Culture of teaching supports style over method, and individualistic discretion over professional standards
- Weak norms for professional comment on practice

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What are the consequences of the pattern of personal and private practice?

- Idiosyncratic path to learning to teach, rooted in apprenticeship of observation (Lortie)
- Reproduction of inequitable practice
- Lack of development of collective professional knowledge (Grossman, Hiebert & Morris, Stigler)
- Inhibitor of instructional improvement
- A broad view of teaching as "can do" by anyone

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➢What is involved in public teaching?

1. Supporting observation (seeing, hearing, understanding)
2. Making teaching and learning visible
3. Minimizing the public-ness: creating a "cocoon"

What is public teaching NOT?

- Modeling "best practice"
- Demonstration teaching for professional development purposes

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Challenges of public teaching

1. Easy equating to "modeling best practice" or an opportunity to see a particular teacher.
2. Conflating of the public teacher with the opportunity to study teaching.
3. For the person doing public teaching, remembering that it is about making teaching visible, not doing it "right." Seeing "bad episodes" or errors as part of the work, and not a failed lesson.
4. The multiple levels of focus, purpose, and attention require deliberateness and attention.

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Public teaching, other considerations

SUPPORTING OBSERVING

- Standing and moving to make it easy for observers to see
- Speaking loudly enough and creating a norm of children speaking to be heard by peers
- Making large artifacts and using public space for representation

MINIMIZING THE "PUBLIC-NESS"

- Creating a "cocoon" around oneself and the students
- Focusing intently and persistently on students and creating an serious focus in the room for concentration on the talk and the ideas
- Creating norms of attention to one another's talk and ideas
- Deliberately non-attending to the observers

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Other considerations

1. Public teaching requires practices in addition to those entailed by teaching children.
2. The practices involved in public teaching seem not to interfere with the teaching and learning of the children, and even may enhance the children's learning opportunities.
3. Need to develop and make more explicit practice of public teaching and opportunities to learn practices of public teaching and not assume that these are natural or just to be figured out on one's own.

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Today's focus

Two Common Core mathematical practice standards:

1. Make sense of problems and persevere in solving them.
3. Construct viable arguments and critique the reasoning of others.

One high-leverage practice (HLP): Making content explicit

1. What have we learned about teaching through our work in the laboratory?
2. How does the laboratory support teachers' learning?

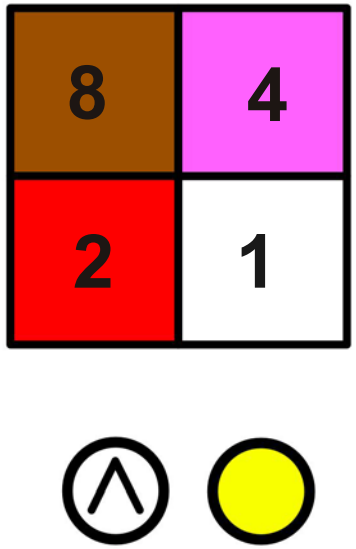
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WHAT HAVE WE LEARNED ABOUT THESE CCSS STANDARDS AND THIS HLP FROM OUR WORK IN THE LABORATORY?

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What is this problem asking, and what is involved in trying to solve it?



Using exactly one positive and one negative checker, find all the numbers that can be represented on this minicomputer board.

Prove your answer and explain why.

(Papy Minicomputer)

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Identifying and using problem "conditions"



Using exactly one positive and one negative checker, find <u>all</u> the numbers that can be represented on this minicomputer board. Prove your answer and explain why.

CONDITIONS OF THE PROBLEM

1. Use exactly one positive and one negative checker.
2. Must be a number that can be made on the Minicomputer.

PROPOSED SOLUTIONS

3 *YES, because it can be made with a positive on the 4 and a negative on the 1. This (1) uses exactly one positive and one negative checker and (2) it can be made on the Minicomputer.*

9 *NO, because it cannot be made on the Minicomputer with exactly one positive and one negative checker on the Minicomputer.*

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The role of conditions of a problem

- Identifying conditions can help in making sense of and interpreting a problem (MP.1)
- Using the conditions can help in persevering on a difficult problem (MP.1)
- Conditions are useful in constructing a mathematical argument (MP.3)
- Referring to the conditions is useful in critiquing an argument (MP.3)

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HLP #1: Making content explicit

