“Harnessing” Practice for Professional Learning

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Overview

- What is teaching, and what does it take to get better at it?
- What might be involved in learning in and from practice?
- How can practice be "harnessed" to make learning from experience more educative? Some examples from preservice teacher education

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1. What is teaching and what does it take to get better at it?

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A set of premises about teaching and learning teaching

- Learning teaching occurs mostly from experience.

- Experience is often a poor teacher:

  1) Experience often reinforces familiar assumptions.

  2) Experience leaves no trace.

- Teaching is ephemeral. Many products of teaching are intangible and unknowable.
- Many important aspects of the work of teaching are invisible.

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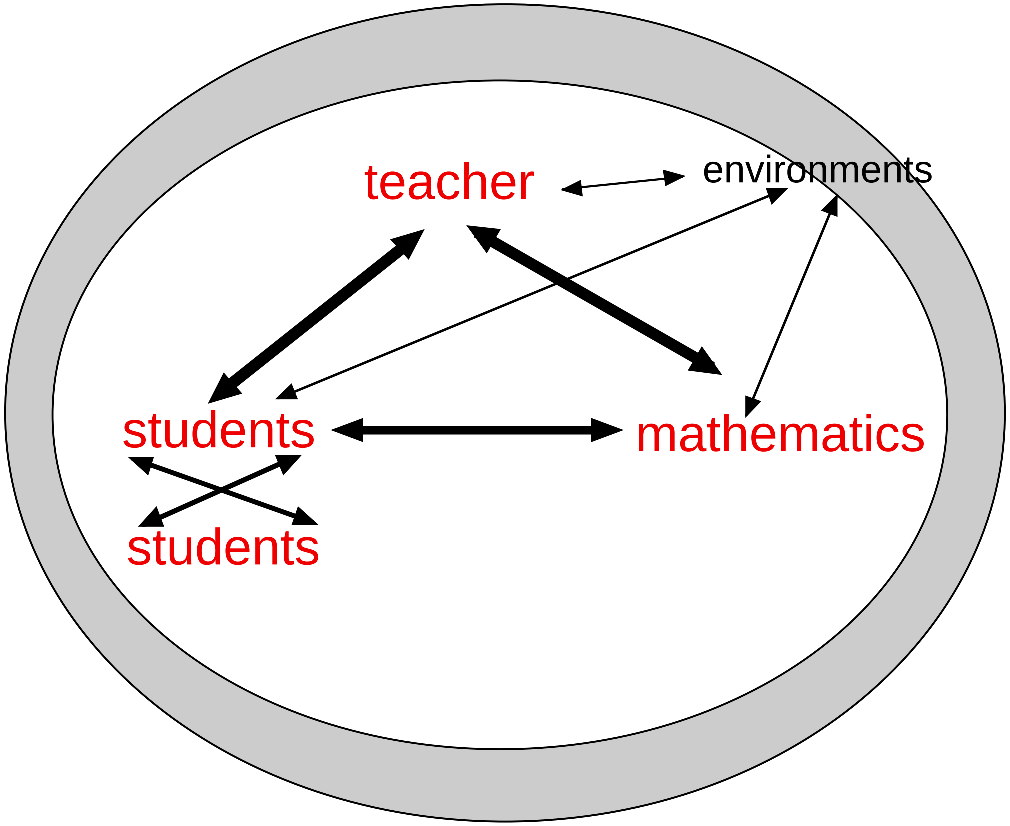
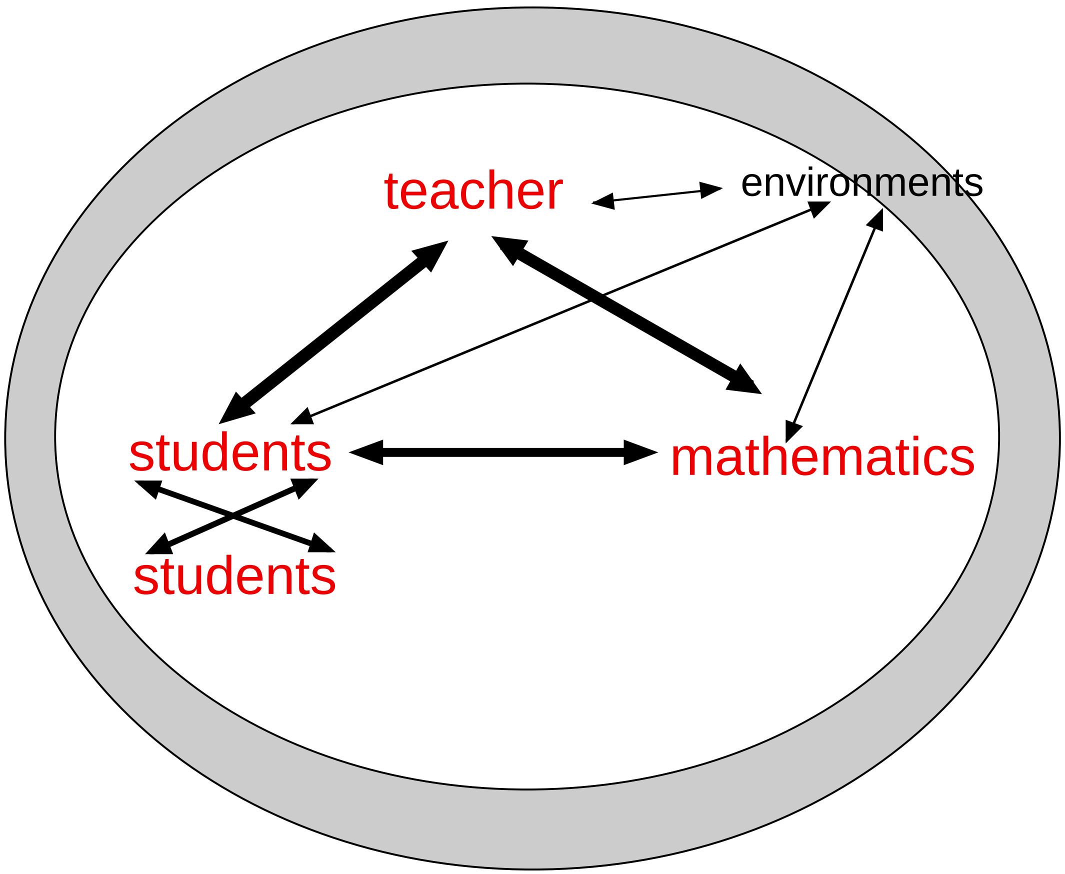
Teaching is a complex practice, not just a domain of knowledge.



