Designing and Using a Laboratory Approach to the Collective Study of Instruction

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San Francisco, CA

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The problem

- Increasing evidence that teaching matters (Nye et al., 2004)
- Teaching and learning to teach remain largely isolated and individualistic (Jackson, 1968; Lortie, 1975)
- Attention must shift toward teaching and its production (Morris & Hiebert, 2011)
- Teaching is complex work, much of which escapes notice (Lewis, 2007)

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Why is it called a "laboratory"?

Laboratory:

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



Features of the laboratory:

- Teaching that is public and designed to be open for collective study
- Careful documentation
- Planned instructional experiments

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The Elementary Mathematics Laboratory (EML)

A University of Michigan summer program for students who have not been successful in school mathematics

- *Focused on the development of —*
  - Mathematical proficiency: specific concepts and procedures in fractions and integers, operations, pre-algebra; mathematical practices
  - Learning practices: expressing, writing, and representing mathematical ideas, presenting one's thinking, doing homework, studying for a test
  - Strong and positive academic identities



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The Secondary Mathematics Laboratory (SML)

A University of Michigan summer program for entering ninth grade students who have not been well-served in school mathematics

- *Focused on the development of —*
  - Individual and collective commitment to doing mathematical work
  - Mathematical proficiency: specific concepts and procedures in the meaning and use of variables to represent or model physical systems; factoring; mathematical practices
  - Learning practices: productive routines for working individually and in small groups in math class; expressing, writing, and representing mathematical ideas; presenting one's thinking within small groups



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Overview

1. Designing laboratory space and documentation to support the examination of teaching and learning
2. The role of "lesson plans" in collective work on teaching
3. The work of making one's own teaching practice studyable by observers
4. Designing for the interactive mathematical work of teaching
5. Discussant comments

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Designing laboratory space and documentation to support the examination of teaching and learning

Kara Suzuka

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Supports undergirding the laboratory classes

- **Observation** – *Enable and, in many ways, enhance "live" observations of the lessons*
- **Discussion** – *Provide records of practice that help ground and inform EML participants' discussions and explorations soon after the lessons*
- **Study** – *Make high quality documentation of the laboratories available for future study and re-use*

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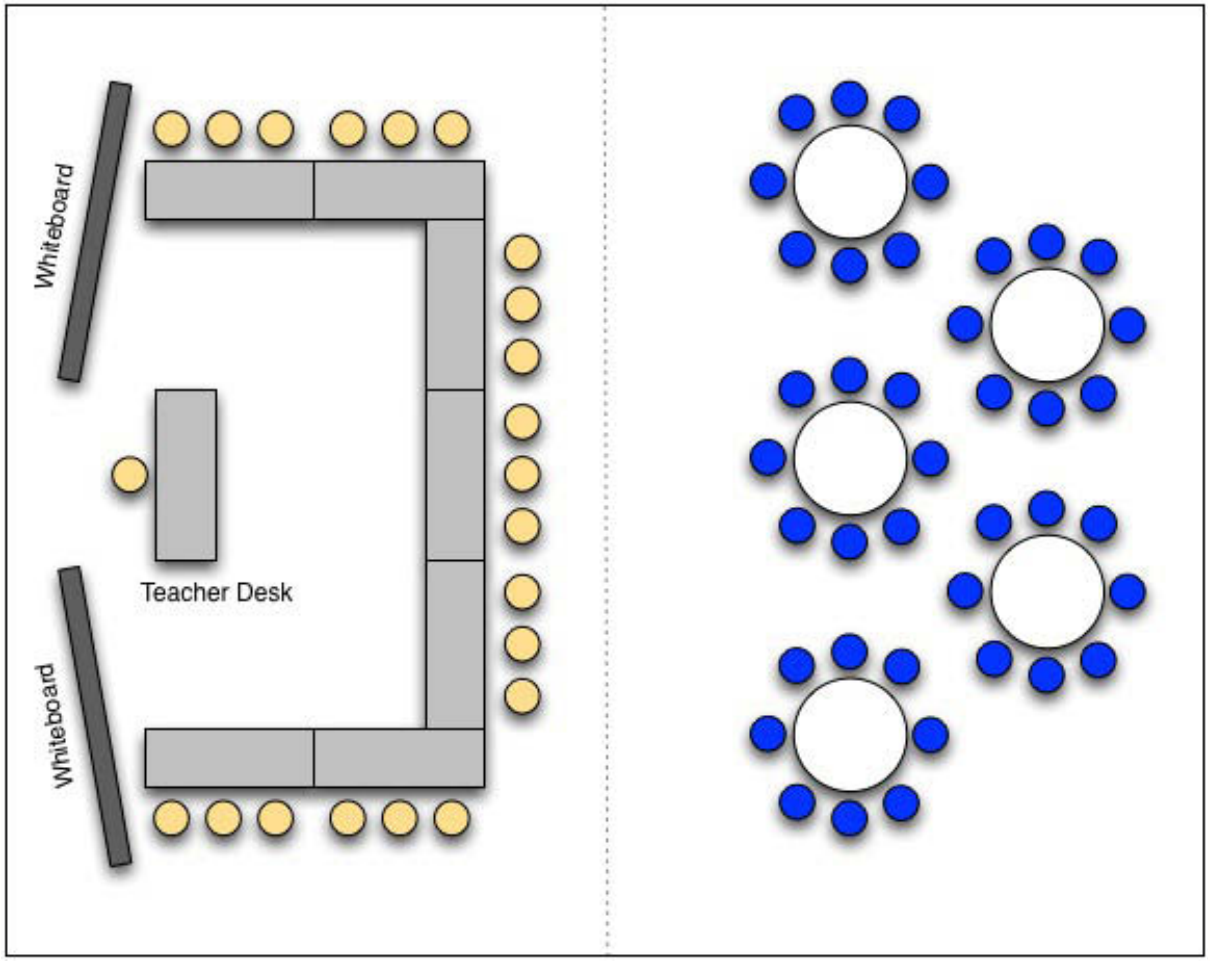
Operating theater in Ann Arbor, 1893