- With increasingly greater expectations for engagement in complex mathematical work, it is crucial to unpack and structure opportunities to learn key ideas and practices, e.g.:
  - What it means to explain your thinking about an answer
  - What is involved in showing your work
  - How to work on a hard math problem
  - How to study mathematics on your own
- An entailment of equitable teaching to make ideas and practices transparent and learnable for all students (Delpit, ELA)

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Explicit teaching

- Naming, labeling, writing about important aspects of mathematical ideas, concepts, and procedures:
- Naming, highlighting, scaffolding specific mathematical practices
- Naming and supporting qualities of productive mathematical habits and mindset

(Mann, Owens, & Ball, 2013)

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Explicit teaching ≠ direct instruction: Investigating similarities and differences

DIRECT INSTRUCTION

- Breaks down practice or knowledge into small constituent parts
- Presentation of information, rules, and examples
- Tasks only address information from the presentation and the task is uncomplicated
- Lessons are composed of 4 – 10 exercises (presentations with task series) with only 10% new material
- Teacher's role to demonstrate, students follow, shift to independent practice
- Seeks to reduce complexity

Engelmann & Colvin (2006)

EXPLICIT TEACHING

- Unpacks practice or knowledge to make it open to learners
- Teacher's role to make elements visible, provide language, supports
- Seeks to make complex practice accessible

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Explicit teaching ≠ direct instruction: Investigating similarities and differences

SIMILARITIES

- Decomposes practice into smaller parts
- Seeks to support learners' mastery of specific knowledge and skill

DIFFERENCES

- Reducing complexity versus maintaining and making it accessible
- Teacher's role to demonstrate versus to support students' engagement with learning the components
- Students' role to follow and reproduce versus to appropriate and practice with understanding

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Teachers' Learning in the EML

EXPLICITLY SUPPORTING STUDENTS TO EVALUATE MATHEMATICAL EXPLANATIONS

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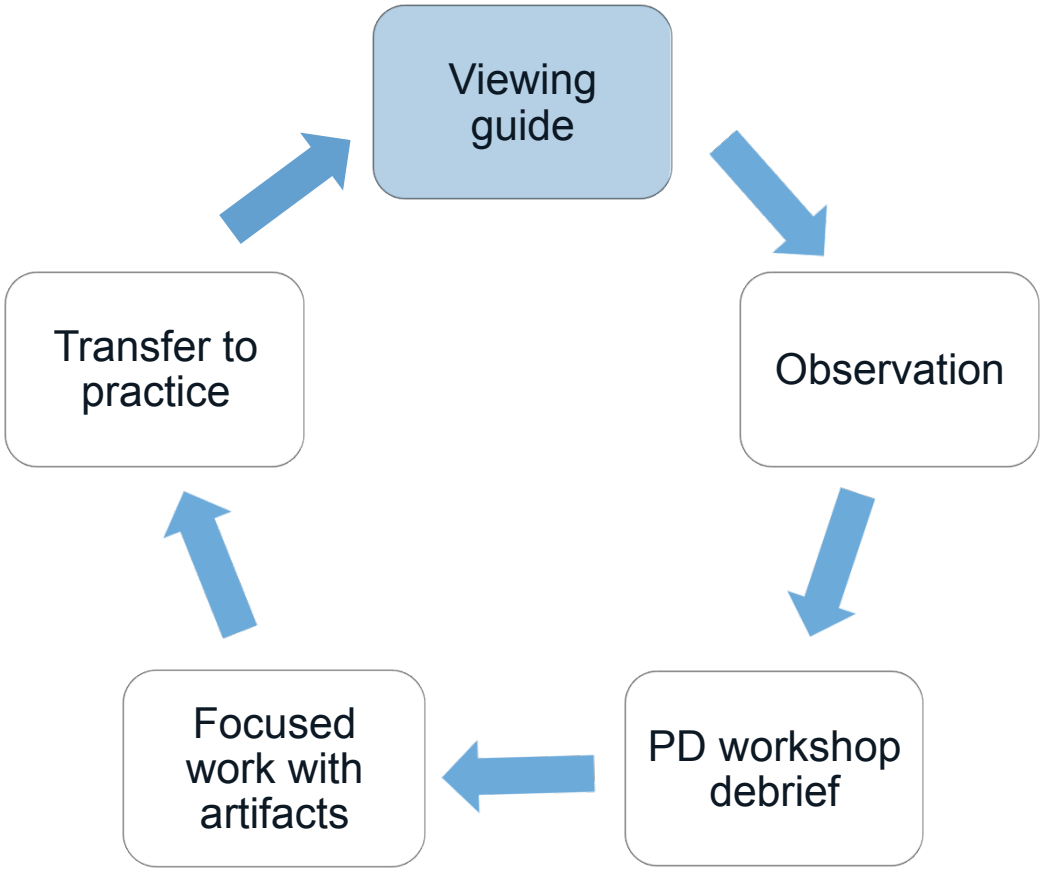
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Professional development themes