Joshua ate 16 peas on Monday and 32 peas on Tuesday. How many more peas did he eat on Tuesday than he did on Monday?



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Three perspectives on teachers' professional learning

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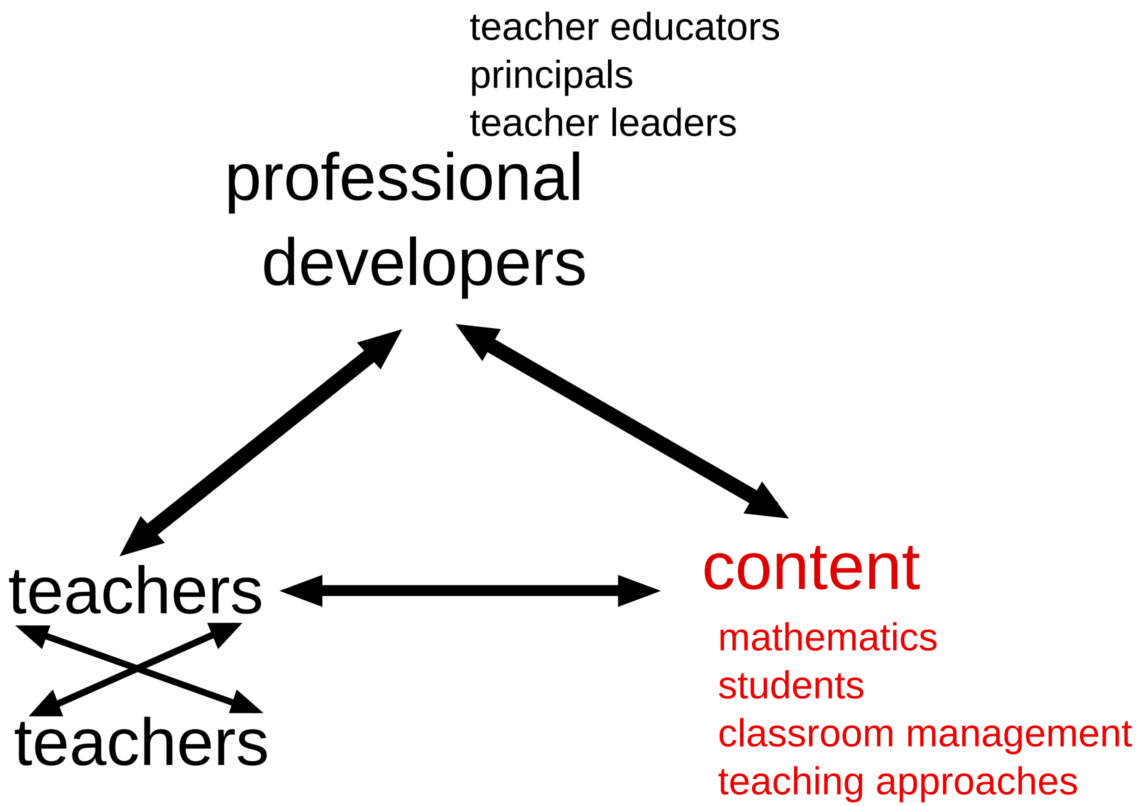

