Learning Practice through Practice: Design considerations of a practice-based course

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Overview of Session

1. Reconceptualizing a “practice-based” course
2. A closer look at one practice: Modeling a computational algorithm with manipulatives
3. Conclusion

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Reconceptualizing a "practice-based" course

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A Course about "Practice"

Content:

- **teaching practices** (Ball et. al, 2007; Shulman, 2005)
- **mathematical practices** (Ball & Bass, 2003)

Design:

- **practice as a context** for learning (Lampert & Ball, 1998; Lave & Wenger, 1991)
- **practice as rehearsal** (Farmer & Williams, 2005; Lampert, in preparation)

Assessment:

- **practice as evidence** of preservice teacher learning (Stiggins, 1997)

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Content: Identifying the Work of Teaching

- Course focuses on learning to *do* the work of teaching
- Content consists of practices that are "high-leverage" for beginners and are of appropriate grain size for a course
- Temporarily decompose teaching into smaller practices whose aspects can be:
  - articulated, unpacked, studied, and rehearsed
  - reintegrated in more holistic acts of teaching

Related to work by Lampert (2001); Grossman (2005); Stein & Smith (2007); Franke (2005); Kazemi (2007)

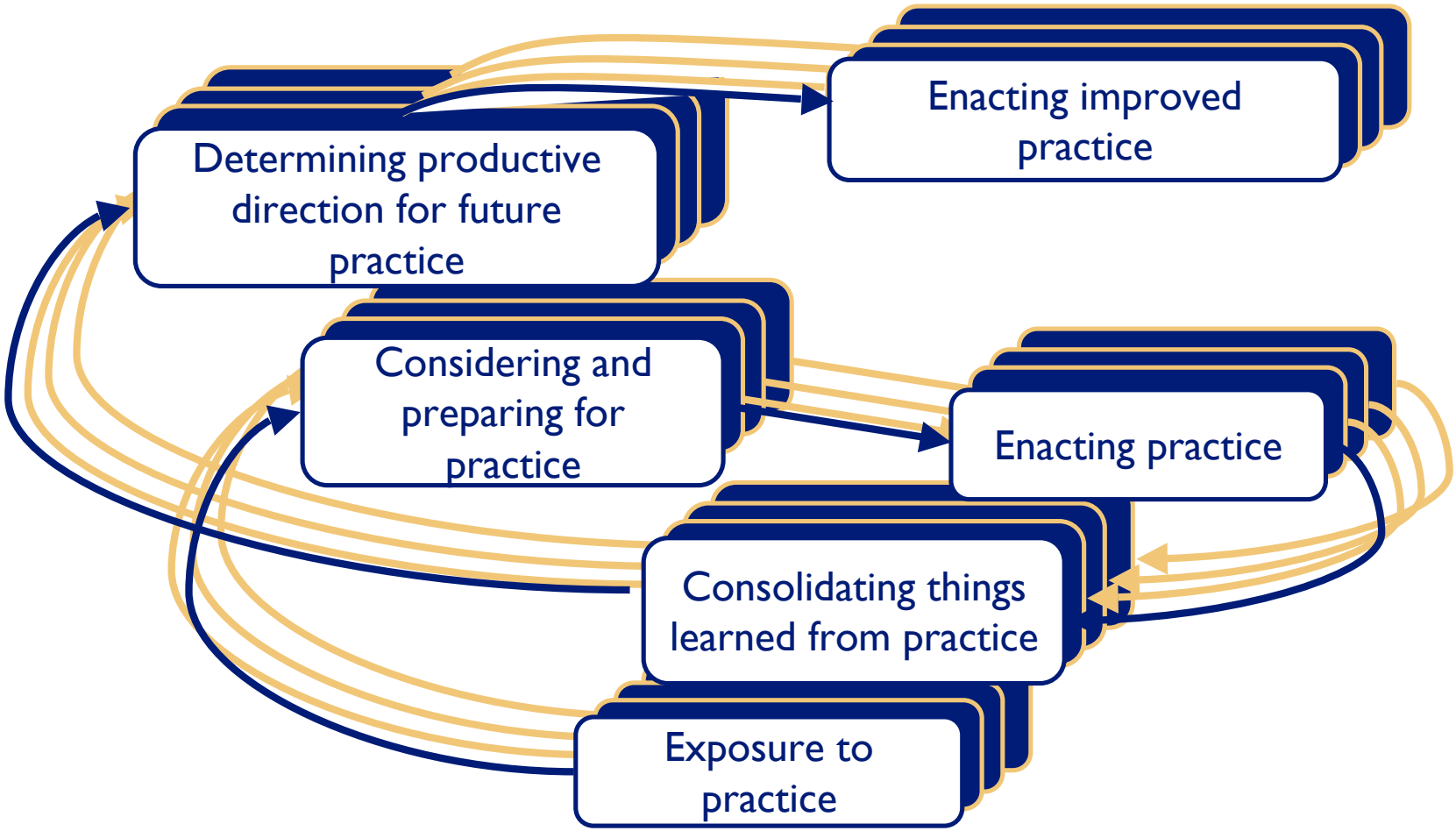
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Course Content: Principled Practice