- Leading whole class discussions
- Considering worthwhile tasks
- Examining the high-leverage practices
- Teaching the mathematical practices

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Professional development process



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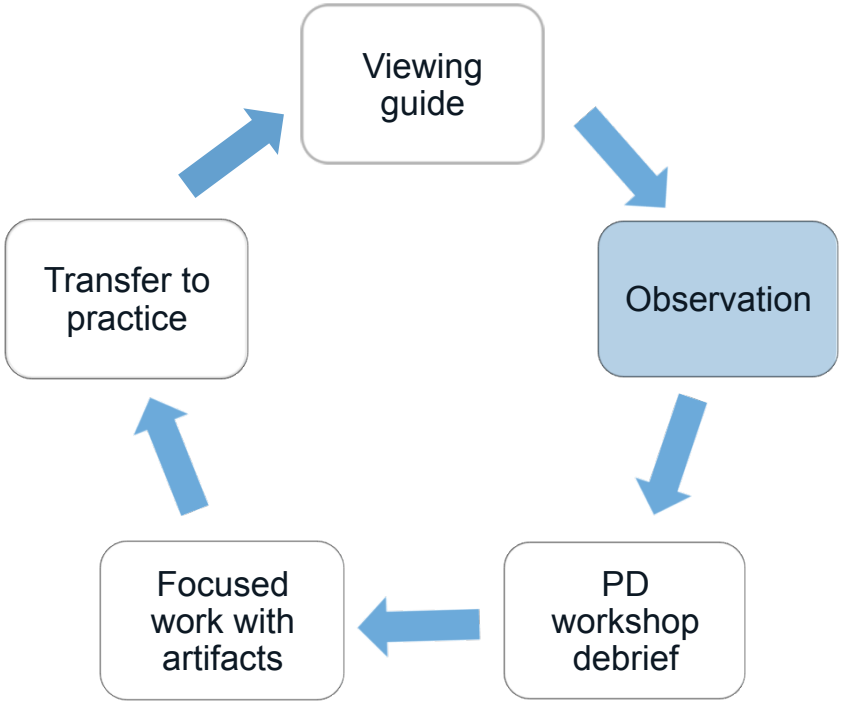
Viewing guide

How does the teacher support students in learning to give mathematical explanations that:

- Have a clear purpose
- Have a logical structure
- Use representations and language clearly and carefully
- Have a focus on meaning and are oriented to the listeners

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Professional development process



1. **The pre-briefing session**
   - Discussing the lesson plan, making changes
   - Anticipating what might come up and considering moves
2. The class session
3. The de-briefing session
   - Analyzing the class (design, enactment, students, . . .)
   - Beginning to plan for tomorrow's class

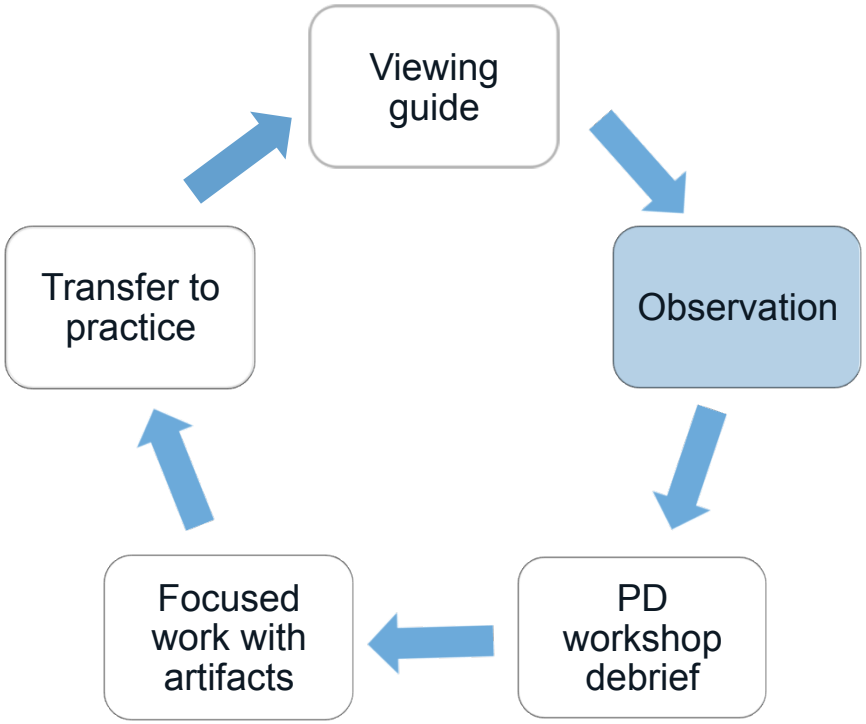
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Pre-Brief



