

Detailing Teaching Practice: Why, How —— and Whether?

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What's your orientation?

With whom do you agree most?

Jill: I would really appreciate materials like these because teaching is so hard and this would help me teach well.

Judy: I would be reluctant to work with materials like these, because they do not draw enough on what I know and know to do, and also does not allow room for me to adapt to the learners with whom I am working.

Alex: I would like to work with materials like these because they would make it so much easier to make decisions about how to improve my teaching as I would be able to study closely how particular aspects actually work.

Lucy: I would like to do it if everyone else was using them too so that we could learn from each other.

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The environment of U.S. mathematics education

- U.S. students are not learning as much as they could, or should
- Many causes, but instruction is key
- Students' access to high-quality instruction is uneven and inequitable
- We lack a reliable system of supplying such instruction
- Historically, two principal approaches to addressing these problems

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Improving teaching by recruiting PEOPLE

- Suppose Colin Powell tires of giving $100,000-a-pop speeches and wants to teach high school social studies. Suppose Meryl Streep has a hankering to teach drama. Alas, they would be "unqualified" for a public school. Elite private schools would snap them up, of course, but public schools that are begging for teachers would have to turn them away because they don't have teacher certification. That's an absurd snarl in our education bureaucracy. Let's relax the barriers so people can enter teaching more easily, either right out of college or later as a mid-career switch. Sure, there are lots of other problems in the U.S. education system. But this is one of the easiest to solve.

(Nicholas Kristof, April 30, 2007; *New York Times* op-ed)

- Teaching should be open to anyone with a pulse and a college degree—and teachers should be judged after they have started their jobs, not before.

(Malcolm Gladwell, December 15, 2008; *New Yorker* essay)

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Improving teaching by "teacher proofing" the WORK

- Individualized instruction (e.g., IPI)
- Basal textbooks and scripted teachers' guides
- Curriculum pacing guides
- Computer-assisted instruction (CAI)

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Improving teaching by learning to do the work

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Effective teaching as unnatural and intricate work

1. Teaching requires teachers to do things that are more than commonsense.
2. Teaching involves some moves or orientations that are unnatural in regular adult life.
3. Teaching practice is intricate, requiring a complex combination of knowledge, skill, timing, and relational work.

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Core teaching practices
(examples)

- Anticipating and probing students' thinking
- Diagnosing student difficulties
- Getting to the point in a lesson
- Posing good questions, choosing strategic examples
- Explaining content in terms that students can understand
- Assessing and keeping track of student progress
- Creating and managing a respectful learning environment
- Interacting with students' parents and caregivers
- Treating students with respect

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Teaching practice

- Teaching and learning teaching
- An effective approach must enable agency by a range of different people, in context, while also creating consistency of quality and support for pulling it off

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The case for detail

1. Teaching is intricate work: inefficient to develop by chance and through individual experience
2. Detailing the work of teaching can give credibility to the level of skill involved in doing it
3. Much about teaching is predictable
4. The scale of the occupation: many people must teach; need to provide equitable opportunities to learn: how to do this reliably

This session: Costs and benefits of detailing practice and ways of doing this

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Definitions

- **Detailing**: Talking about and working on teaching in concrete and local detail to support enactment; can be done in different ways:
  - **Specifying**: Offering detail about how to do something in teaching
  - **Prescribing**: Instructing specifically what to do in advance

These are not identical. This session intends to talk about cases of these in sufficient detail to enable concrete examination and consideration.

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Framing questions

1. What are the purposes for detailing teaching practice, and what is the underlying model of teacher learning?
2. In what way is teaching practice treated in detail? What is and is not detailed about practice, and why?
3. What kinds of knowledge are made available in these efforts and who produces this knowledge?
4. In what ways is detailing potentially problematic?

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Four examples

1. Japanese lesson study (classroom teachers working on their teaching)
2. Michigan MMPG (preservice teachers being helped to learn teaching)
3. Delaware (teacher educators teaching preservice teachers)
4. Michigan mod4 (teacher developers working with teachers)