Dr. Nancrede's Clinic at the Catherine Street Hospital

From the Bentley Historical Library, University of Michigan

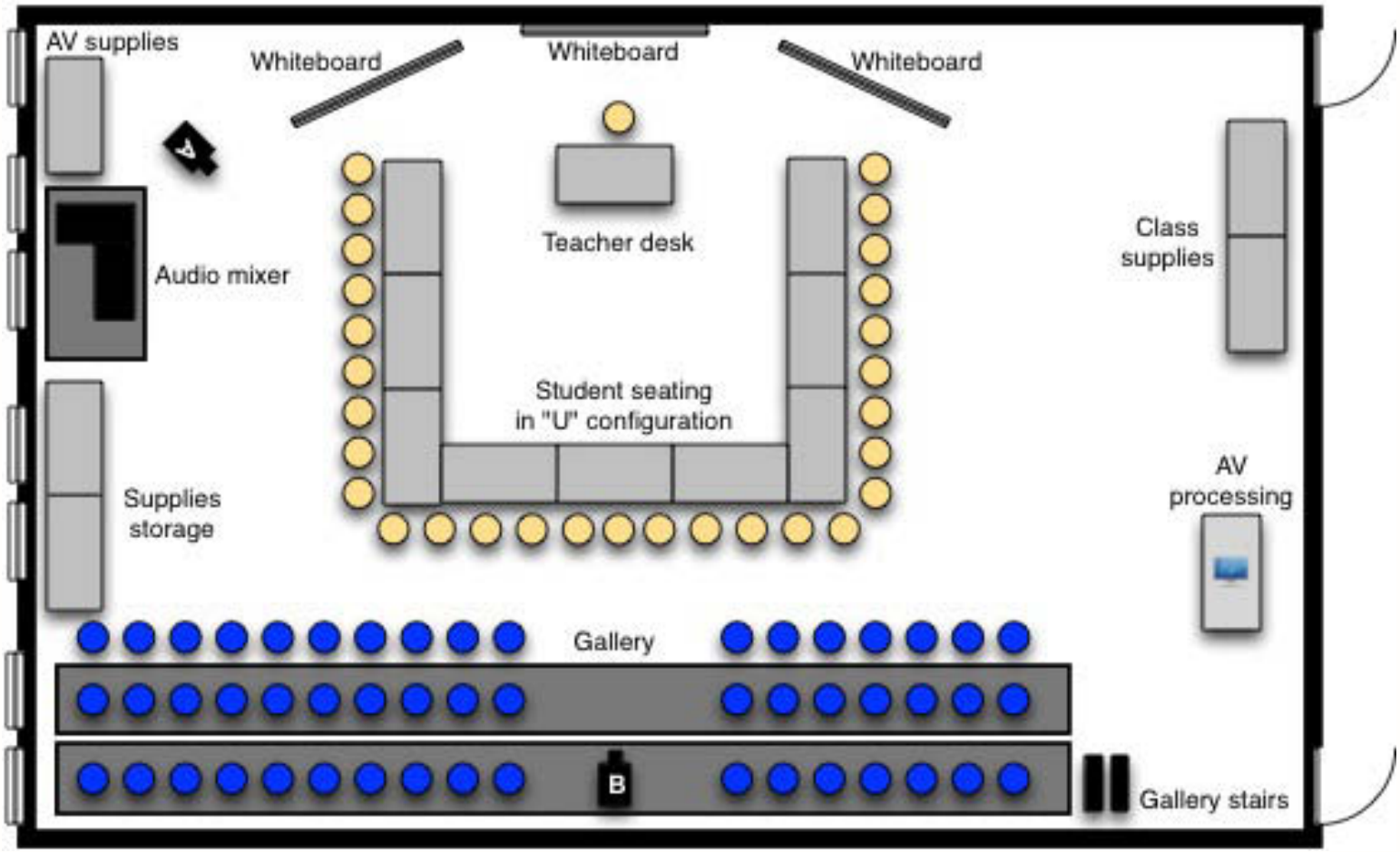
Early laboratory class, 2002



Mathematical Education of Teachers Workshop

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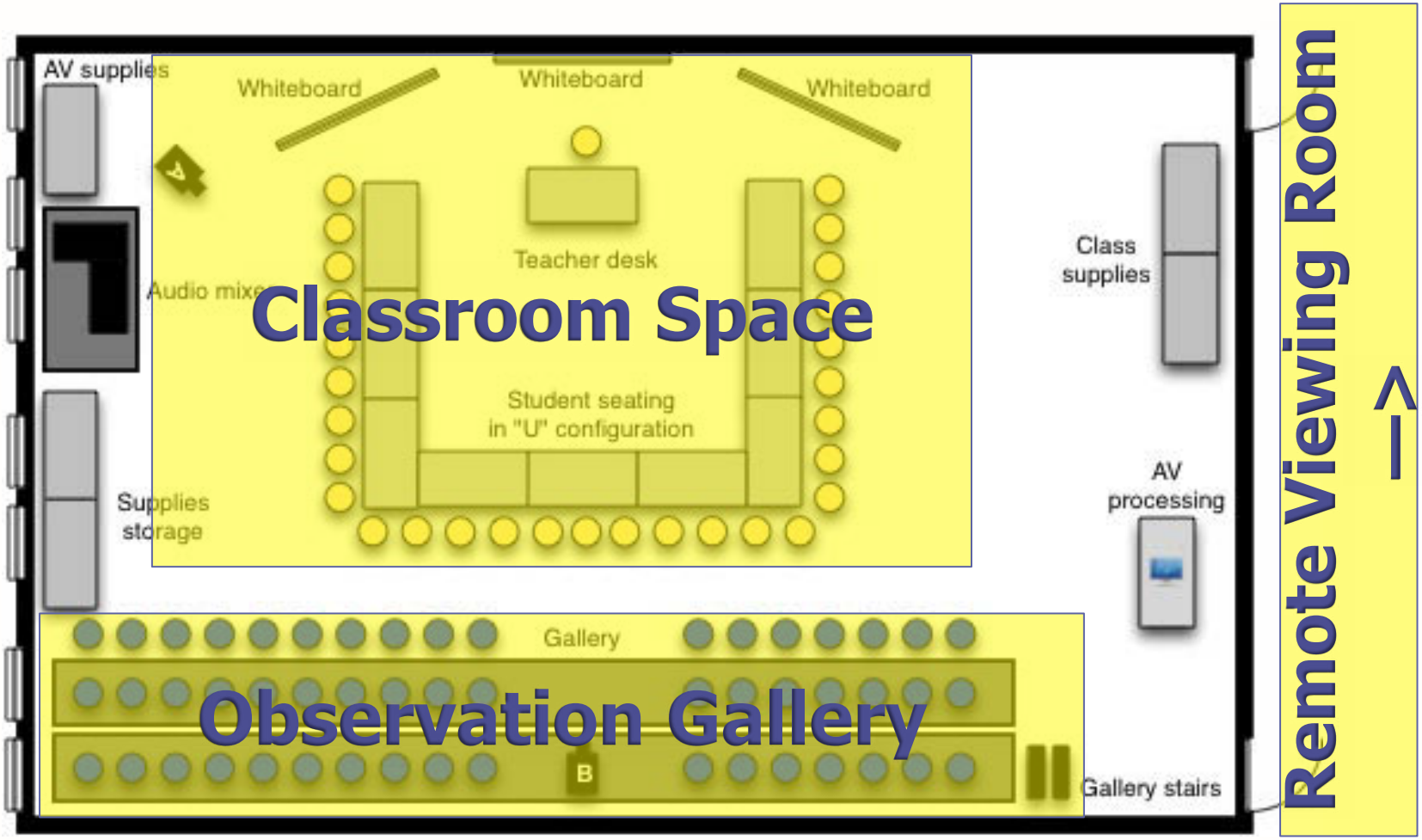
Laboratory classroom basic layout



The EML2012 laboratory classroom layout

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Laboratory classroom basic layout