Learning by acquiring new knowledge

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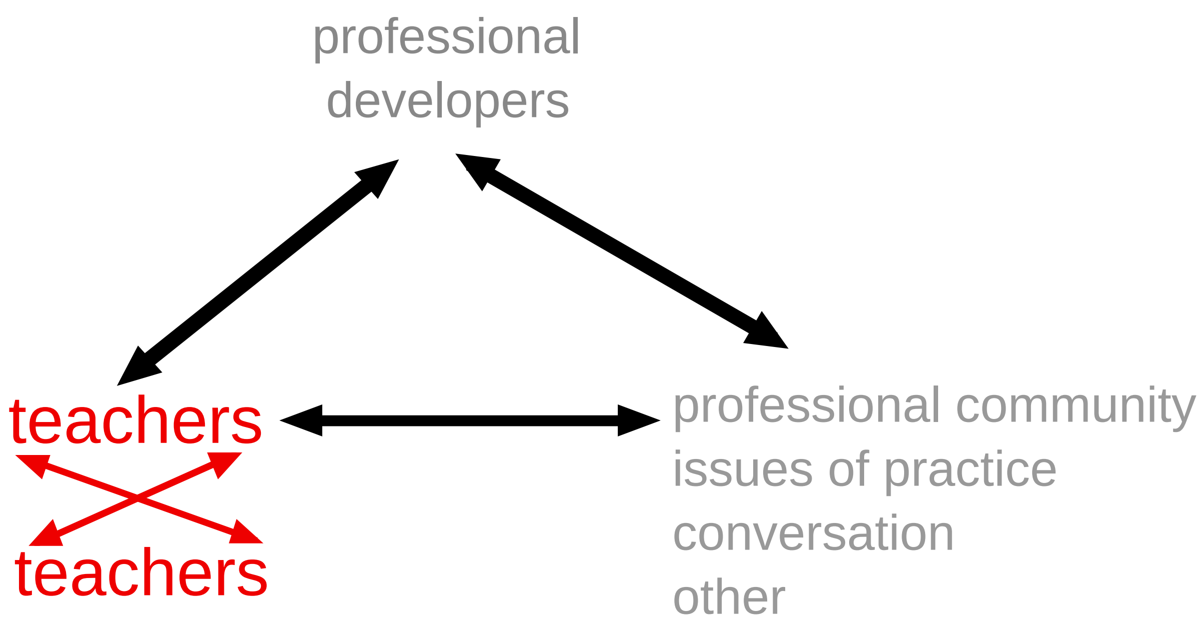