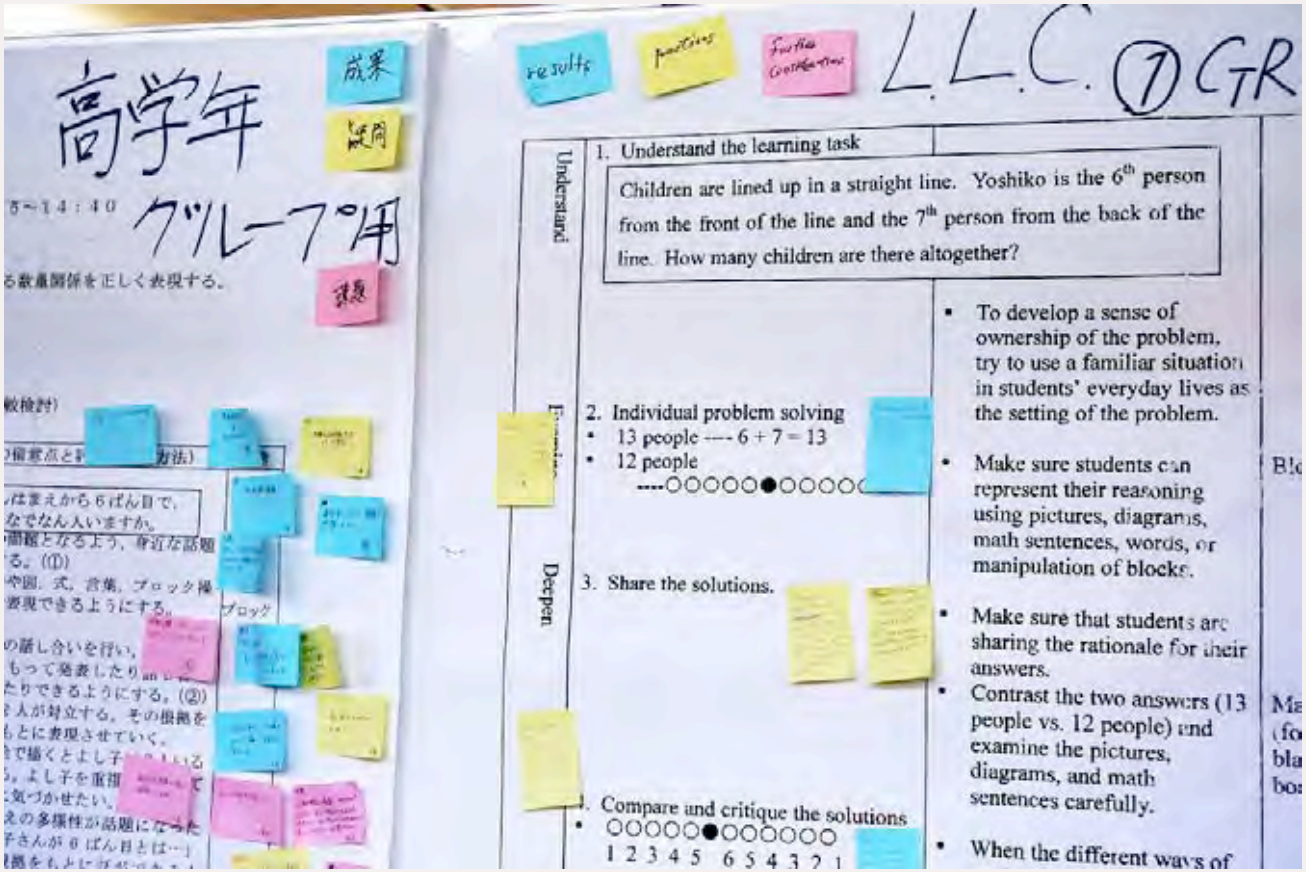
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Example 1: Japanese lesson study

Classroom teachers working on their teaching

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The specification of visual representations in mathematics Instruction: An example from Japanese lesson study