The EML2012 laboratory classroom layout

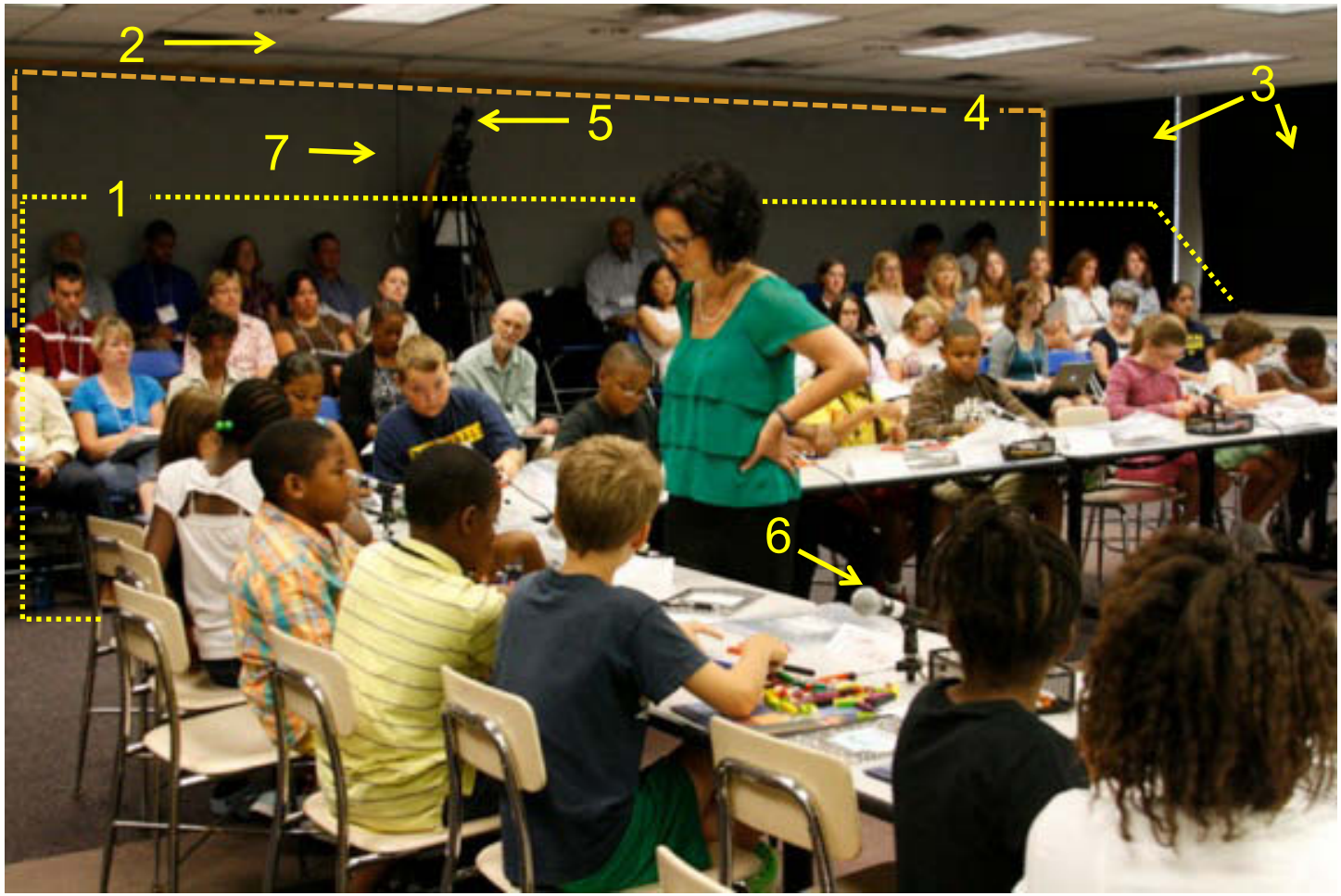
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Observation gallery

1. Support for seeing and hearing
2. Efforts to minimize distractions within the laboratory classroom

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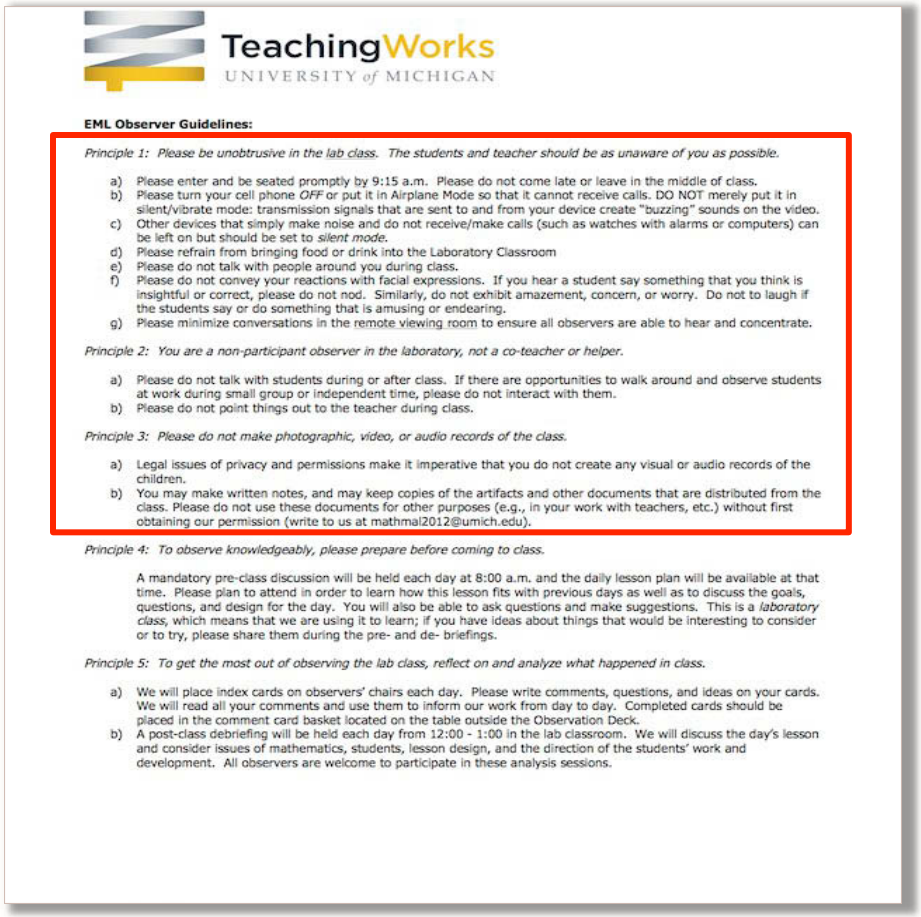
Observation gallery



The EML2010 laboratory observation gallery and classroom space

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Observer guidelines



TeachingWorks
UNIVERSITY of MICHIGAN

EML Observer Guidelines:

Principle 1: Please be unobtrusive in the lab class. The students and teacher should be as unaware of you as possible.

a) Please enter and be seated promptly by 9:15 a.m. Please do not come late or leave in the middle of class.
b) Please turn your cell phone *OFF* or put it in Airplane Mode so that it cannot receive calls. DO NOT merely put it in silent/vibrate mode: transmission signals that are sent to and from your device create "buzzing" sounds on the video.
c) Other devices that simply make noise and do not receive/make calls (such as watches with alarms or computers) can be left on but should be set to *silent mode.*
d) Please refrain from bringing food or drink into the Laboratory Classroom
e) Please do not talk with people around you during class.
f) Please do not convey your reactions with facial expressions. If you hear a student say something that you think is insightful or correct, please do not nod. Similarly, do not exhibit amazement, concern, or worry. Do not to laugh if the students say or do something that is amusing or endearing.
g) Please minimize conversations in the remote viewing room to ensure all observers are able to hear and concentrate.

Principle 2: You are a non-participant observer in the laboratory, not a co-teacher or helper.

a) Please do not talk with students during or after class. If there are opportunities to walk around and observe students at work during small group or independent time, please do not interact with them.
b) Please do not point things out to the teacher during class.

Principle 3: Please do not make photographic, video, or audio records of the class.

a) Legal issues of privacy and permissions make it imperative that you do not create any visual or audio records of the children.
b) You may make written notes, and may keep copies of the artifacts and other documents that are distributed from the class. Please do not use these documents for other purposes (e.g., in your work with teachers, etc.) without first obtaining our permission (write to us at mathmal2012@umich.edu).

Principle 4: To observe knowledgeably, please prepare before coming to class.

A mandatory pre-class discussion will be held each day at 8:00 a.m. and the daily lesson plan will be available at that time. Please plan to attend in order to learn how this lesson fits with previous days as well as to discuss the goals, questions, and design for the day. You will also be able to ask questions and make suggestions. This is a *laboratory class*, which means that we are using it to learn; if you have ideas about things that would be interesting to consider or to try, please share them during the pre- and de- briefings.

Principle 5: To get the most out of observing the lab class, reflect on and analyze what happened in class.

a) We will place index cards on observers' chairs each day. Please write comments, questions, and ideas on your cards. We will read all your comments and use them to inform our work from day to day. Completed cards should be placed in the comment card basket located on the table outside the Observation Deck.
b) A post-class debriefing will be held each day from 12:00 - 1:00 in the lab classroom. We will discuss the day's lesson and consider issues of mathematics, students, lesson design, and the direction of the students' work and development. All observers are welcome to participate in these analysis sessions.

1. **Please be unobtrusive in the lab class.**
   Guidelines to help observers be more inconspicuous during the lesson.

2. **You are a non-participant observer in the laboratory, not a co-teacher or helper.**
   Expectation that observers not interact with the teacher or students during the lesson.

3. **Please do not make photographic, video, or audio records of the class.**
   Guideline that serves (among other things) to reduce distractions created by the use of recording devices.