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Professional development process



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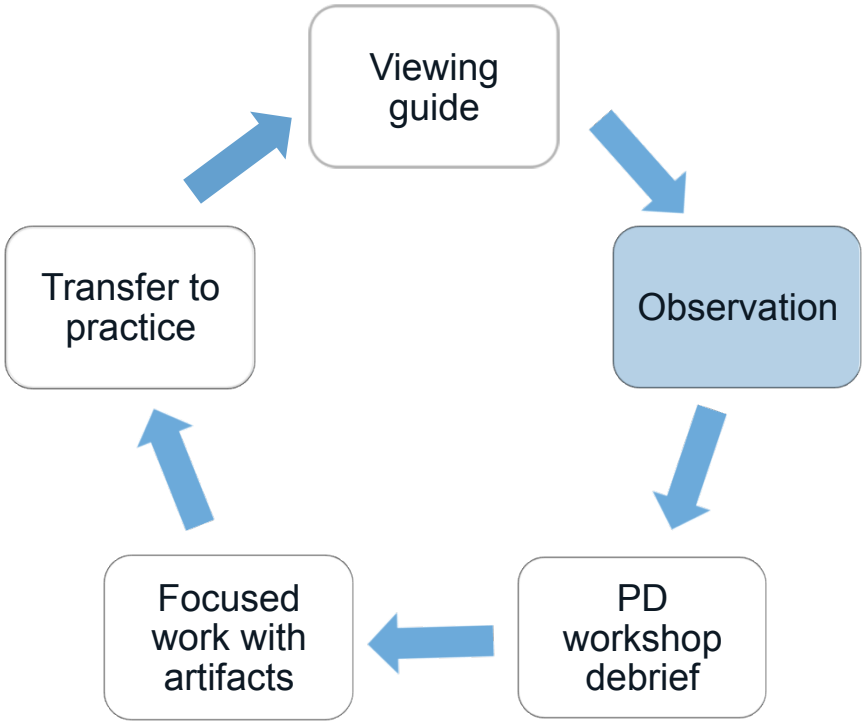
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Dual focus

- Teaching the children
- Making teaching studyable

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Professional development process