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An overview of lesson study

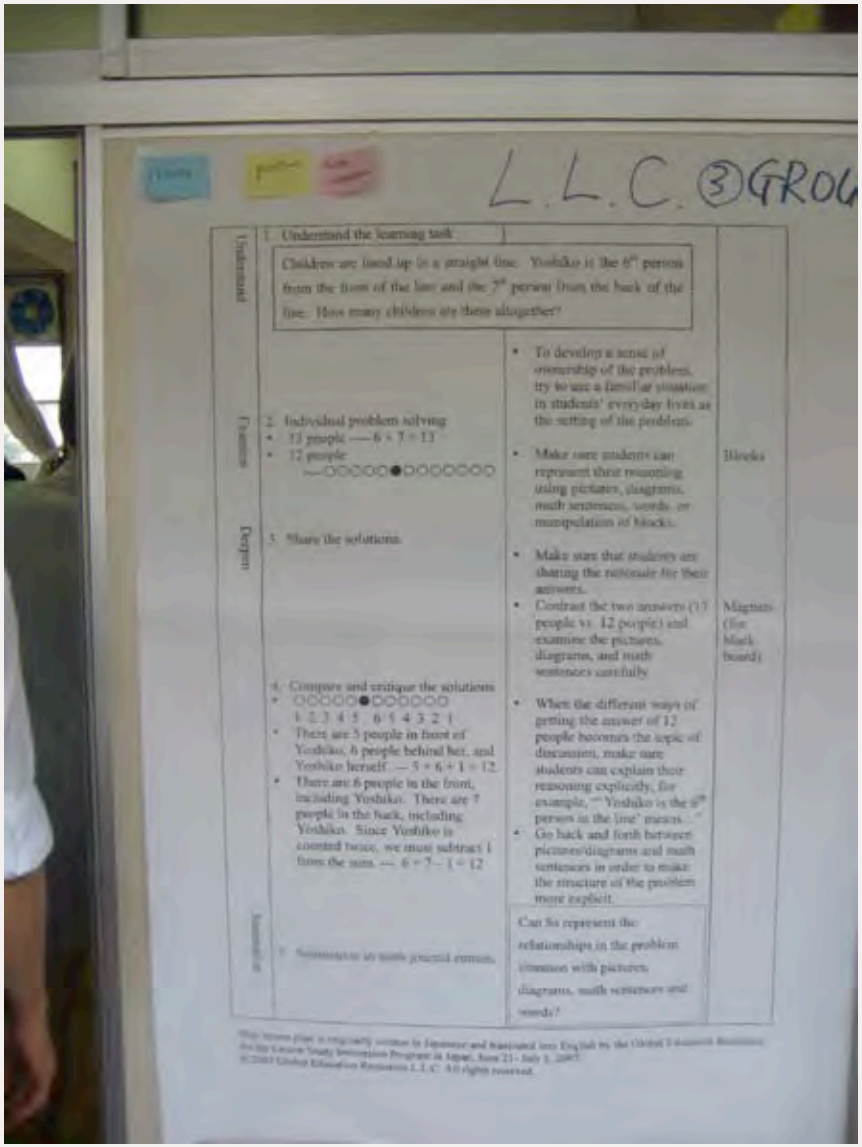
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Lesson study and specification

A single lesson plan is intricately researched, negotiated, and specified, including:

- A range of goals
- An overview of the lesson
- Lesson outcomes and ways to assess these outcomes
- Ways to motivate or excite the children
- A teaching script, including anticipated children's ideas and teacher responses in a discussion
- Visual representations of mathematical ideas
- A concise summary or conclusion for the close of the lesson

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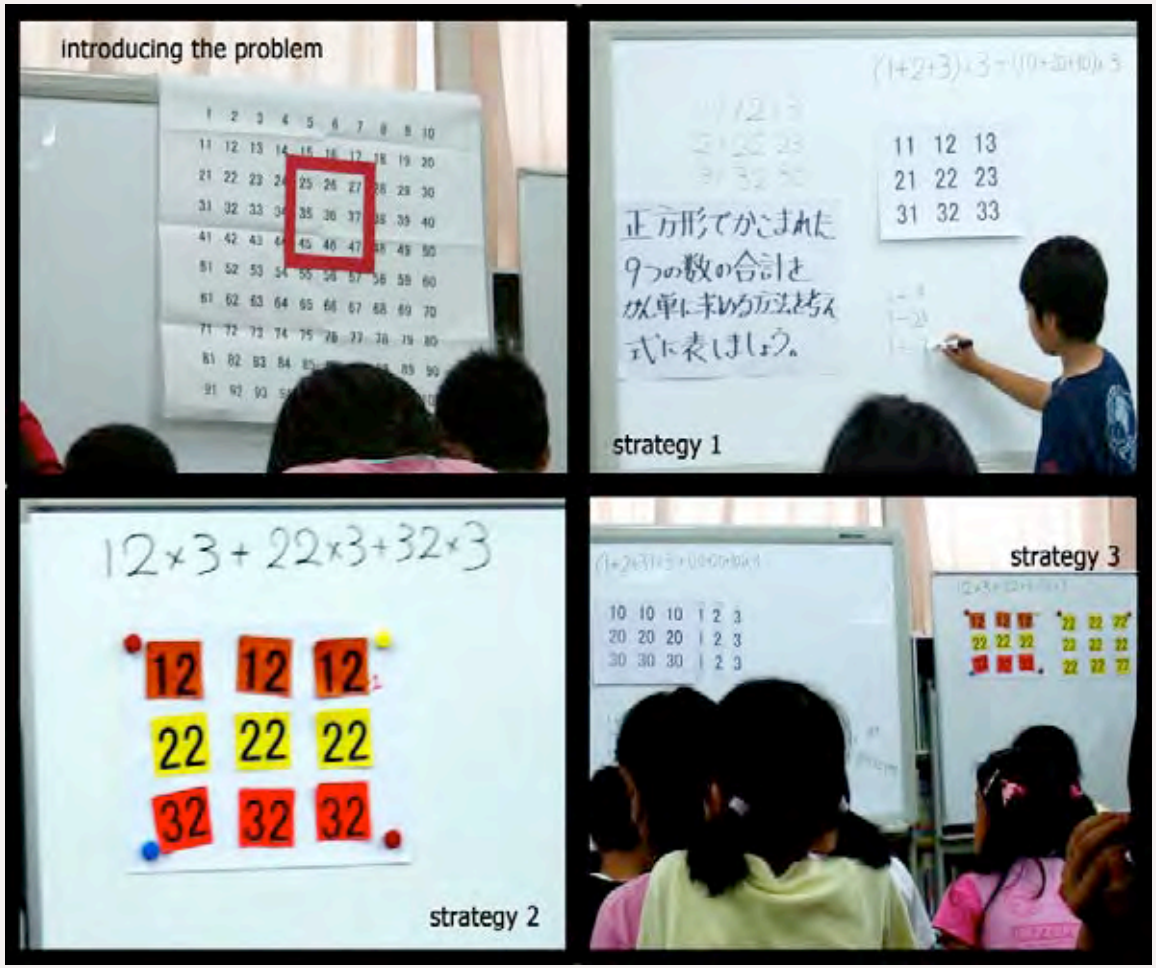
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What are the purposes for specifying teaching practice, and what is the underlying model of teacher learning?