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Classroom space

Efforts to capture good video/audio (shaped by–)

a. The instructional needs of and designs for the class
b. The anticipated uses of the documentation

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Classroom space & instructional needs



EML2010 laboratory classroom space

- Whole group
- Frequent opportunities for individual, pair, small group work



SML2011 laboratory classroom space

- 4 small groups
- Occasional presentations and whole group activities

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Classroom space & documentation use



EML2010 laboratory documentation

- Materials development
- Research

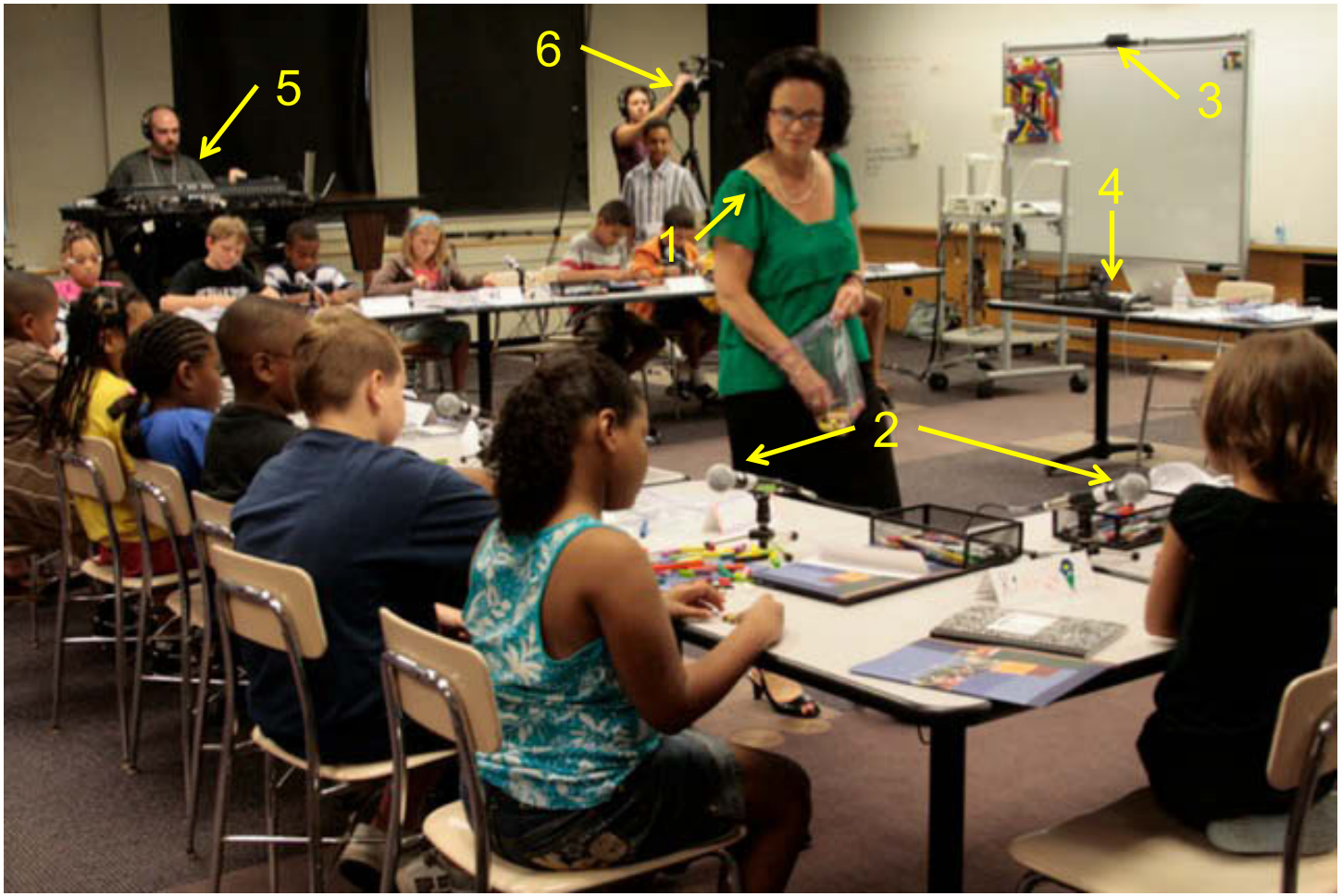


SML2011 laboratory classroom space

- Research (with special interest in the small groups)

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Classroom space



The EML2010 laboratory classroom space

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Classroom space



The SML2011 observation gallery and laboratory classroom space

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Remote viewing room

1. Accommodations for more observers – an "overflow room"
2. Efforts to provide alternative viewing experiences for observers

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Remote viewing room



GREML2011 remote viewing room



EML2010 remote viewing room

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Summary:
Design problems/goals

1. Support for seeing and hearing
2. Efforts to minimize distractions within the laboratory classroom
3. Efforts to capture good video/audio (shaped by–)
   a. The instructional needs of and designs for the class
   b. The anticipated uses of the documentation
4. Accommodations for more observers
5. Efforts to provide alternative viewing experiences for observers

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Design experiments

Data sources

- Documentation of problems, solution designs, and results
- Recording samples
- Informal observer/user feedback

Analysis

- Footage review sessions
  - Problem identification
  - Analysis of potential causes/ reasons
  - Consideration of potential solution approaches/designs
  - Testing and review
- Sampling and comparisons during post-production processing

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Supports undergirding the laboratory classes

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Bringing together multimedia records of teaching and learning practices for the study and improvement of education

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The role of "lesson plans" in collective work on teaching

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AERA, San Francisco

April 30, 2013

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Context

- Evidence of teaching effects has increased interest improving *teaching*
- Teaching can be learned
- Increasing the skillfulness of teaching depends on:

  "… deliberately cultivated teaching practices that are informed by carefully thought-out intentions and actions designed to encourage learning"

  (Cohen, 2011, p.28)
- Many sources of knowledge and expertise that could inform improvement of instruction
- Need ways of bringing people together to work on teaching who might not otherwise

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Problem

How can “lesson plans” support collective work on teaching?

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Overview

1. Collective work on teaching
2. “Lesson plans”
3. Our study
4. “Lesson plans” and collective work on teaching: challenges and supports

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Collective work on teaching

By *collective work on teaching*, we mean: **engagement across communities with requisite expertise in deliberations of attentive teaching**

- For example, lesson study, professional learning communities, laboratory classes, …
- Involving teachers, mathematicians, teacher educators, education researchers, ...
- Not everyone teaching, but deliberating on teaching
- Potentially different foci, but together building deliberate professional teaching practice

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Challenges for collective work on teaching

Challenges

- Invisibility of teaching
- Lack of shared language
- Diverse professions, differing perspectives

Analogous to Star and Griesemer (1989) study of cooperation in scientific work

- Boundary objects and shared practices

  "inhabit several intersecting social worlds and satisfy the informational needs of each" (p. 393)

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Lesson plans as supports

Not well defined or extensively studied

- Not in title or abstract: JTE, ER, AERJ, HER, RER, …

Commonplace types

- Teacher education: To support learning
- In schools: Prescribed documentation for accountability
- Individual teacher plans: Varied
- Online or passed around: Just enough to be usable

For laboratory classes

- Explicit coverage of planning
- Unpack practice
- Additional supports for collective work

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Parts of a lesson plan

- Goals
- Reminders to do before class
- Student learning goals
- One-page overview
- Detailed plan
- Mathematical territory being addressed
- Design enactment problems and debriefing foci

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Parts of the lesson plan: Goals

MONDAY, AUGUST 13, 2012
Lab Class #1

First day purposes:

1) To learn about the students and to begin to make some kind of connection with each one. Try to get each student to speak in class at least once.
2) To learn about some aspects of the students' mathematical habits, skills, knowledge, and inclinations by assigning a task and observing how they approach, solve, and discuss problems.
3) To develop organizational norms and routines for the classroom that enable efficient use of learning time (e.g., how we use materials, transitions, notebook set-up and use).
4) To begin to form a sense of ourselves as a group who will be doing mathematics together.
5) To develop shared values, and expectations, and routines for how we work on mathematics together:
   - that we are careful with mathematical ideas and interested in and curious about patterns, puzzles, and problems;
   - that we treat other people's ideas with respect and interest, and respond to and use them as appropriate;
   - that working on mathematics is a collective as well as individual endeavor — that is, that knowledge must be established within a local community or group and, ultimately, connected to the wider mathematical community.
6) To begin to establish norms for mathematical work, including:
   - paying careful attention to language,
   - representing ideas and building correspondences among them,
   - experimenting with possibilities,
   - using structures for mathematical reasoning,
   - analyzing errors and missteps;
   - attending to others' ideas with interest and respect,
   - asking questions, seeking sufficiently complete explanations;
   - asking fundamental questions about mathematical problems (e.g., why is that true? how could that be explained? is there another way to do or represent that? do we have all the solutions? is there one way, more than one way, infinitely many ways to . . .?).
7) To develop habits of making and using records, both collective and individual, including:
   - construction of own notebook (i.e., setting up the notebook, pasting in problems, writing notes, keeping track of new words and ideas, etc.)
   - interest in and care with notation,
   - representation,
   - structure and organization,
   - legibility and usability,
   - keeping track of changes and corrections,
   - keeping track of other questions and observations.
   - To develop effective practices of studying mathematics (e.g. skills of mathematical attention; summarizing, revoicing, strategies for practicing, doing homework, checking on one's own learning, formulating questions when one is confused).

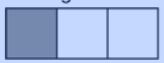
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Parts of the lesson plan: Overview

Instructional segment	*Time*	*Principal purposes and emphases*	*Materials needed and where/how to use them*
Introduction to lab class (*without observers*)	25	• Begin this right away when the bus arrives. • Meet students in children's room, introduce self, help them feel comfortable and welcome, set some immediate expectations about behavior in the building, take them to get snack, go into the room, explain set up, etc.	
Official beginning of class Introductions	15	• Learn names, help them learn names • Try to have everyone talk in whole group • Communicate to students that this course will involve hard work and require their commitment to that, and that, in turn, the teacher is committing to work closely with them to support their learning	• Notebooks • Name tents
Skills practice	20	• Write number sentences for 10 • Provide experience with a problem with infinitely many answers	• Poster and worksheet for projector with problem: Write number sentences for 10. • Small copy of problem for notebooks
Begin work on fractions	25	• Work with unevenly shaded regions, name fractions of area that are shaded • Focus on area and fraction as a measure of that area, rather than as counting out of a set of parts	• Small copy of problems for notebook • Copies of problem for the board • Extra copies of the brown square
Break	10	• Establish routines for break: behavior, drinks and snacks, trash	
Number systems and operations; proof and reasoning	25	• Introduce minicomputer as a mathematical "system" or "environment"	• Class minicomputer boards • Individual minicomputer mats for students
Contracts	15	• Discuss and sign student contract; discuss teacher contract	• Contracts • Student Contract on poster paper
Wrap-up	5	• Comments on day • Prepare for rest of day	• Homework • Homework kits
End of class check/reflection	10	• Establish routine of end of class check and reflection	• Handout with Day #1 end of class check

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Parts of the lesson plan: Detailed plan

Time/format	*Learning goal(s) for students*	*Detail*	*Commentary: notes and anticipations*
10:30 – 10:55	Students will begin to understand and use the concepts of "the whole" and "equal parts". Students will begin to use elements of a definition of a fraction to name parts of areas. Students will begin to use the language of the whole and equal parts.	Problem on chart; ask students to paste it into their notebooks and write what they think: What fraction of the rectangle below is shaded brown?  What fraction of the rectangle below is shaded brown?  Use this problem to articulate what is required to explain fractions: identification of the whole, equal partitioning. Try to work with the students to make explicit what students use to construct an explanation of the correct answer. Try to get this to be more explicitly shared: • Refer to the fact that fractions refer to an equally-partitioned whole, not just the number of pieces. • Note that the large rectangle (the whole) is not divided into equal parts. • Divide the large rectangle so that all the parts are equal. • Identify the parts as "fourths" because there are 4 equal parts, because one of the parts iterated four times equals the whole. • Name one of these parts as "one–fourth." Discuss the rectangle with one-third as a contrast, since those who get this question wrong are likely to label it as 1/3.	*Begin with an equally partitioned rectangle and use this to contrast and support reasoning about the unequally partitioned rectangle.* *Students might think that a square is not a rectangle. Will need to discuss/clarify this if it comes up.* *The task is intentionally drawn with the area of the brown squares in both questions being equal. This allows a discussion of how the fraction of the rectangle is determined by the size of the shaded part in relation to the size of the whole. When the size of the whole changes, the size of the shaded part in relation to the whole changes as well.* *Students might think that 1/4 of the rectangle is shaded brown when there is a line drawn, but go back to thinking that that same area is 1/3 of the rectangle when you take the line away. Will need to be attentive to this in students' talk.*

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Our study

How do the lesson plans support collective work on teaching?

Data:

- Lesson plans
- Lab class participation and observations
- Video of class pre-briefs and debriefs
- Participant interviews

Analysis:

- How do lesson plans support collective work on teaching in the lab class?

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Challenges for collective work in the lab class

- Individual agendas
- Knowledge and awareness
- Communication and vocabulary

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Lesson plans as a resource

- Useful to members of various communities
- Help manage cognitive demand of watching teaching
- Work to develop shared aims and common practices

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Conclusion

Potential roles for lesson plans in collective work:

- Support interests and learning goals of participants
- Elaborate teaching adequately for participants
- Legitimize teaching as non-random and skillful
- Ease cognitive demand of observing and examining
- Allow seeing oneself as doing the teaching
- Provide common language and foci of collective work

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Public Teaching: The Work of Making One's Own Teaching Practice Studyable by Observers

Deborah Loewenberg Ball, Meghan Shaughnessy, and Laurie Sleep

Annual Meeting of the American Educational Research Association

April 30, 2013 • San Francisco, CA

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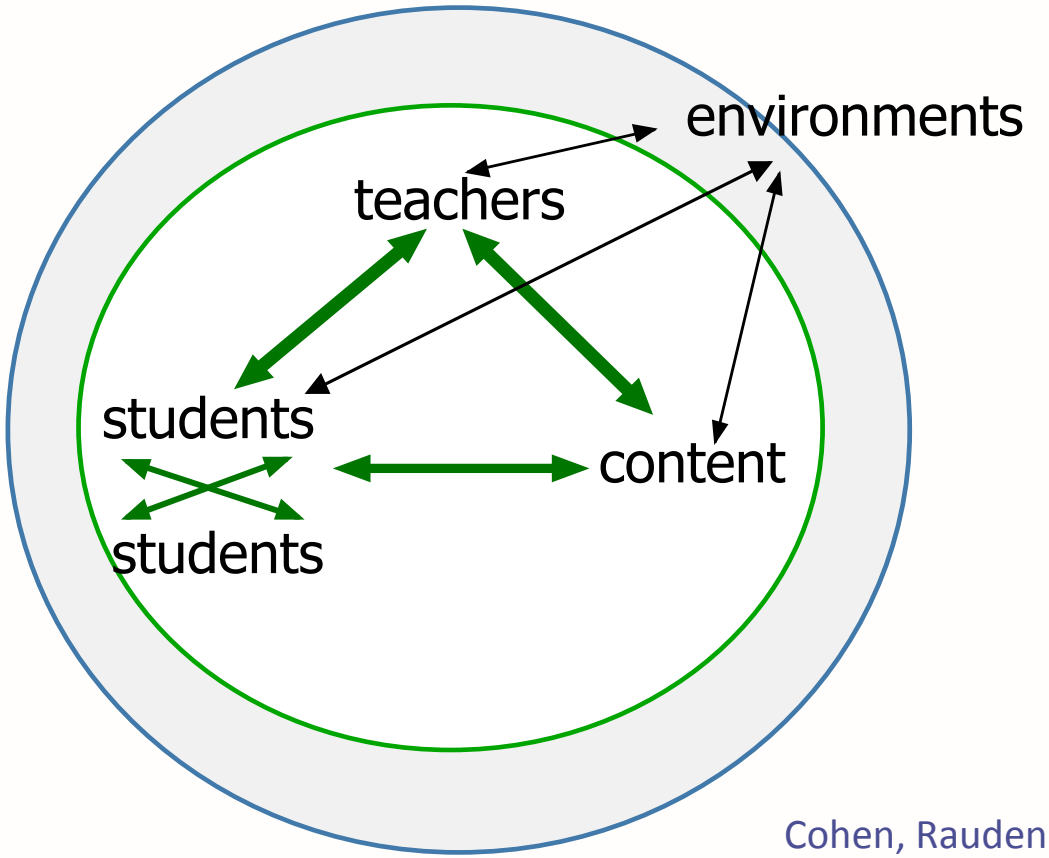
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Overview