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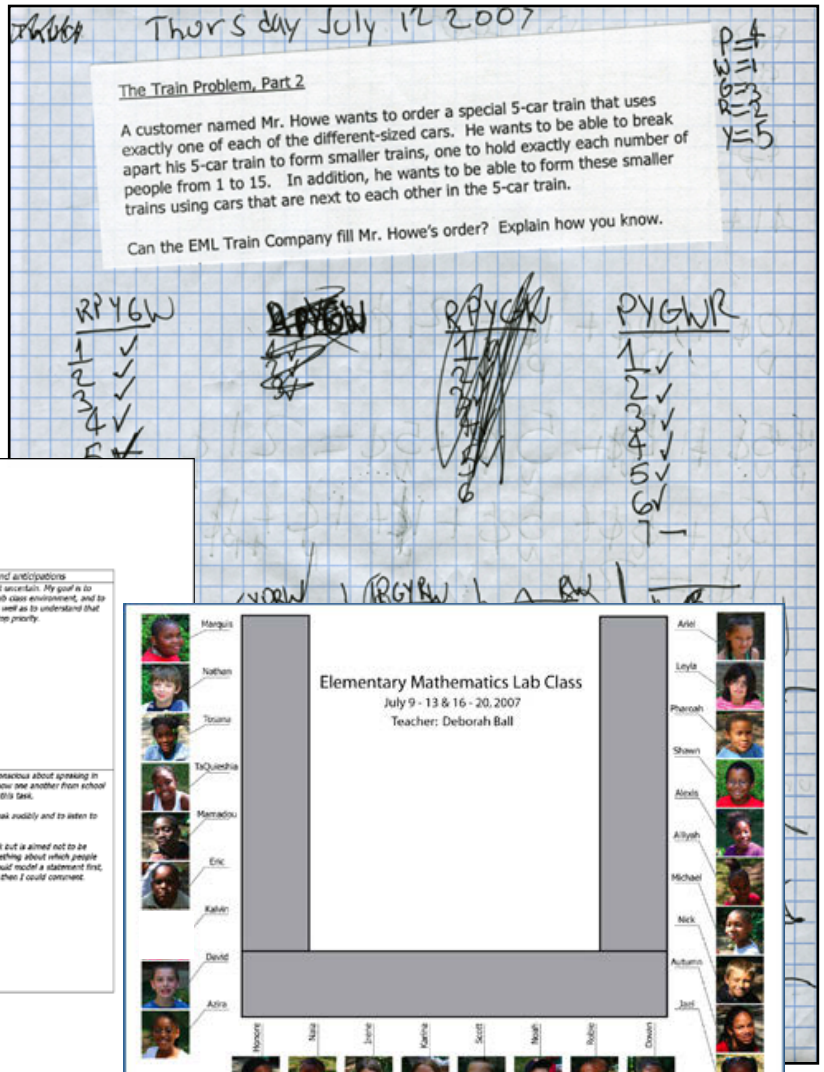
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Debrief



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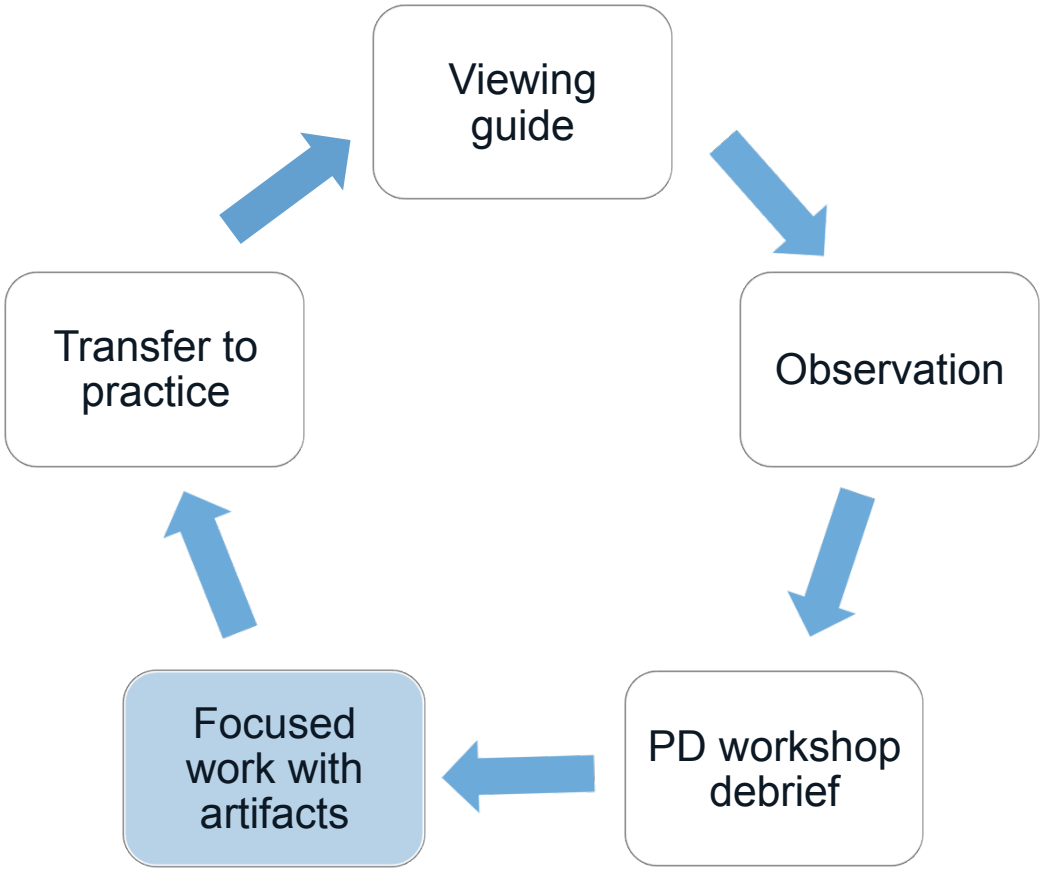
Time/format	Activity segment	Detail	Commentary: notes and anticipations
8:45 – 9:00 whole group	*Introduction to lab class* (without observers)	Meet students at bus and greet them individually. Begin learning names. Explain morning routine and introduce TE student assistants. Get breakfast snack, explain routine. Enter classroom, find their seats (assigned to pair boys and girls as much as possible) and explain the lab class and the observers • Why the observers are here (we are doing interesting mathematical stuff and they are interested in what we do) • What will we do with them (ignore them) • What the EML is	*Students will likely be quiet and a bit uncertain. My goal is to help them understand the unusual lab class environment, and to feel special about being involved, as well as to understand that their learning and well-being is the top priority.*
9:00 – 9:30 whole group	*Official beginning of class*	1) Introduce notebooks and supplies (to be shared between a couple of people; clean up at the end of class) 2) Students talk to person next to them; find out the person's name, and something he/she likes to do or is good at. Then we go around and each child says his/her own name and introduces the other child.[1] *"I'm _____ and this is _____. S/He likes to _____ (and/or) s/He is good at _____."* Practice speaking audibly and asking others to repeat if that per they cannot hear them. I might also ask at certain points for people to recall something someone else said. I need to practice pronouncing the students' names correctly and memorizing them.	*Some students may be shy or self-conscious about speaking in front of the observers. Some will know one another from school and others won't and this will affect this task.* *Important to help them begin to speak audibly and to listen to others.* *The task requires composition of talk but is aimed not to be threatening or embarrassing or something about which people might make fun of one another. I could model a statement first, or I could ask someone to try it and then I could comment.*