Learning through collegial interaction

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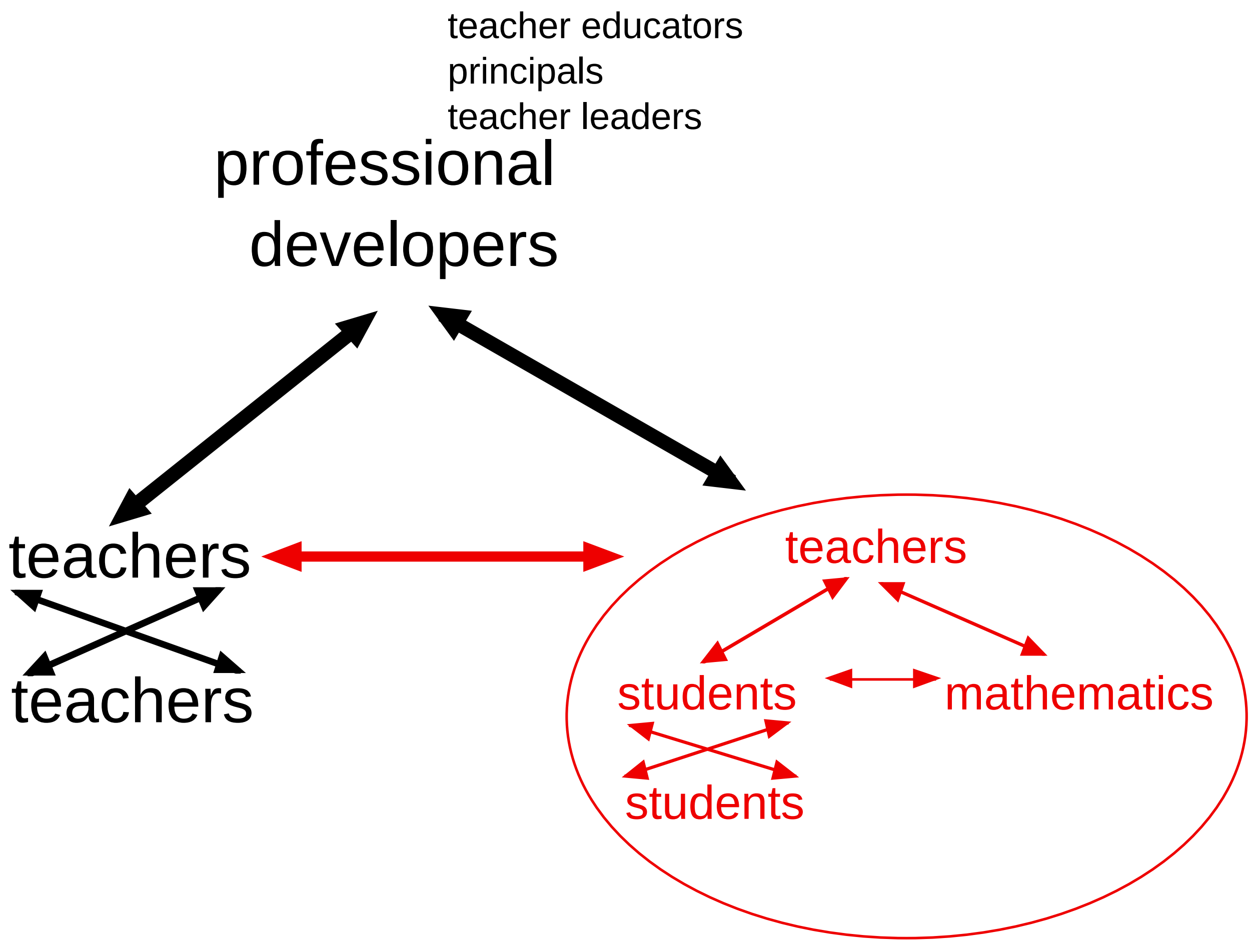

Learning in and from practice

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What is teaching and what does it take to get better at it?

- Teaching is a complex practice.

- Getting better at teaching depends on becoming skillful at using and learning from experience in order to become more skillful at framing, interpreting, and solving problems of practice.

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2. What might be involved in learning and from practice?

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Professional learning: Working on problems of practice

- Listening to and interpreting students' ideas
- Deciding which ideas to take up and in what ways and on what role to play in a discussion
- Sizing up where you are in the larger mathematical territory
- Considering particular children
- Unpacking the mathematics
- Considering the mathematical implications and connections
- Deciding what to do next

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Joshua ate 16 peas on Monday and 32 peas on Tuesday. How many more peas did he eat on Tuesday than he did on Monday?

- What might third graders think or do as they work on this problem?
- What might a teacher have to manage as students work on this problem?