Guiding Principles **Domains of Practice**	Attending to the **integrity of the mathematics**	Committing to the learning and achievement of **all students**	Establishing and managing a **productive learning environment**	Learning from and systematically **improving practice**
Leading a whole class discussion about mathematics				
Representing mathematical ideas				
Assessing students' knowledge, skill, and dispositions				
Planning mathematics lessons				

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Design: Repeated Opportunities to Practice



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Assessment: Moving Beyond *Products* to *Practice* as Evidence of Learning

Since mathematics teaching requires the development of specialized knowledge that cannot only be drawn upon in action, **but is often expressed through performances**…

We need to consider ways in which we can develop assessment practices, tasks, and tools capable of valuing mathematical performance and nurturing teacher growth in this area

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Assessing Teaching Practice

Ongoing-formative assessments of practice:

- structured rehearsal with instructor, peer, and whole group forums for feedback
- punctuating field experiences that allow instructors (methods, field, and cooperating teachers) to provide multiple points of feedback and students to reflect on records of their own practice

Four culminating performance assessments:

Three are based on a lesson taught in field

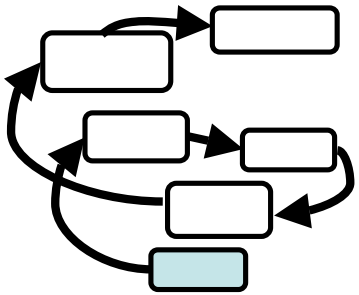
- Lesson planning conference
- Leading discussions in a mathematics lesson
- Assessing students through an end-of-class check

One occurs during final exam

- Modeling a computational algorithm with manipulatives

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Teaching While Students are Working Independently



What do we mean by “independently”?

Three types of teaching work:

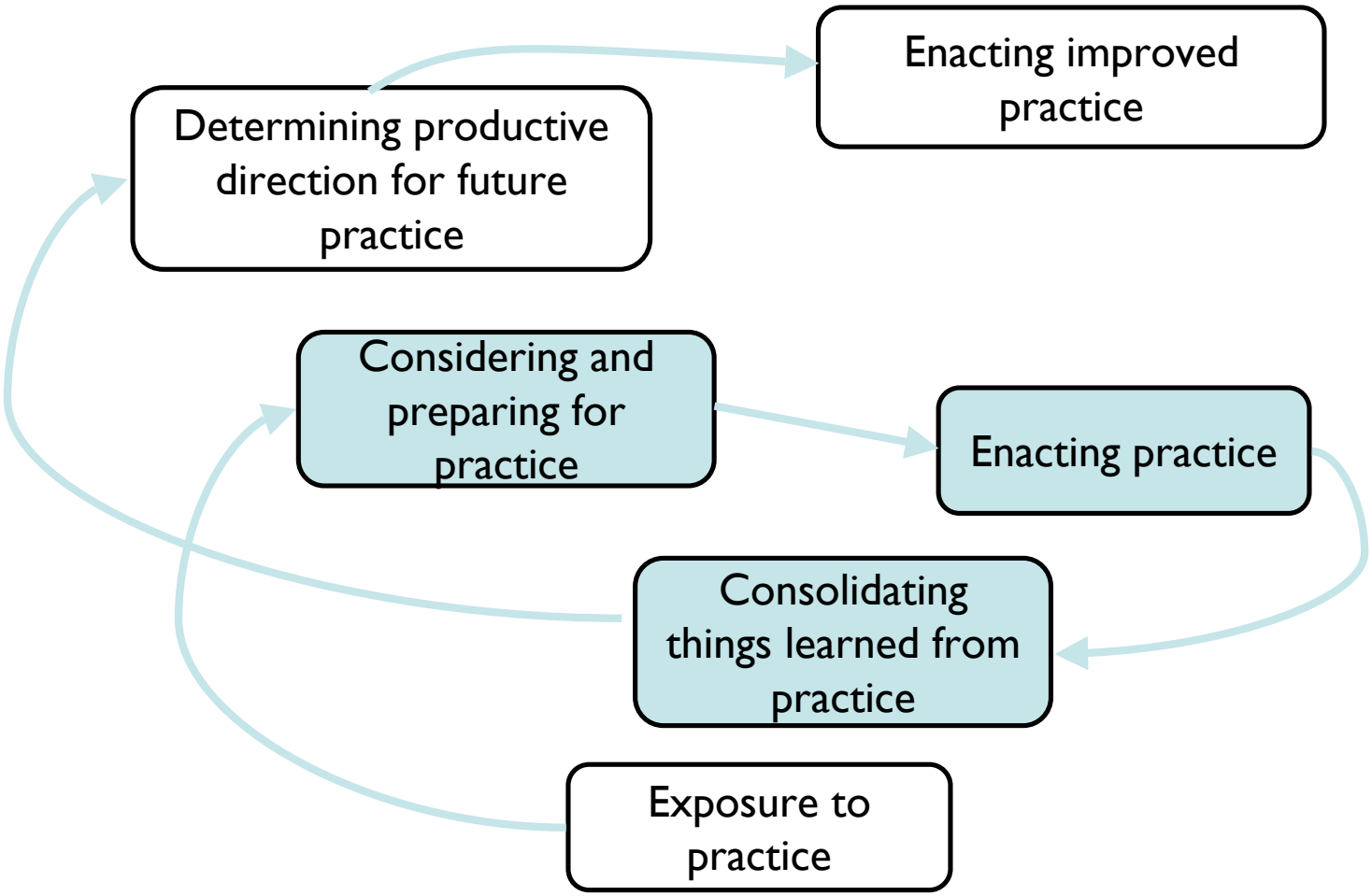
1. Observing students to learn what and how they are doing
2. Responding to specific student questions
3. Probing and intervening in students' work

Multiple purposes of teacher work:

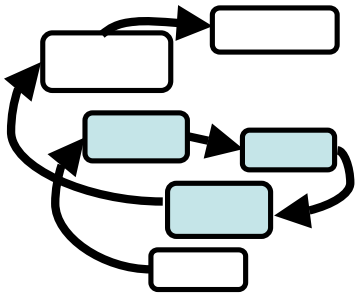
- to learn about individual students and the state of the the class.
- to meet the particular needs of all students in equitable way
- to gain insights into tasks or material for later teaching
- to establish and maintain a productive student work environment

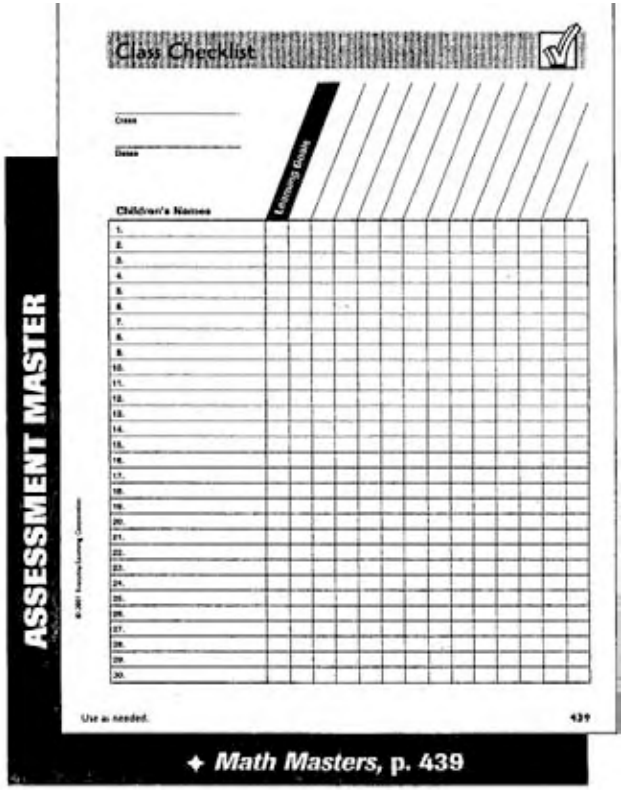
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Designing a Course for the Learning of Practice