[1] *NOTE. Many ideas rejected along the way here because they might embarrass some students, create or reinforce inequities, or not help creating constructive respectful norms.*

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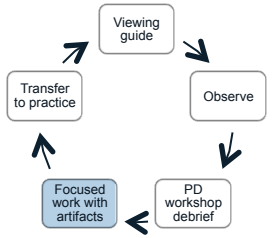
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Professional development process



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Permutations of 1, 2, and 3



- How many different three-digit numbers can you make using the digits 1, 2, and 3, using each digit only once?
- Show all the three-digit numbers that you found.
- How do you know that you have found them all?

Solve the problem and consider how you would explain that a particular three-digit number is or is not a solution.

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The conditions of the problem

How many different three-digit numbers can you make using the digits 1, 2, and 3, using each digit only once? Show all the three-digit numbers that you found.

How do you know that you have found them all?

THREE CONDITIONS

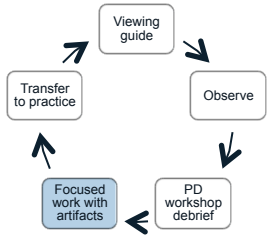
1) Use only 1, 2, and 3
2) Use exactly three digits
3) Use each digit only once

WORK OF THE CLASS SO FAR

- Unpacked the conditions of the problem
- Shared non-examples with justifications

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Classroom video



How many different three-digit numbers can you make using the digits 1, 2, and 3, using each digit only once? Show all the three-digit numbers that you found.