1. An inherited cultural conception of teaching practice in the U.S.
2. Public teaching: What is it? And what is it not?
3. Three domains of work in the practice of public teaching
4. Challenges of public teaching
5. Provisional conclusions

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The basic instructional triangle: The interaction of teachers and students around some content



Cohen, Raudenbush, & Ball, 2003

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Teaching as personal practice

- 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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Examples of teaching that is less personal and more shared

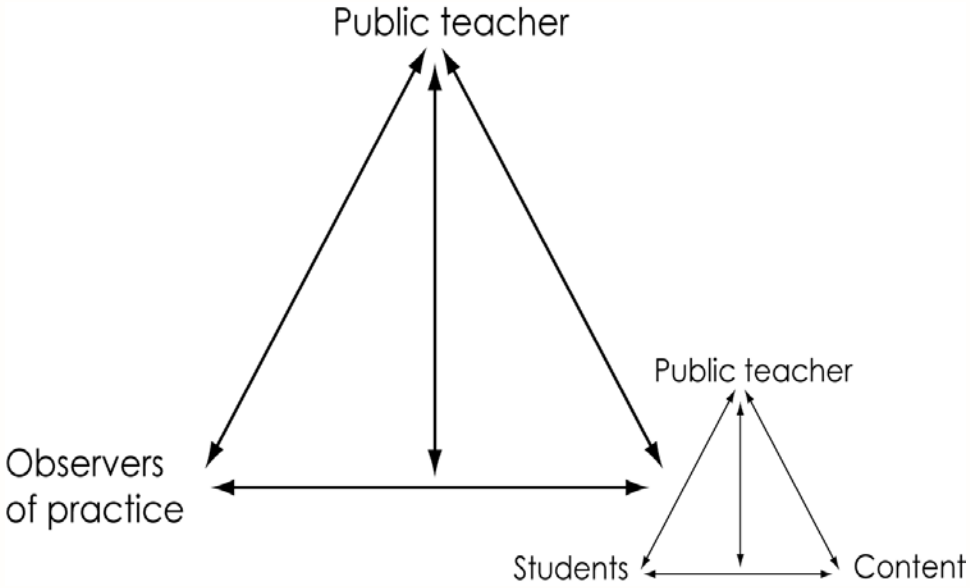
- Rounds, rehearsals, and other shared opportunities in initial teacher training
- Lesson study
- Demonstration teaching
- Studios (Teacher Development Group)

Goal: Make teaching more available for shared study, coaching, development

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"Public teaching" in the EML

- Seeking to "raise the curtain" on the practice of teaching
- Classroom teacher plays a dual role: teacher of the children and teacher of the observers of practice
- But: The children's learning is central



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The structure of public teaching

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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➢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"

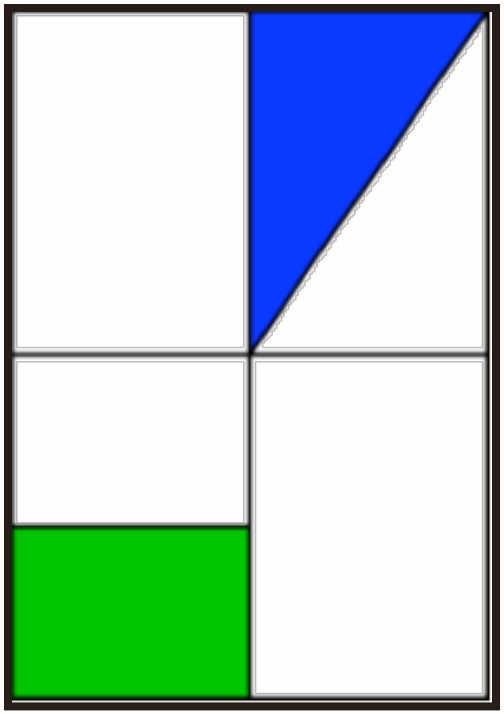
What is public teaching NOT?

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

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Public teaching: A glimpse of the work

What do you notice of the dual focus of the teaching?



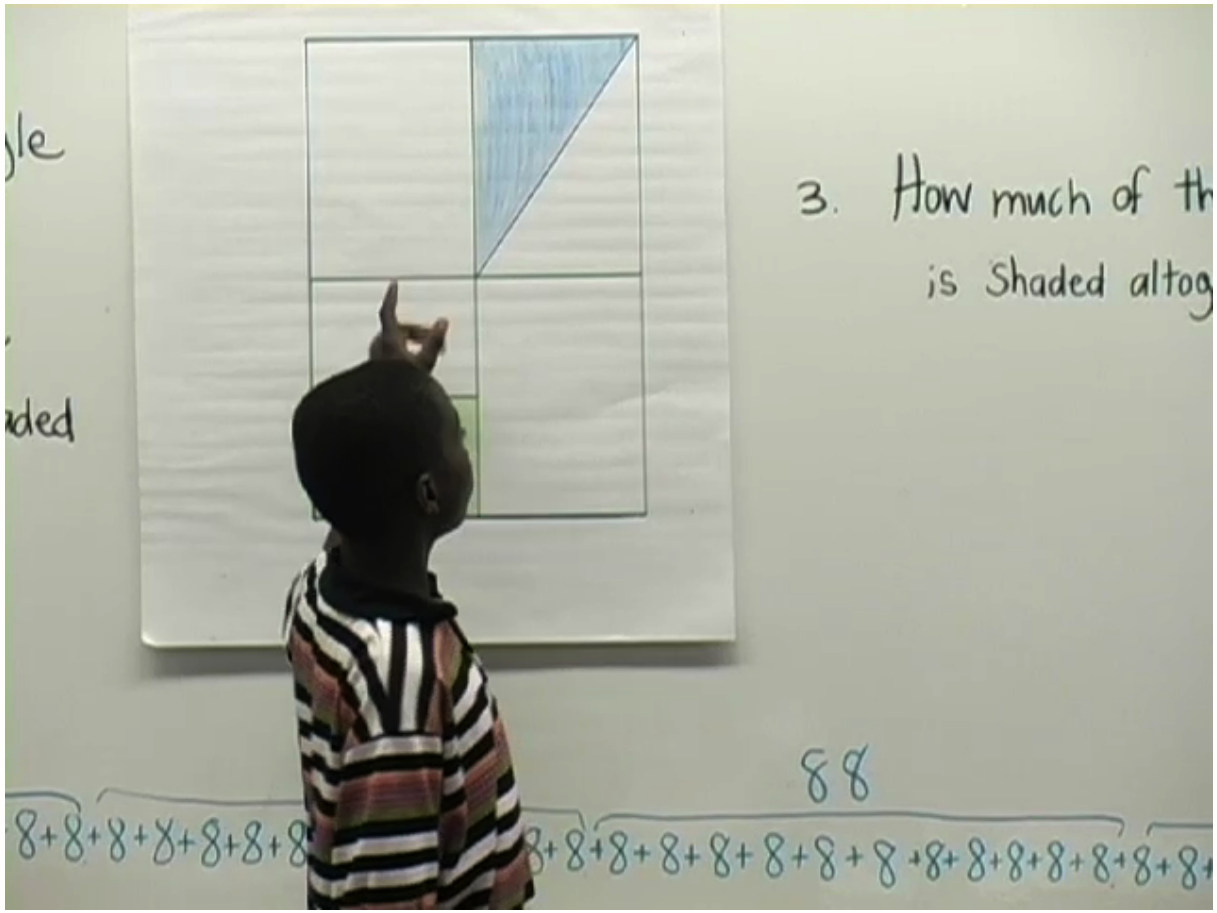
What fraction of the big rectangle is shaded blue?