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LOG SHEET

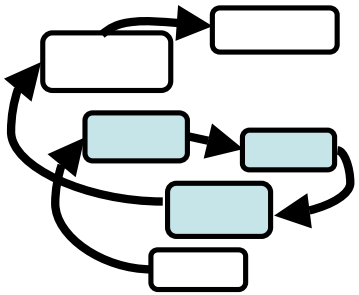
Group members Ellie, Henry, Lin, Rosa

Investigation title Consecutive number sums

Date	Work done	Questions	Teacher notes
9/19	Made a plan to list all numbers to 100, begin by dividing up numbers.	How far do we have to go. Do we need to make a written report?	your decision You'll need something to show what you made your oral report to the class.
9/20	Decided it was better to work with numbers than sums (1+2+3...)		

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Taking Anecdotal Observation Notes While Circulating



Course assignment:

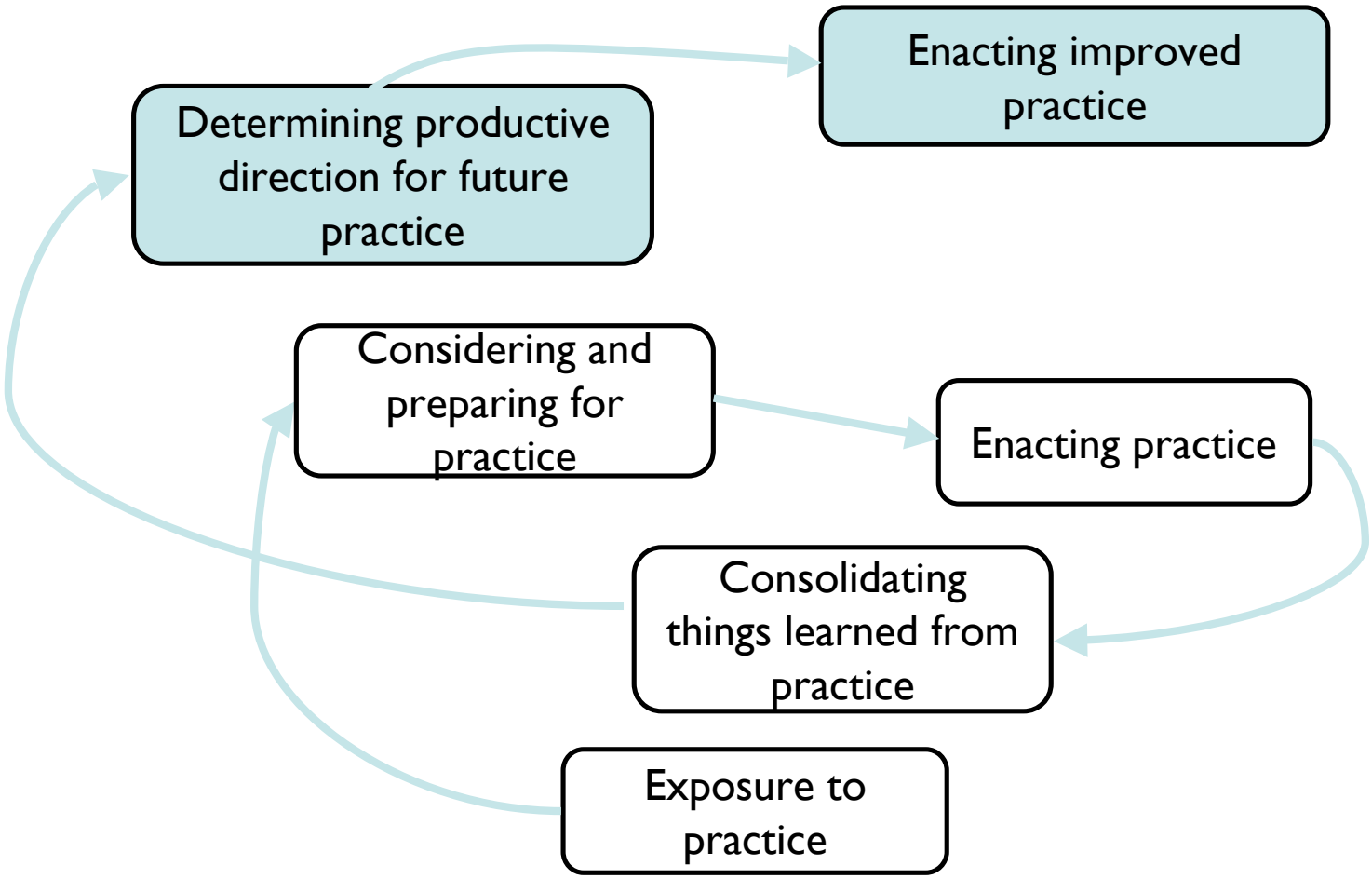
> "Before our next class meeting, experiment with a method for taking notes on your observations of and interactions with students. (You could use one of the systems we discussed in class or another method that you'd like to try.) We will discuss this in class next week."