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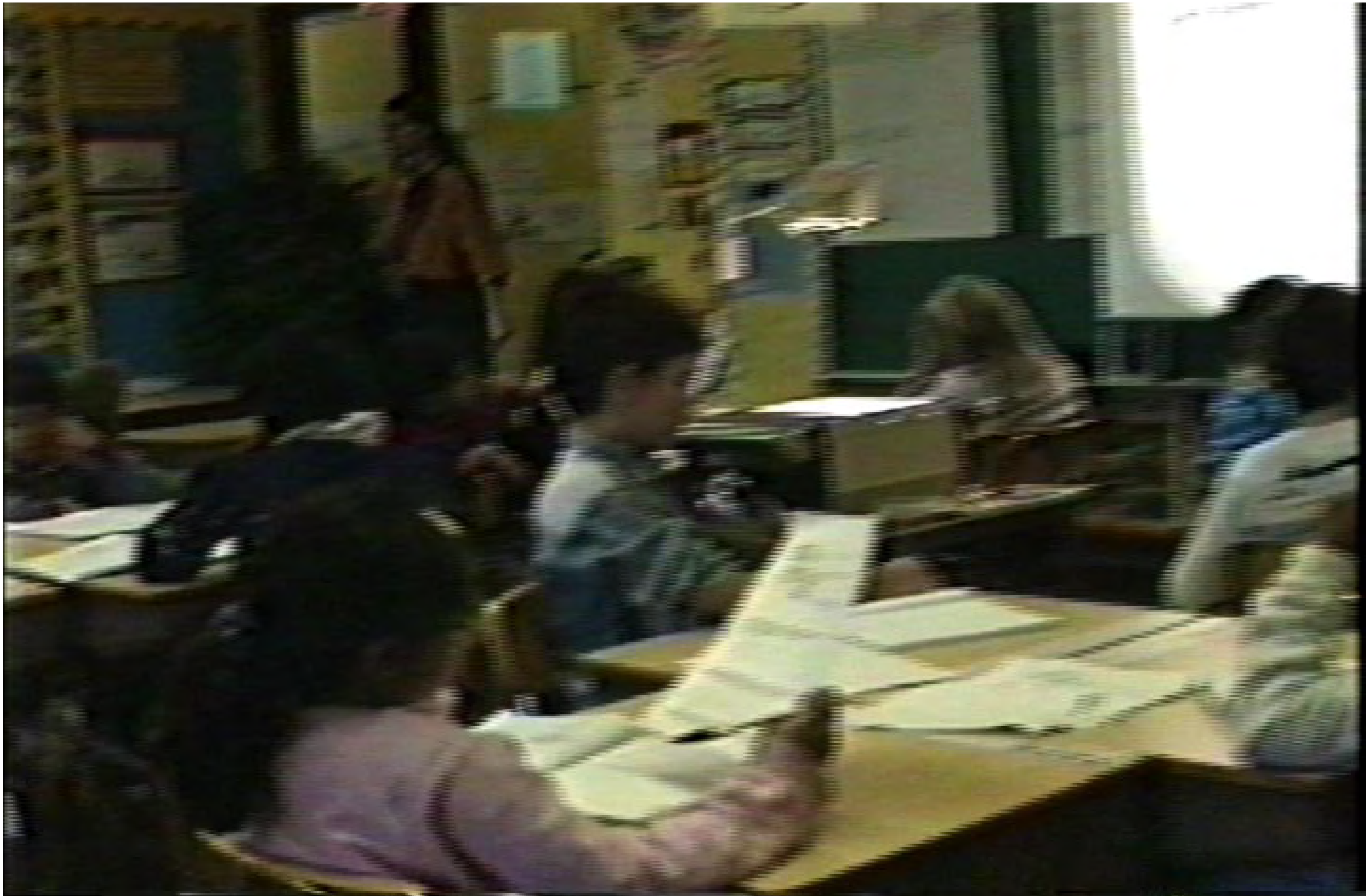

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Studying a segment of practice

**Joshua ate 16 peas on Monday and 32 peas on Tuesday.
How many more peas did he eat on Tuesday than on Monday?**

- **Listening to and interpreting students' ideas**
- **Deciding which ideas to take up and in what ways**
- **Deciding how much to insert yourself into a discussion**
- **Sizing up where you are in the larger mathematical territory**
- **Deciding what to do next**

- **Shea's solution: "I used the number line."**
- **Rania: "I want to prove that his answer is right."**
- **Bernadette disagrees: I used the sticks . . . I got 15 . . . I matched the sticks."**
- **Lin disagrees: "You shouldn't be putting the 16 and the 32 up there."**
- **Other students**

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What might be involved in learning in and from practice?