- For children's learning:
  - To direct learning about averaging clearly and sequentially
  - To think through all possible solution paths and make them explicit, in order to be prepared for students' individual and group work, their ideas, and their turns in discussion
- For teachers' learning:
  - To make visible the thinking of the teacher and his planning team
  - To invite observers into the deliberations about teaching this content
  - To generate a record so that participants can compare what the planners anticipated and what actually transpired with children
  - To generate and maintain a sense of collective endeavor

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In what way is teaching practice "specified," or treated in detail? What is and is not specified about practice, and why?



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What kinds of knowledge are made available in these efforts and who produces this knowledge?

- Teaching practices are "unpacked" or "decomposed"
  - Content knowledge
  - Knowledge about children and child development
  - Relational work
  - Pedagogical moves
  - …and then "recomposed"
- Collectively produced
- Cross-occupational contributions



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In what ways is specification potentially problematic?

- For children:
  - Curtails responsiveness in the moment
  - Precludes mathematically productive diversions and digressions
  - Funnels ideas towards teacher's desired conclusion
- For teachers: How is teacher agency affected?
  - How porous are these specifications?
  - Who gets to specify or modify?
  - Who creates and receives knowledge?

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Example 2: MMPG

Preservice teachers being helped to learn teaching

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Specification in MMPG

- Specification of *teacher education practice* for course instructors
- Specification of *teaching practice* for preservice teachers

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What are the purposes for specifying teaching practice, and what is the underlying model of teacher learning?

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Underlying model of teacher learning

- Learning in, from, and for practice
- Practice as the content, a context for, and a method of learning
- Cycles of engagement and feedback in increasingly complex practice

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Purposes of specification

- Teaching is complex: hard to "see" and learn to do well
- Enables decomposition of practice so it can be articulated, unpacked, studied, and rehearsed
- Holds aspects of teaching "still" and/or reduces in-the-moment complexity
- Assessing practice requires specification of what the work is and what competent performance looks like

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In what way is teaching practice specified?
What is and is not specified about practice, and why?

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Specification of teaching practice for preservice teachers

Focus on practice in four domains

- Planning mathematics lessons
- Assessing students' mathematical knowledge, skills, and dispositions
- Representing mathematical ideas
- Leading a whole-class discussion about mathematics

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Challenges of specifying the work of leading a discussion

- Discussions are (by definition) interactive
  - Can't specify what students are going to do/say
  - Teacher moves are contingent on student responses
- Mathematical substance and appropriate moves depend on problem and purpose of discussion
- Many field classrooms do not routinely engage students in discussions of mathematics problems

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What have we tried to specify?

- Specified an overarching structure for the discussion of a mathematics problem
  - Five components: (1) setting up the task; (2) monitoring student work; (3) launching the discussion; (4) orchestrating; (5) concluding
- For each component, we have worked on specifying:
  - What the teacher is trying to accomplish
  - Things the teacher should consider or do during its planning and enactment
  - Specific moves the teacher can use
  - What competent performance looks like

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Written forms of specification

- Planning frameworks
- "Tool boxes" of teacher moves
- Lesson sketches
- Discussion protocols
- Grading tools

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Planning frameworks

1. Setting up the task
   - How will you present the task to students?
   - What materials will you and the students need?
   - If needed, how will you familiarize students with representations used in the task?
   - What should students do if they finish the task?

2. Monitoring student work
   - What will you look for or listen for to determine if students are engaging with the task?
   - What will you do to learn about and keep track of what students do as they engage with the task (e.g. what strategies students are using, errors they are making, etc.) that might inform how you lead the discussion?
   - What questions or variations will you pose if students finish quickly or have trouble getting started?

3. Launching the discussion
   - How will you start the discussion of students' solutions and strategies? (i.e., What specific question, example, or idea will you use?)