Debriefing the following week:

- What methods did you try?
- What were you trying to document?
- How well did it work?

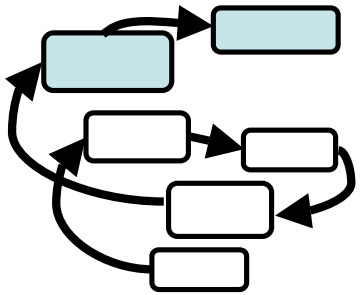
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Teaching While Students are Working Independently: A formative performance task



Make arrangements with CT to record interactions between November 13 and 17. (Send email when scheduled.)

Familiarize yourself with content of lesson.

Make digital audio recording of your interactions:

- Approx. 10-15 minutes; at least 7 students
- Document three types of teaching: observing, responding to questions, probing students' work

Design two end-of-class check prompts for that lesson based on an analysis of your interactions. (We will discuss end-of-class checks next week.)

Complete write-up by November 30.

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Modeling a computational algorithm with manipulatives

Content

Design

Assessment

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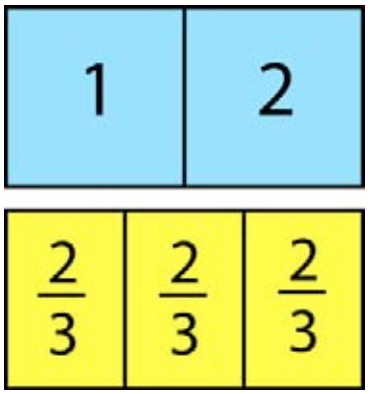
Assessment

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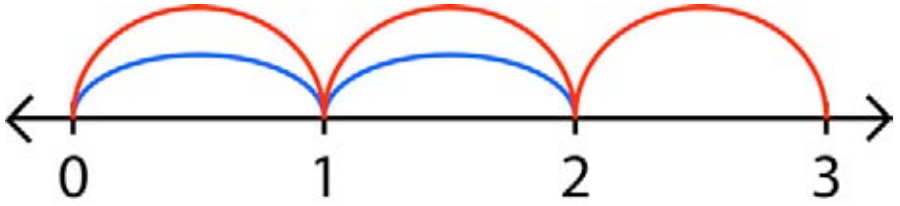
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Which of these could be a representation for $2 \div \frac{2}{3}$?