- Learning to frame and study problems of teaching
- Working on elements of practice
- Working with colleagues to build knowledge of practice in and from practice

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Slides from this presentation available at

http://www-personal.umich.edu/~dball

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3. How can practice be "harnessed" to make learning from experience more educative?

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What are examples of “harnessing” practice?

- Case studies
- Records of practice (video, student work, teacher notes, lesson plans, assessments)
- Lesson study

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Lesson study in preservice teacher education: Two linked examples

- Teacher educators' work on their own practice in a mathematics methods course
- Preservice teachers' work on their own practice in the methods course

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Teacher educator lesson study group

- Five instructors, two "apprentice" instructors

- Selection of problems in our own teaching:

Lesson design, management of class time, interweaving work on mathematics and work on teaching, ways to incorporate issues of equity, making use of records of practice, helping preservice teachers learn to make records of their own practice

- Weekly design meetings-- common lesson plan
- Observing one another's teaching, debriefing and analysis sessions, redesign of lessons
- Discuss student productions and ways to respond
- Making collective products

About significant elements of practice (mathematics, aspects of teaching particular ideas, lessons, tasks, good questions, etc.)

From collective work

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, , 2001
Class #

Things to do before class:

1.

Goals for today's class:

1.

Basic sketch of class activities:

1.

Specific class plans:

1.

Time / format	Activity / task	Notes to myself	Reflections / analysis

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Monday, September 24, 2001
Class #5

To do before class:

1. Get Cuisenaire rods.
2. Put agenda for today on board.
3. Prepare handout for small group work.

Goals of today's class:

- Develop train problem further. Focus on mathematical practices and ideas of (a) simplifying mathematical problems; (b) examining mathematical structures; (c) considering similarity of mathematics problems. (In some ways, these are all about mathematical structure.)
- Identify some of the mathematical work of the train problem.
- Begin developing a sense of core issues related to equity and the teaching and learning of mathematics.
- Work on using professional reading to develop one's teaching practice.
- Foreshadow field teaching assignment.

Basic sketch of class activities:

1. Continue work on train problem.
2. Opening discussion of equity.
3. Work in small (jigsaw) groups on the work of teaching (the same domains as those in which we have been working already — teaching students to participate in the culture of the math class, selecting and using mathematical work to help create patterns and norms of mathematical work in class).
4. Assignments upcoming (including reminder of assignment due Wednesday). We will talk about Project #1 on Wednesday, too.
5. Notebooks: Please turn in notebook sometime when you can spare it for a day — that is, when you can leave it with us overnight and can stop by to pick it back up the next day.

Assignment for Monday, Oct. 1: *(Handout)*

1. Read Lampert, chapter 5, "Teaching While Preparing For a Lesson," pp. 101- 120. Identify three things Lampert *thinks about* or *does* as she prepares to teach on which you would like to try to concentrate as you prepare for your lesson.
2. Study handout (entitled "The task for the teaching assignment: *Write number sentences for 10* (or a "re-scaled" variation of it)")with different versions of the number sentences/train problems. Pick three versions of the mathematics problem and analyze carefully (a) how they are the same and (b) how they differ. Identify the version that seems most appropriate to try with your class and explain why you think so.
3. Work out with your cooperating teacher when you can teach a mathematics lesson to a small group or (preferably) the whole class sometime the week of October 1 or 8.
4. Begin working on plan for lesson (see resources for the mathematics task distributed today; other details to be given on Wednesday).
5. Notebooks: Please turn in notebook sometime when you can spare it for a day — that is, when you can leave it with us overnight and can stop by to pick it back up the next day.