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"Tool boxes" of teacher moves

6. Extending students' current thinking, and assessing how far they can be stretched

- *What happens if you plug in different numbers?*
- *How would you explain that to a ___ grader?*
- *Are any other answers possible?*
- *What changes if you (add, subtract, multiply, divide) instead of (add, subtract, multiply, divide)?*
- *How else can you express that number?*
- *Can you give an example?*
- *What happens if you change the sign [of the number]?*
- *Can you think of a situation where that wouldn't be true?*
- *Would it still be true if _____?*
- *What would happen if _____?*
- *Is that always true?*
- *How can we test it?*
- *Can we come up with a general rule?*
- *What other ways can we represent the solution?*
- *Can you show us (with a picture)?*
- *Can you solve it a different way?*
- *Can you use this same method to solve _____?*
- *What would happen if the numbers were changed to _____?*
- *What if the problem was like this instead: [give slight variation of problem]?*
- *If someone said [wrong answer], how would you respond?*
- *Can you think of another problem that could be solved with this method?*

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"Tool boxes" of teacher moves

When setting up the task with the students

Establish the work environment

- Make sure students know where to sit
- Do introductions (if needed)
- Give clear, explicit instructions
- Establish expectations for work
  - Explain materials students will use and how they should record their work
  - Establish who students will work with (individually, with partner, in group, etc.)
  - Explain what will be done with the work that is finished (e.g., Tell students they will be asked to explain their thinking.)
  - Establish time frame (e.g., how long students will have to work, that they will be discussing their solutions, etc.)
  - Explain what students should do if they finish
  - How students signal when they need help or want to ask a question

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Lesson sketches

~ 6 min	Orchestrating the discussion	Discuss one pair of fractions at a time. The following sequence of questions might be helpful: • Ask for a volunteer to explain which fraction they think is greater. • Ask a student to revoice, or to make a connection with how they were thinking about it. • If students have different answers, discuss until resolved by getting different people to explain their own and other's thinking. If everyone says the same fraction is greater, ask if anyone has a different way of explaining why. • If no one says the incorrect answer, could ask a "what if" question about the pair that gets at a common misconception or unmentioned strategy (e.g., What if a third grader said that 4/4 and 4/8 are equal because they have the same number of pieces?) Continue with as many pairs as you have time to discuss. You don't need to discuss all of the pairs. It is better to discuss multiple strategies for each pair.
~ 1 min	Concluding the discussion	Summarize one of the comparison strategies that was discussed. Conclude with a comment about how they listen to and/or responded to each other's ideas.

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Discussion protocols

	Questions, prompts, or points to try	Commentary on situation or rationale
Setting Up the Problem	• What is happening in this problem? • Can someone try saying that in her own words? • What is the problem asking us to figure out?	Use questions like these to build common understanding of the problem. If you believe that students do not have a clear enough understanding of the problem after you have tried these questions, you may need to explain a bit more about whatever aspect of the problem would prevent students from starting on the problem. As you talk it is critical to be careful not to diminish the work you are hoping the students will do by "giving away" what students are supposed to be figuring out.
	• What sorts of tools might be helpful when working on this problem? • I am going to have you work on your own at first and then share your method with a partner. • Lets be ready to share with the group in 5 minutes.	Use questions and comments like these to establish the work environment for solving the problem. Students need to know information about materials, time, social arrangement, and expectations
Monitoring Student Responses: The teacher circulates around the room attending to what students to as they work on the task and using what is learned to think about "what and who to make focal." (Lampert, 2001)		
Launching the Discussion- The teacher invites contributions with an initial question that points the discussion in a goal-driven direction.		
Orchestrating Contributions- The teacher encourages students to engage in extended dialog about key facets of the problem by sharing their ideas in multiple ways and attending to the contributions of others.		
Concluding the Discussion- The teacher recaps or surfaces key mathematical and/or social dimensions from the discussion		

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Grading tools

Aspects of **Enacting Instruction**	Performance Description and Comments	
Setting up an instructional task	The set up: • supports students access to the task (all students, maintains mathematical demands) • establishes the work environment (work format, time, materials, expectations) • is accomplished in a suitable time span (corresponds with student familiarity with mathematics, task structure, representations) • effectively distributes materials	
	Comments on Performance	
	Strengths:	Site(s) for further improvement:
Launching a discussion	The launch: • reestablishes whole-group work format • points work in the direction of the instructional purpose and content of the task • elicits responses • is understood by respondents	
	Comments on Performance	
	Strengths:	Site(s) for further improvement:
	The discussion:	

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What is not specified, and why?