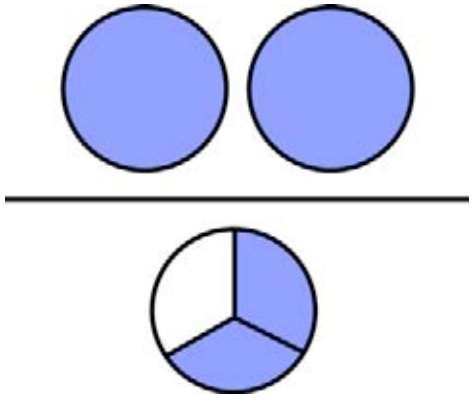
(a)



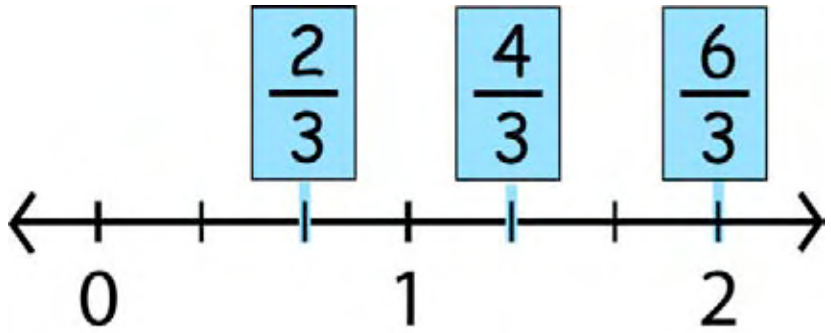
(b)



(c)



(d)



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What is the Work of Choosing and Using Representations in Teaching ?

- Sizing up the mathematical ideas that are highlighted in different representations
- Selecting the best representations for particular mathematical and pedagogical purposes
- Deploying representations in ways that support student learning
- Using language that matches and supports the meaning of a representation
- Making correspondences across different representations of the same mathematical idea
- Helping students learn to choose and use representations to explain mathematical ideas

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Why Focus on Modeling Computational Algorithms?