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Specific class plans:

Time/format	Activity/task	Notes to myself	Reflections/analysis
1:10-1:15 **whole group**	Overview of class for today: 1. continue train problem 2. begin work on equity in relation to establishing a classroom culture that can enable the development of mathematical competence 3. upcoming assignments	Discuss videotaping.	
1:15 – 1:45 **whole group**	**Continue work on train problem:** ***Make trains that are equal to an orange rod.*** We want to return to the work we were doing on the train problem. We are doing this for a number of reasons which will become clearer in class today. 1. What are some examples of trains you made? How did you record them? What decisions did you make, and what is useful about your method of recording? *Did anyone organize their solutions, so that the notational/recording scheme was also about the entire set of solutions, not just for a particular solution?* *Might look at an example, or discuss briefly.* 2. Now we want to see if we can figure out how many <u>different</u> trains can be made that are the same length as the orange rod. Today we are going to define "different" as ones that <u>look</u> geometrically different, so p + d will be different from d + p. *Invite guesses.* Are there infinitely many solutions? 3. One thing to try when faced with something like this is to try a simpler problem. So let's try building trains that are the same length as a <u>light green</u> rod. Then for <u>purple</u>. *Discuss solutions. Possibly show way of organizing solutions by number of rods in train. Note table as a means of recording.* 4 . Go back to orange rod. How many 10-rod trains can be made? How many 1-rod? How many 2-rod trains? How many 9-rod trains? Any conjectures about how many trains are possible? 5. So one other reason we chose this problem is that it has some important mathematical similarities to the problems we did on the first day of the course: number sentences for 10 and for 0.1. What do you see as similar? What is not similar? 6. One thing that teachers often have to do is a lot like this mathematical work we have been doing — we have to make simpler (or more difficult) versions of a problem, or even one that is a lot the same for practice. *Connection to my changing from the 3-coin to the 2-coin problem.* Doing this requires careful consideration of the mathematical structure of the problem — and often simplification — as well as what makes something "easy" or "difficult" for students. *Handout with many versions of the number sentences/train problems. Ask students to read,*	<u>Purposes for doing this problem</u>: • to explore mathematical practices involving attention to and use of mathematical structure (try a simpler problem, examine structures, examine similarities across problems) • consider mathematical practices of recording: inventing, choosing and using notation • to begin investigating pedagogical work of scaling • continue building mathematical culture of <u>our</u> class **g=** **w + w + w w + r g** **r + w** **p=** **w+w+w+w r+w+w g+w p** **w+w+r w+g** **w+r+w r+r** similarities: orange can represent 10, so the trains built can be seen as similar to addition sentences for 10 differences: the train problem lends itself best to addition, whereas the number sentences problem can be used with many different operations, and many of you did that	Pedagogical "layer" of problem:

COMPARING MATERIALS FOR MODELING PLACE VALUE AND COMPUTATION

	bundling sticks	beansticks	base ten blocks	Unifix cubes	money
equity issues					
kind of model					
mathematical features					
grade range					
range of numbers					
deployment in class for other students or for teacher to see what kids were doing					
language					
investment required for productive use					

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	bundling sticks	Unifix cubes	beansticks	base ten blocks	money
range of use **For what grades and what numbers are they most appropriate?** **Any material might be used at any grade depending on purpose & students. These guidelines focus on development of place value.**	pre-K to grade 2 0 – 1000 (for counting) 0 – 100 (for addition and subtraction)	pre-K to grade 2 0 – 100	grades 1 to 4 0 – 100 Young children may find the concept of 10 in beansticks abstract and confusing, wondering why ten beans equals one stick.	grades 2 to 8 small decimals to big whole numbers (infinite) By changing the unit or by imagining a progression of tiny flats, tiny rods, tiny cubes, or big rods, big flats, big blocks these can be across a wide range.	grades 3 to 8 0 – 1000 (pennies as ones) 0.001 – 1000 (dollars as ones and introducing "punies" or some other version of a tenth of a cent—as in gas prices) Instruction on money can begin earlier, but as a model for place value it is more abstract.
mathematical elements	can be grouped and counted in different ways and used to count by tens efficiently can be used to link quantity to our base ten-system number system and to represent numbers in different ways can be used to highlight composing and decomposing procedures for adding and subtracting not easy to see the ten in a bundle or to know that it is ten without counting (and, in fact, sometimes a bundle will be bundled imprecisely and will turn out <u>not</u> to be a ten, an unwelcome surprise at times) the bundle or "ten" is actually a group of ten sticks that can be grouped and ungrouped (with a rubber band) the ones are visibly forming the tens bundling and unbundling can be linked to composing and decomposing a ten	can be grouped and counted in different ways focuses on length and comparing by length or "measuring a ten" can be used to explore procedures for adding and subtracting permits breaking numbers into other parts besides ones an tens, e.g., a 10 into 7 and 3 (hence, less focus on grouping into tens and more on other number structure) can see and break apart the individual ones (subitizing) stacking and unstacking can be linked to composing and decomposing a ten the ones are visibly forming the tens	not for counting better for representing numbers and adding and subtracting can count and see the ten but the stick isn't just ten beans and the unit isn't a bean on a little piece of stick the "ten" cannot be broken into groups of another size the choice of ten beans on a stick may seem arbitrary to kids (this could distract or highlight the ten-ness) the ones are visibly forming the tens	can be used to represent large and small numbers as well as all four operations (and different meanings of operations) provides a geometry for place value: length, area and volume as well as repeated shapes completely standardized grooves make it so you can see and count the ten even though cannot be broken apart introduces another level of abstraction because the grooves suggests being made of cubes but they aren't actually cubes (whereas beansticks are discrete beans)	can be used to represent a range of decimals and whole numbers as well as addition and subtraction introduces a more abstract system based neither on counts nor on geometry, but on value ten pennies does not look like a dime, has no relationship physically or visually to dime nickels and quarters are not groups of ten or even of some standard group size (2 nickels in a dime, 2.5 dimes in a quarter)