- Depends on context
  - Easier to specify teaching the more particular the instructional setting and task
  - Different types of and purposes for discussions impact what is and can be specified
- Depends on location in cycle of work on that practice
  - Continuum of specification from more to less
  - Gradually add on and integrate new practices
  - Gradually add nuance and complexity to already detailed practices

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What kinds of knowledge are made available and who produces this knowledge?

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Kinds of knowledge made available

- Considerations to make when planning and enacting discussions
  - about the task, mathematics, students, teaching moves, materials, environment
- MKT
- Teaching moves and their purposes
- Images of competent practice

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Who produces that knowledge?

- Structures, organizations, and names are typically provided by teacher educators
- Preservice teachers are involved in "unpacking" practices through course activities and assignments
  - Studying records of practice
  - Analyzing and receiving feedback on their own practice
  - Observations of and interactions with CTs
  - Readings

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In what ways is specification potentially problematic?

- Might encourage preservice teachers to plow through protocols or use teaching moves without attending to students or mathematics
- Might encourage preservice teachers to focus on "What am I supposed to do next?" rather than on "What are students supposed to be learning?" and "What is my purpose in doing this?"
- Can be hard to pull general practices out of the specifics
- Can be hard to reintegrate into more holistic tasks of teaching
- Can be mismatched to context, task, and instructional purpose

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Example 3: University of Delaware

Specifying the teaching of pre-service mathematics courses: A long-term project on improving teaching

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Project on improving teaching

Goals of the project

- Build a knowledge base for teacher education.
- Represent what we learn about effective teaching in a form that allows all instructors to share, test, and modify the knowledge.

Achieving these goals requires specifying our teaching.

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Context

K-8 mathematics teacher preparation program:

- 3 mathematics content courses
- 2 mathematics methods courses
- Student teaching

Several sections of the courses are offered each semester.

Several instructors teach each course each semester.

- 7 faculty
- Approximately 10 doctoral students

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Improving knowledge for teaching through highly specified lesson plans

Each lesson plan specifies:

- lesson learning goals
- instructional activities
- rationales for including instructional activities
- time allocations
- some teacher explanations
- predicted student responses

Reasons for specification are

- unless the details are specified, we have no way of studying the effects of teaching and improving it
- the best we know should become standard practice.

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Learning goals

Learning goals for pre-service teachers are specified—in lesson-level detail.

- Example: Prospective teachers will understand how to represent subtraction of fractions with a story problem. This involves understanding the need to employ the same referent for each fraction as well as being able to distinguish story problems in which the referent is the same from those in which the referent is different.

Without such specification, it is impossible to measure improvements in teaching.

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Knowledge for teaching

Knowledge of students' thinking: predicted student responses, history of the lesson

- Example: A common error pre-service teachers make when writing subtraction story problems is treating the minuend as the referent for the subtrahend. For example, a number sentence like 8/5 – 1/2 = ? would be matched with a story for 8/5 – (1/2 of 8/5), or 8/5 – (1/2 × 8/5).

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Knowledge for teaching

Strategies for teaching toward particular learning goals: instructional activities, proven explanations

- Example: Write one story for **8/5 – 1/2**, and one story for **8/5 – (1/2 of 8/5)**. Then draw a diagram to represent and solve each number sentence.

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Challenge 1:
Changing common perceptions of "scripted" instruction

Usually caricatured as "teacher proofing" the curriculum

- Some justification for this (many prescriptions based on opinions of "experts")
- The danger is that all prescriptions are painted as undermining teachers' professionalism

The lesson plans (scripts) we develop are products of teachers' professional work

- They are the outcomes of teachers' creativity and research
- They are (tentative) answers to "How can we best help students achieve learning goal x?"

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Challenge 2:
Specifying instruction in ways that communicate well

Written lesson plans cannot fully capture subtleties of teaching

- We have found more variation than our knowledge warrants
- Video examples are needed as supplements

Level of detail can be too small or too large

New instructors often need different specifications than experienced instructors

Specifications must both (1) communicate knowledge acquired (justify current prescription) and (2) invite innovation (to search for improvements)

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Conclusions

Specifying teaching is essential for studying and improving it

Specifying teaching can promote, capture, and build on teachers' expertise rather than undermine it

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Example 4: mod4 Project

Teacher educators and professional developers working with teachers

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mod4 Project

- Developing materials for preservice teacher education and inservice professional development
- Focused on helping elementary teachers develop mathematical knowledge for teaching (MKT)
- Tasks and supports for teachers educators and professional developers (facilitators) to use in their work with teachers

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What are the purposes for specifying teaching practice, and what is the underlying model of teacher learning?