- Number and operation is a core topic at all grade levels (K-8)
- Work on computational algorithms develops preservice teachers' understanding of place value and meaning of operations
- Provides opportunities to confront and unpack mathematics that preservice teachers already "know"
- Standard algorithms are the most opaque, making them difficult to understand and to teach with meaning
- Can use their skills with representation and understanding of place value to model alternative algorithms

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Modeling a computational algorithm with manipulatives

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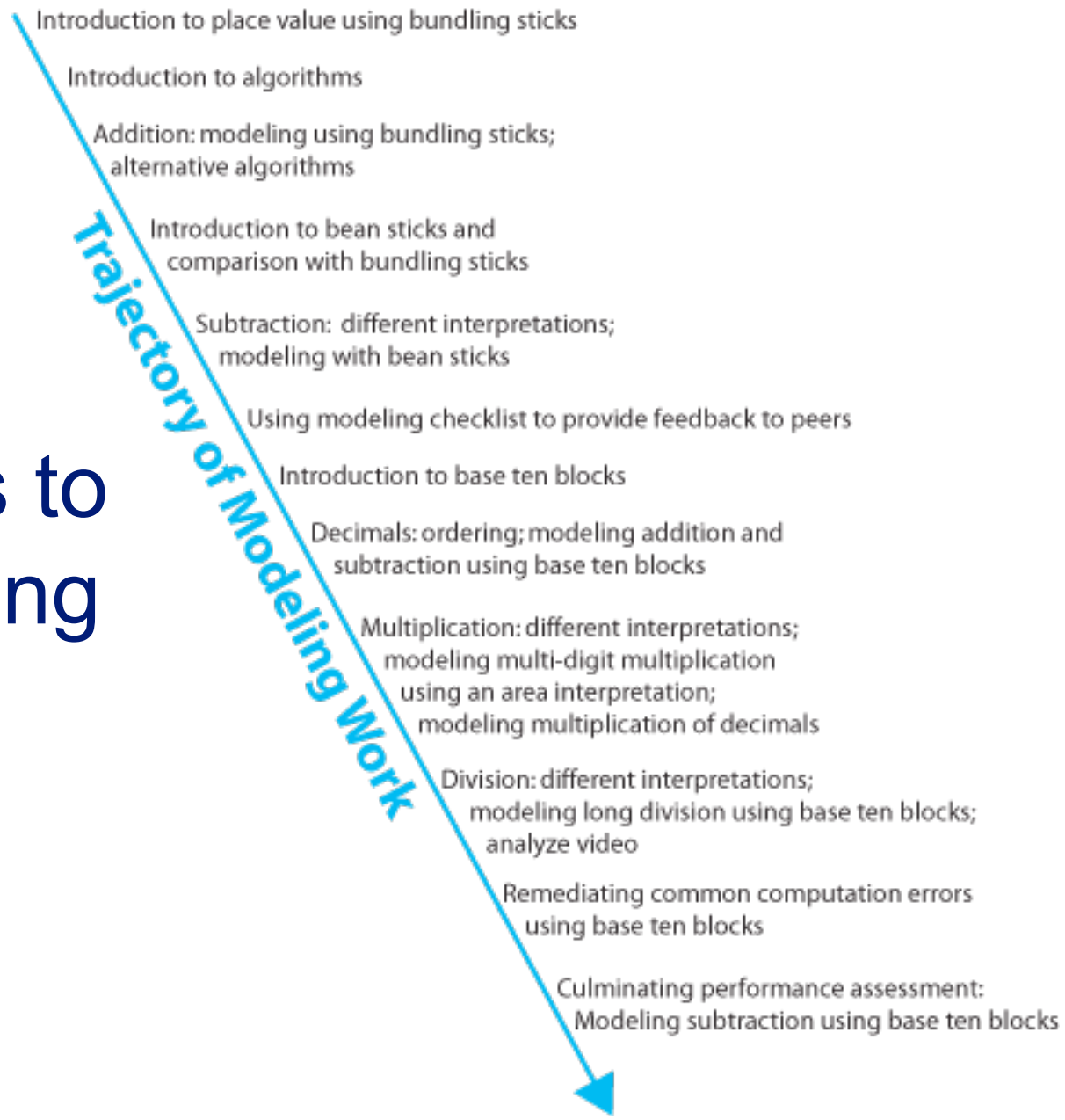
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Opportunities to Learn Modeling