Preservice teachers' lesson study work

- A whole class of preservice teachers (seniors, UM)
- Drew from interviews of children K-8: issues in learning place value
- Framed a problem of learning place value
- Design of a common lesson to work on place value
- First teaching of the common lesson

  Teacher educator taught to 2nd graders, preservice teachers observed; debriefing and analysis of lesson, and redesign to teach to their own grade level
- Second teaching of the common lesson in their field placements
- Preservice teachers made records of the entire sequence of work

	bundling sticks	Unifix cubes	beansticks	base ten blocks	money
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The common mathematics problem

Using popsicle sticks bundled in tens and loose ones, show all the ways to make 42. Make a record of your work.

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Three examples of preservice teachers' work

What might each student be learning about mathematics, teaching, students, learning, learning to teach, or other things?

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Example #1: Wendy

Besides altering the total number of students and the number of students in the small groups, we also wanted to try a different manipulative, the Unifix cubes. We were interested in seeing if the students' learning would be affected based on the manipulative. There are some definite advantages to using Unifix cubes. We felt that it represented the "bundles" more clearly. Students would be able to visually see there are 10 cubes in a "long." Furthermore, students can construct and deconstruct the cubes more easily than using the rubber bands with popsicle sticks.

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Example #2: Kim

For the manipulatives, the students used popsicle sticks, but one way that might have aided the students would be to use base 10 blocks. While this would have limited the students' ability to group and "bundle," it would also eliminate the problems with making groups besides groups of ten. Another manipulative that might have helped the student would be drawing out pictures of the different options that would make the combinations of 42. Having the students make picture representations of the possibilities gives one more way to visualize the problem. This way might also help some students observe the pattern between the number of "bundles" and the number of loose sticks.

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Example #3: Katy

There were several things about our lesson that we planned to be similar to Jenny's lesson. First of all, we chose to use manipulatives with our students. Instead of using the popsicle sticks, we chose to use flats, longs, and cubes. We chose these for a couple of reasons. First of all, we had witnessed our students using these manipulatives in the class before. We thought that this pre-exposure would help them to stay more focused in this lesson. Also we felt that our fourth graders should work on something a little more advanced than the second graders worked on. The flats, longs, and cubes seemed to be more appropriate for higher level mathematics.

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What is involved in making practice educative?

- Records
- Problems or questions
- Language for distinguishing practice
- Frameworks for practice
- Stance of inquiry toward practice
- Norms for the collective study of practice
- Using mathematical lenses, and developing them

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How can practice be "harnessed" to make learning from experience more educative?

- Choose forms to "harness" practice
- Consider, and mediate, affordances and pitfalls
- Write and read broadly about related work on professional learning in and from practice

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Next steps

- What makes some instances so filled with curriculum potential? Or is any record useful, depending on what one wants to do?
- Development of ideas and materials that can support a systematic "curriculum of practice"
- How do professionals learn to <u>study</u> practice?
- Investigating what teachers learn from different modes of studying practice
- Ways to track teachers' learning validly and reliably as they engage in professional study
- What is the contribution of <u>making</u> records of practice in learning?
- Opportunities for the development of teacher leaders

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