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Underlying model of teacher learning

- **For teachers:**
  Practice as the content, context for, and method of learning
- **For facilitators:**
  Use of representations of practice and design of simulations of components practice for enactment and analysis

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Purposes of specification

Specification allows for several things when grounding teacher learning in practice –

For teachers:

- Holds some of the complexity teaching "still" so that focused work can be done on MKT
- Enables MKT, embedded within practice, to be articulated, studied, and rehearsed

For facilitators:

- Provides detailed supports to help facilitators attend to and focus teachers' work on the special *mathematical* knowledge and skills needed for *teaching*



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In what way is teaching practice "specified," or treated in detail?

What is and is not specified about practice, and why?

For facilitators: Two levels

1. Specifying the kinds of representations and designs of simulations of practice to be used with teachers
2. Specifying the *reasons* for these representations and designs, and *how* they may be used to support teacher learning of MKT

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An example of specification in mod4 materials:

Task: Viewing video records of a third grade mathematics lesson to study mathematical definitions emergent in student thinking

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MKT focus

Helping teachers develop –

- a flexible command of the mathematical terrain of the instruction, and
- knowledge of student thinking and learning

And the capacity to–

- hear and evaluate significant emergent mathematical thinking among the children who do not yet have the more formalized concepts, language, and notation with which to articulate or represent their ideas

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What have we tried to specify in this use of video?

- Preliminary setup
- Goals for the work
- Contextual setup of the video
- Preliminary viewing task
- Viewing focus setup and video viewing task
- Post-viewing reflection
- Post-viewing discussion
- Transition to session wrap-up

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Preliminary viewing task

Detailed description of activity	Comments & other resources
<u>Optional preliminary activity before introducing the viewing focus:</u> If you have extra time available (approximately 15 minutes), you might want to do a preliminary activity before launching the viewing focus. (See the notes on the right for the rationale and suggested work.)	*This video can provoke strong reactions among viewers who sometimes find the teaching quite exciting or rather troubling. It can be helpful to allow time for general reactions to be aired so that these first impressions are given some attention. Often this preliminary activity enables viewers to then turn to the viewing focus more directly. You may want to –* • *Delay presenting the* Viewing Focus *and say that you will be showing the video through once before turning to the real focus of the work. Point out that people often have strong reactions to the teaching shown in the video and you want to provide them a little time to make general comments before returning to your work on definitions.* • *Show the video all the way through and spend a few minutes collecting comments. When you are ready to move on, you might want to mention that the teaching practice captured in the video makes the children's reasoning and ideas more visible and available for examination than might otherwise be the case. (This can be said regardless of how people feel about students' interactions and the teaching.) You can then say that the group will move on to watching for and discussing the children's ideas and reasoning.*

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Viewing focus set up and video viewing task

Setting Up The Viewing focus

- While watching this video, try to figure out what the children understand about what an even or an odd number is.
- What definitions – or implicit definitions – of "even number" do you hear?
- Take notes on the transcript; be prepared to give specific references to important moments in the video that shed light on the children's ideas about even and odd numbers.
- There will be time immediately after watching the video to look over and add to these notes.

Viewing Focus

- What do children in this class understand about what an even or an odd number is?
  - What definitions do they have for "even number"?
    (What evidence do you have?)
  - What other observations can you make about their knowledge of even and odd numbers?
    (What evidence do you have?)

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Viewing focus

- Classroom video is rich and complex; there can be too much to take in and productively process in one viewing
- Need to focus on particular phenomena (the teacher, discourse patterns, participation structure, use of public space, etc.)
- Specific framing questions to be explored
- Answered with evidence from what can be seen/heard on the video

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Supporting materials for video viewing task: Sample transcript

Seating Arrangement



January 19, 1990. *On this day, the teacher began the class by asking students for comments on the meeting they had had the previous day where they talked about even and odd numbers with students from another class. A few minutes into the discussion, a boy named Benny made the observation that even numbers can be "made" from two other even numbers--like 4+4 or 6+6. This video segment opens with the teacher asking if anyone has other comments. She calls on Shea who has his hand raised. Shea doesn't have a comment about the meeting but he has noticed something special about the number six which he claims can be an odd and even number.*

1:05:31

Teacher:	More comments about the meeting? I'd really like to hear from as many people as possible what comments you had or reactions you had to being in that meeting yesterday. Shea?
Shea:	Um, I don't have anything about the meeting yesterday, but I was just thinking about six, that it's a. . . I'm just thinking. I'm just thinking it can be an odd number, too, 'cause there could be two, four, six, and two, three twos, that'd make six...
Teacher:	Uh-huh . . .
Shea:	And two *threes*, that it could be an odd and an *even* number. Both! *Three* things to make it and there could be *two* things to make it.
Teacher:	And the two things that you put together to make it were odd, right? Three and three are each *odd*?
Shea:	Uh huh, and the other, the twos were even.
Teacher:	So you're kind of--I think Benny said then that he wasn't talking about *every* even number, right, Benny? Were you saying that? Some of the even numbers, like six, are made up of two odds, like you just suggested.
	Other people's comments?