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Unpacking Modeling Practice



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Modeling the Standard Subtraction Algorithm

The "modeler":

Model the multi-digit subtraction problem: 403-219

Tell your group whether you will be using a take-away or comparison interpretation of subtraction.

Model the subtraction -- talk through each step and carefully map between the materials and the written form.

The "critics":

Use the modeling checklist to make notes about the performance.

Provide comments and suggestions based on your observations.

If your group finishes early, each person should try a new problem using the other interpretation of subtraction.

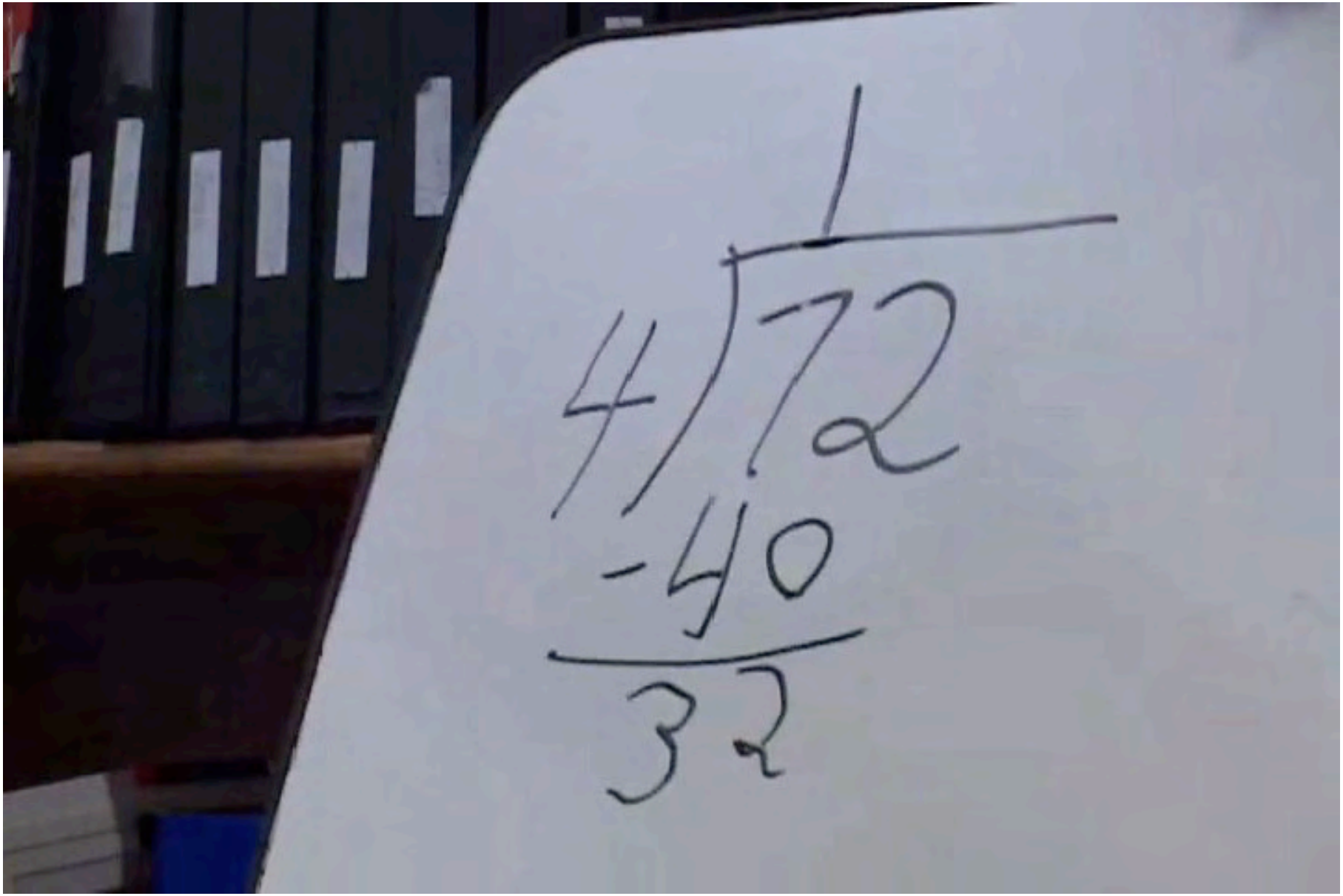
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Video Analysis

- Third grade
- Working with small group on long division
- Using cubes to model the problem 72 ÷ 4

Use modeling checklist to analyze & critique the modeling of long division in the video.

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137 + 25 = 387

Using Modeling to Remediate Student Errors

$$\begin{array}{r} 24 \\ \times\ 53 \\ \hline 72 \\ 120 \\ \hline 192 \end{array}$$

Select and analyze one of the student errors

- What is wrong? What mistake, confusion, or idea might lead to this error? What might this error tell you about a student's understanding of place value?

Design a strategy for using base ten blocks to work with a student on this error:

- Develop a series of questions or explanations tied to the materials, and anticipate what the student might do. **Your strategy should include modeling the computational algorithm in a way that addresses the source of the student's error.**
- What, specifically, would you be hoping to accomplish in terms of the student's understanding so that the student will not make the error again?

$$\begin{array}{r} 27 \\ 38 \\ +\ 19 \\ \hline 74 \end{array}$$

$$\begin{array}{r} 5.3 \\ -\ 2.64 \\ \hline 2.74 \end{array}$$

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Modeling Culminating Performance Assessment

- Instructor meets individually with each student during final exam
- Assessment task specifies features of the teaching scenario and goal for the modeling
- Scoring tool is used to capture and evaluate live modeling performance

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Sample Student Performance



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Gaining a Sense of Novice Teaching Through this Performance Assessment

This task afforded the opportunity to appraise:

- Mathematical knowledge
- Instructional dispositions
- Skill in sizing up student error
- Pedagogical skill
  - Use of representation
  - Attending to the error through modeling

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Persistent Challenges in Teaching Practice Through Practice

Content challenges

- Identifying and articulating high leverage areas of work in mathematics teaching

Design challenges

- Organizing iterative and increasingly complex opportunities to engage in the work of teaching across multiple domains within a compressed time frame

Assessment challenges

- Developing tasks that elicit and capture teaching performance
- Setting performance expectations for "well started beginners"
- Supporting informed judgment by a diverse instructional team

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