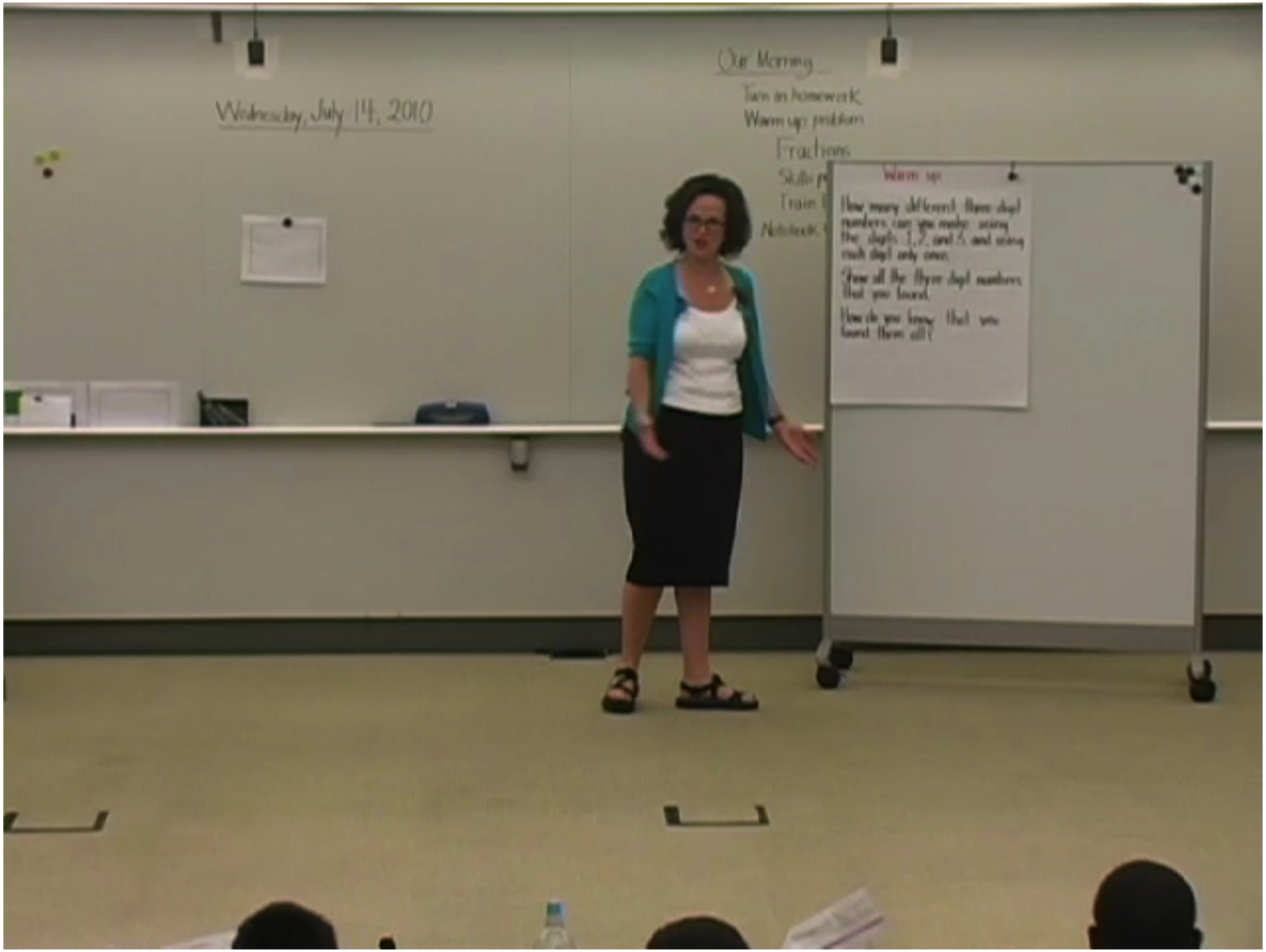
How do you know that you have found them all?

VIEWING FOCUS

To what extent does each explanation:

- Have a clear purpose
- Have a logical structure
- Use representations and language clearly and carefully
- Have a focus on meaning and are oriented to the listeners

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Classroom video

How many different three-digit numbers can you make using the digits 1, 2, and 3, using each digit only once? Show all the three-digit numbers that you found.

How do you know that you have found them all?

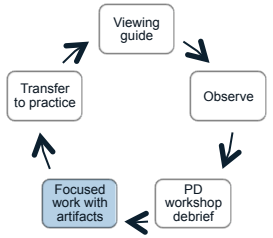
VIEWING FOCUS

To what extent does each explanation:

- Have a clear purpose
- Have a logical structure
- Use representations and language clearly and carefully
- Have a focus on meaning and are oriented to the listeners