1:06:36

Teacher:	Tina?

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Viewing focus (cont.)

- Framing questions guided by:
  - Goals of the session
  - Knowledge of what teachers (now in the role of learners) bring to this material – knowledge, dispositions, misconceptions, etc.

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Post-viewing discussion

Detailed description of activity	Comments & other resources
Taking comments **Grounded in evidence:** As teachers share their comments, consistently press them to identify where in the transcript or video they saw or heard whatever it was that led to their claim. This is an important form of rigor for making observations; it also lessens the risk of having personal beliefs/positions dominate the discourse. **Generating notes/making comments hearable:** Write brief notes in the public space about people's observations (or have one of the teachers help you); use the note-taking process as an opportunity to restate ideas clearly and concisely (have the person who made the comment assist with this if it is helpful to you/them). Also, record the transcript location (line numbers) that served as the basis for each comment. **Making connections:** As the notes are generated, ask teachers to look for connections or contradictions among the comments; you may want to briefly comment about interesting or helpful connections you see or press people to resolve apparent contradictions, refine their statements, etc. if it seems important.	*There is a notes template available for taking discussion notes that can be projected from a computer.* *See notes sample to see how the template can be used and the types of comments that often arise during this discussion.*
Examining children's definitions Three significant definitions (or ways of thinking about even numbers) that the children used in the episode should surface from this discussion: • **Fair share** – a number is even if it can be made of two equal groups with none left over, using only whole numbers) (Shea) • **Pairs** – a number is even if it can be grouped in pairs, with nothing left over) (Ogechi) • **Alternating** – even and odd numbers alternate on the number line, starting with zero being even) (Tina) If one or more of these definitions does not surface, you might consider: • Calling specifically on someone you noticed had picked up on the missing definition(s) during the individual reflection time or pair discussions • Asking about the definition or understanding of *even number* that one of the specific children used (e.g., How was Tina determining whether 6 was even or odd in lines 28-33 of the transcript?) • Asking the group if there is evidence that indicates the children had another way to tell whether a number—like 1, 2, 3, 4, or 10—is even or odd?	*You could also ask about definitions of or assumptions about odd numbers.* *If the teachers seem to cover this ground with some confidence, you might ask them to consider how they might try to reconcile the definitions. For example,* • *Are the children's definitions compatible? How could you show this?* • *If the definitions are all correct, then how could you prove that the fair share and pairs definitions are equivalent – in other words, that a number is even by one definition if and only if it is even by the other?* • *Which of these would it be easiest to show is equivalent to the alternating definition?*

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What kinds of knowledge are made available?

Who produces this knowledge?

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Kinds of knowledge made available

In this example

- The nature and roles of definitions in mathematics
- How these manifest themselves in mathematics instruction and student thinking
- Images of teacher perception of and response to emergent mathematics in student thinking.

General entailments of use of video in learning MKT

- Articulating goals
- Preparing the viewing environment
- Formulating viewing focus and framing questions
- Preparing supporting materials for evidence-based discussion

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Who produces that knowledge?

- Increasingly, knowledge about the MKT and ways to support the learning of MKT is being more systematically developed by:
  - Those who design curricula for teacher education and professional development
  - Researchers on mathematical knowledge for teaching
- Professional developers and teacher educators are also contributing to this work, building craft knowledge through their diverse work with teachers
- Practicing classroom teachers are involved in unpacking, elaborating, and extending this knowledge in and for their own work with students



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How is specification potentially problematic?

- Substantial specification can be mistaken to represent the final goal of professional performance, rather than a foundation on which to more securely rest the skillful integrated enactments of teaching
- Substantial specification can be overwhelming, creating too much to take in or productively process (or requiring too much time to go through)
- How to productively make use of such specification can be unclear, unfamiliar, and uncomfortable for facilitators; it can seem overly constraining, removing too much autonomy, personal style, and openness to serendipity or the unexpected

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Discussion questions

1. What stands out about the detailing of teaching in each case? What are some key commonalties? What are some key differences?
2. What are the affordances of detailing practice?
3. What are the challenges and problems of detailing practice?

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Discussion questions

1. How would you feel if you were handed teaching materials like these and you were expected to teach with them?
2. If you were a department chair, would you want to ask your faculty (and other instructors) to teach with these?

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With whom do you agree most?

Alex: I would love to work with materials like these because they would make it so much easier to make decisions about how to improve my teaching as I would be able to study closely how particular aspects actually work.

Jill: I would really appreciate materials like these because teaching is so hard and this would help me teach well.

Judy: I would be reluctant to work with materials like these, because they do not draw enough on what I know and know to do, and also does not allow room for me to adapt to the learners with whom I am working.

Lucy: I would like to do it if everyone else was using them too so that we could learn from each other.

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