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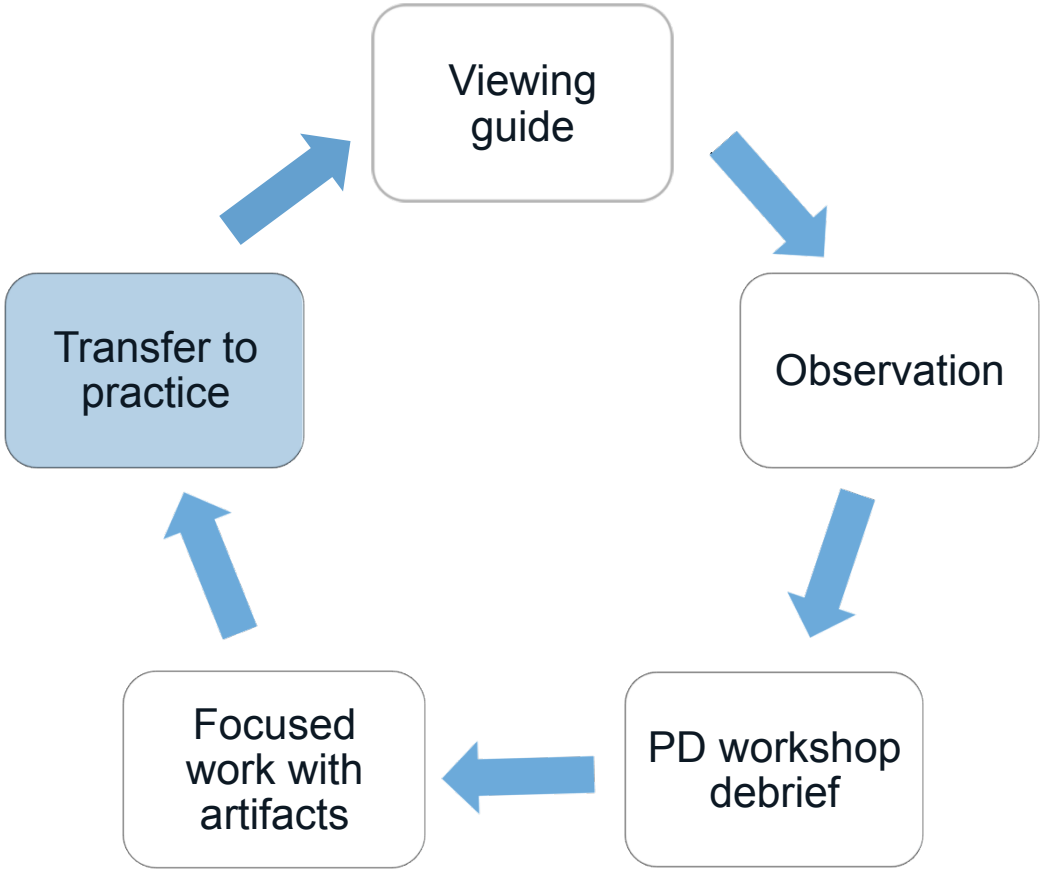
How do you know that you have found them all?

VIEWING FOCUS

- What is the teacher doing to support students in learning to give mathematical explanations?
- What else might the teacher do?

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Professional development process



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Affordances and challenges of using the lab to support this work

AFFORDANCES

- Close to practice
- Able to see impact in real time
- Can test teacher moves
- Teacher impact

CHALLENGES

- Choosing segments for the session on the same day
- Predictability

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Using a laboratory to learn about teaching the Common Core

FINDINGS

- Specific teaching practices that simultaneously "fill in gaps" and also accelerate
- Specific ways to make mathematical practices explicit in class

NEXT STEPS

- Continue to develop ways to support students in constructing oral and written explanations
- Expand work to additional mathematical topics and practices

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Using a laboratory as a resource for professional learning experiences

FINDINGS

- The laboratory can support teachers' learning both in the lab and by using records from the lab
- The explicitness and detail of the work on instruction has been crucial for creating professional learning experiences

NEXT STEPS

- Follow up and support learning in the laboratory during the academic year
- Design opportunities for teacher candidates' learning in the laboratory
- Explore how to make the laboratory accessible using streaming

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Learning from the EML

USING RECORDS OF PRACTICE TO CREATE PROFESSIONAL LEARNING OPPORTUNITIES

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EML records of practice

- Detailed daily lesson plans
- All student and participant handouts
- Video records of prebrief, class, and debrief
- Copies of student notebooks
- Copies of student work, homework, and assessments
- Images of class-produced anchor charts

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How can these records of practice be used to support teachers outside of the laboratory setting?

- Continued support for summer participants
- Topic-focused professional development
- Mathematical practice focused professional development

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CONCLUSIONS

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