What fraction of the big rectangle is shaded green?

What fraction of the big rectangle is shaded altogether?

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What do you notice of the dual focus of the teaching?



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What can you see of the dual focus of the teaching?

- "Still waiting to see a few more hands. Lots of people have work done in their notebooks."
- "You should be thinking already about his reason. Who can repeat what Mamadou said? . . . if you're listening carefully, you should always be able to tell what someone just said. Dovan, what did he say?"
- Can you put your finger around the part you're calling the whole? . . . Do you see where he just pointed? And where are the equal parts?"
- "Raise your hand if you understand what Mamadou did. Who knows what Mamadou did to get his answer of one-half? I don't want to hear how you agree or disagree. I just want you to tell me what did he do."

1. TEACHING THE CHILDREN

- Eliciting student thinking; broadening participation and distributing turns
- Being explicit with students that ***listening*** is an important practice in which they are expected to engage
- Supporting practices of presenting and explaining in whole group
- Being explicit that the work is to pay attention to and try to understand someone else's mathematical explanation

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2. MAKING TEACHING STUDYABLE

Making visible:

- That many children have completed independent work on the task.
- That students are supposed to be thinking about Mamadou is about to say and this is not "dead" time.
- Mamadou's reasoning.
- How many students think they understand what Mamadou said, and what is being asked of students?

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Three domains of work in the practice of public teaching

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

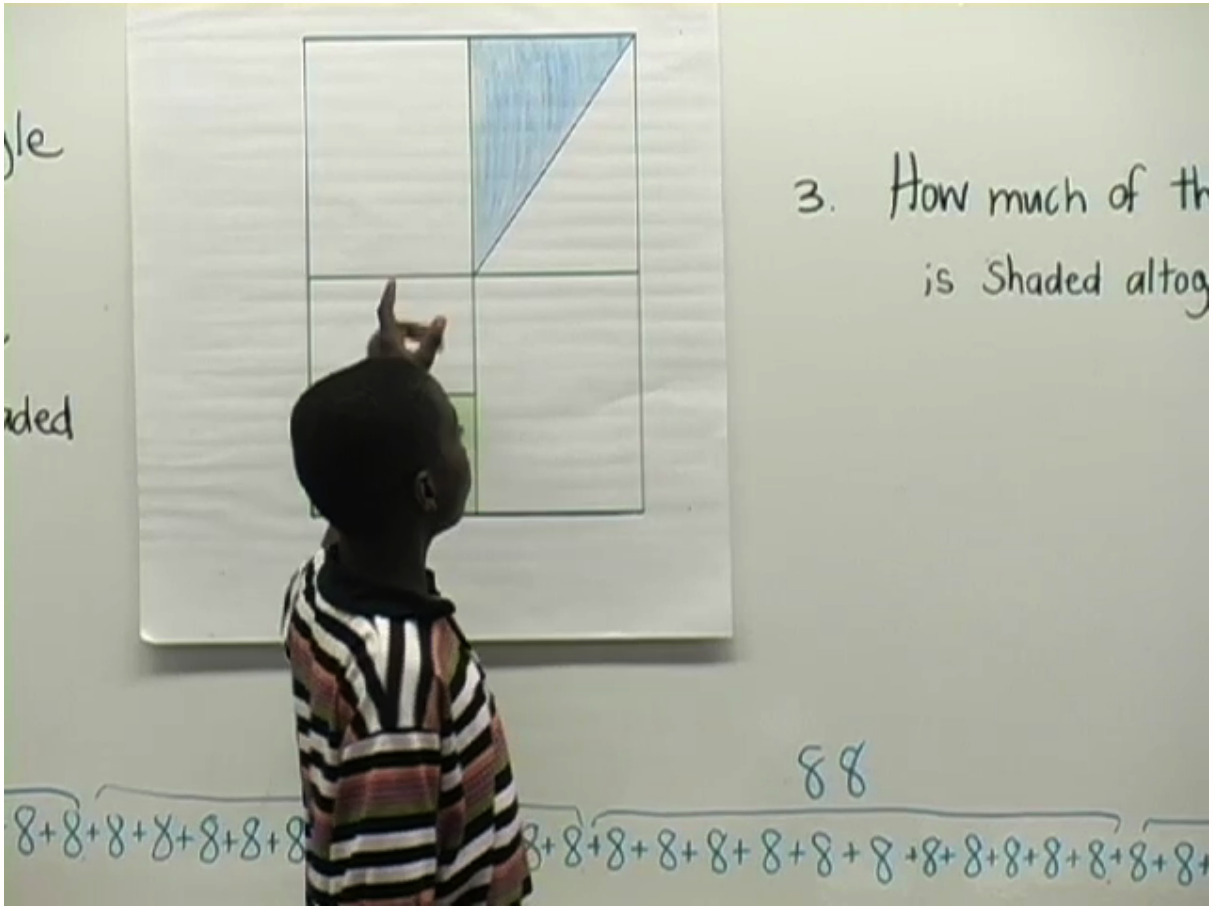
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A second look at the work of public teaching

What do you notice about supporting observing and minimizing the "public-ness"?

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A second look at the work of public teaching



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Public teaching, a second view

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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How does public teaching affect the primary goal of helping the students learn?

- Might it make children feel uncomfortable, embarrassed, shy, or reticent?
- Supports explictness: Expectations, explanation, etc.
- Supports norms of speaking audibly, presenting clearly and visibly
- Enhances sense of seriousness and importance of what the children are doing

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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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Conclusions

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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Designing for the interactive mathematical work of teaching

Meghan Shaughnessy

University of Michigan

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Context

- Current press to increase expectations for all students' learning
- Instructional time is a key commodity
  - Existing instructional time must be efficiently managed and used
  - Anticipating and designing for content-based interactions is one way to maximize instructional time

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Content-based interactions

- Interactions with students that involve:
  - Asking questions
  - Drawing representations
  - Defining terms
  - Proposing explanations
  - Comparing solutions
  - Summarizing key points
- Such interactions are key to supporting students' learning

When handled spontaneously, teachers are often forced to make do with resources that may be inadequate to support the interactive work of the lesson

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Problem

- Researchers studying instruction have studied:
  - Planning
  - The interactive work of managing the discourse and responding to students' productions
  - Teacher reflection
- Limited attention to anticipating and designing for content-based interactions

Purpose of the study: To begin to conceptualize this underspecified aspect of teaching

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Overview

① Types of design work needed to support efficient content-based interactions

② The design work in action

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① Types of design work needed to support efficient content-based interactions

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Methods

Context: The EML

A site for studying because:

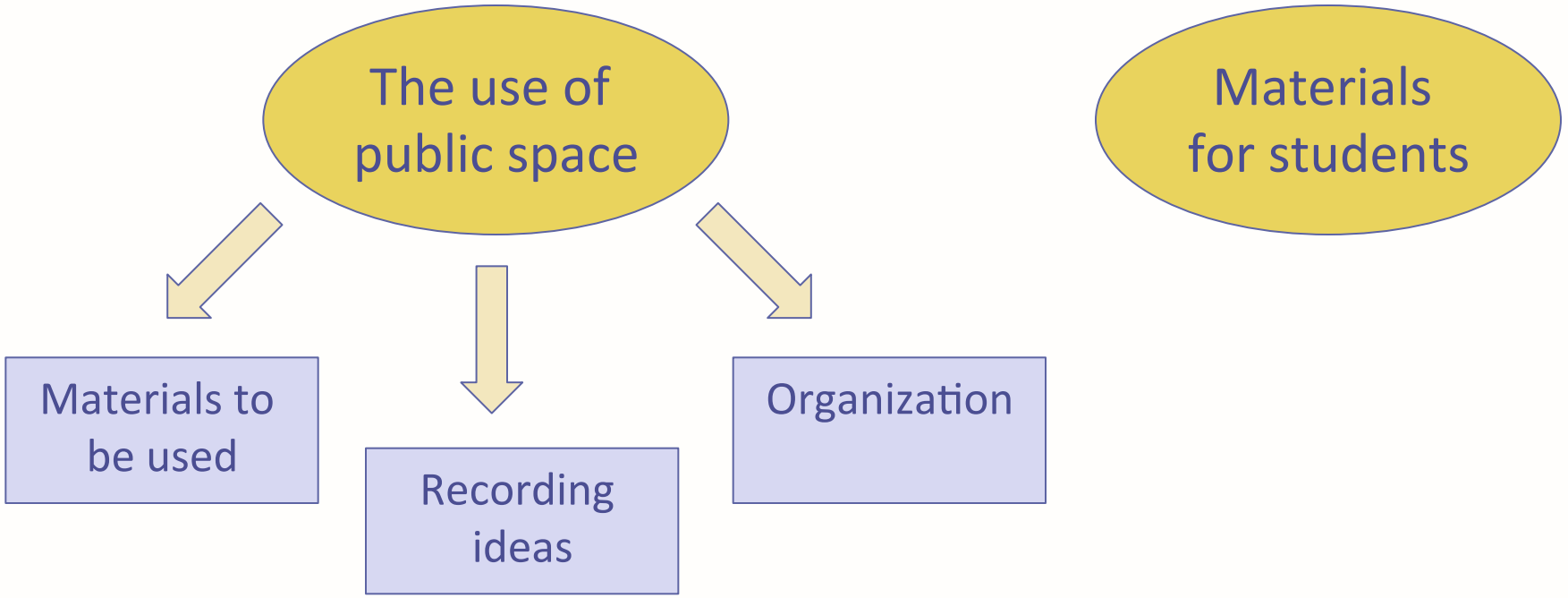
- Instruction is co-planned
- Focus on making teaching public in the moment
- Instruction is carefully documented

Records analyzed

- Lesson plans
- Video records of the instruction
- Documents prepared to support the instruction

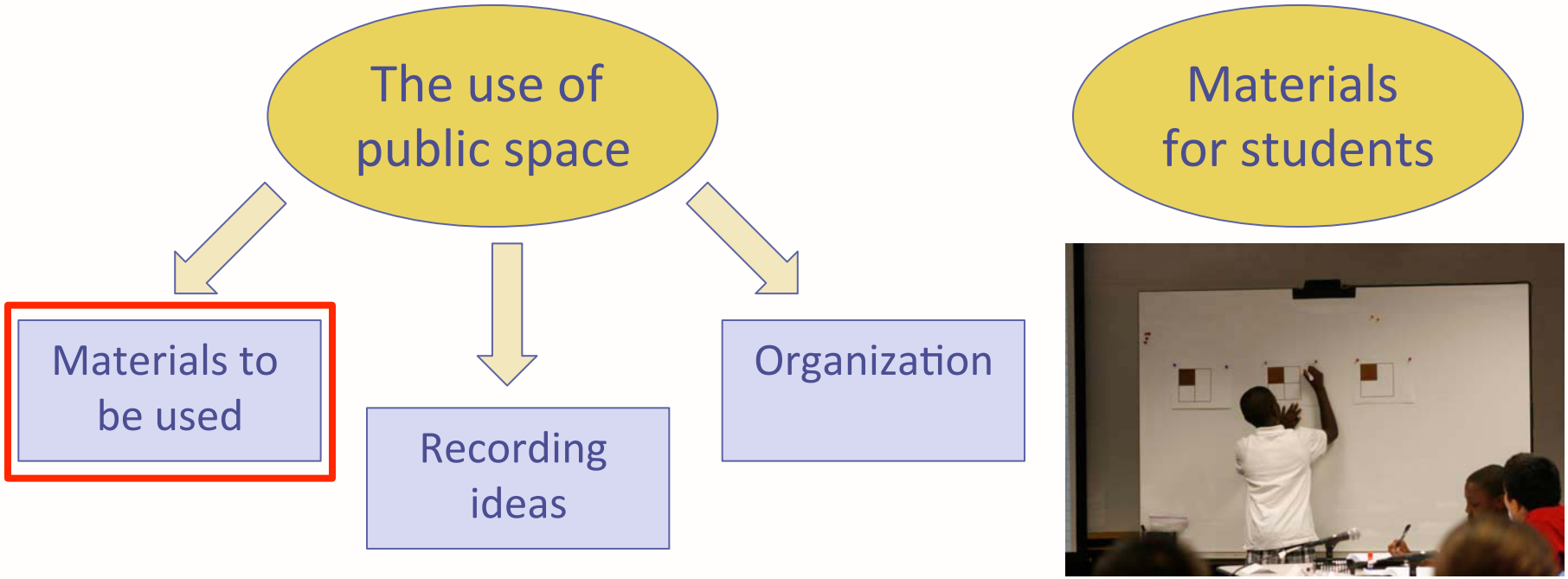
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Findings: Types of design work



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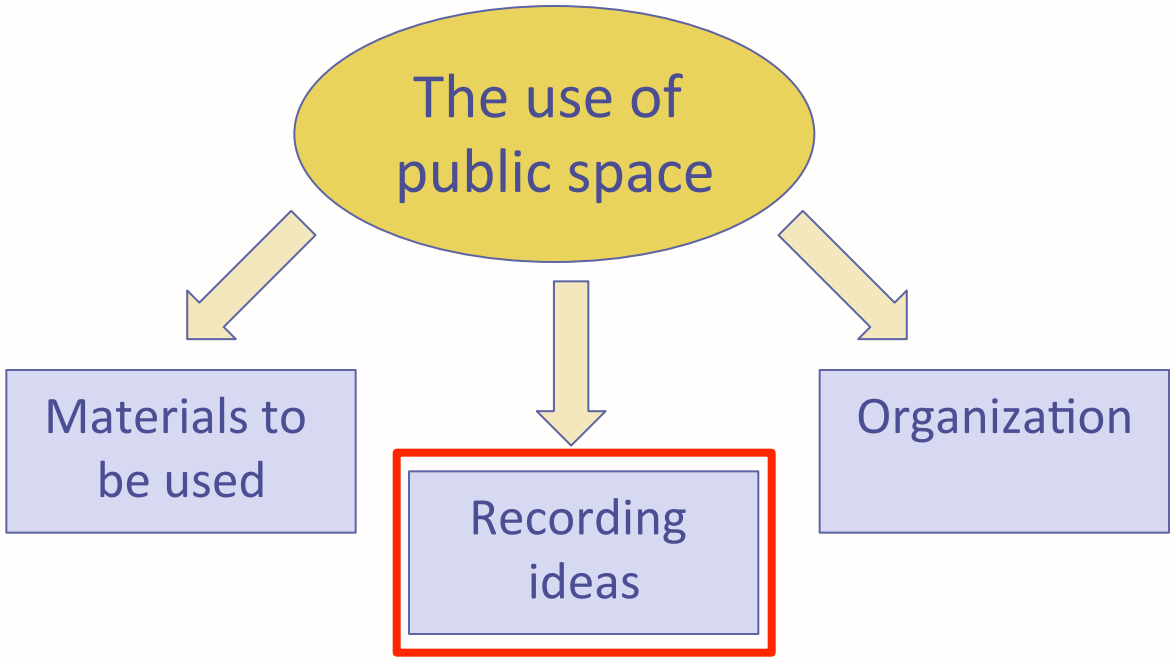
Findings: Types of design work

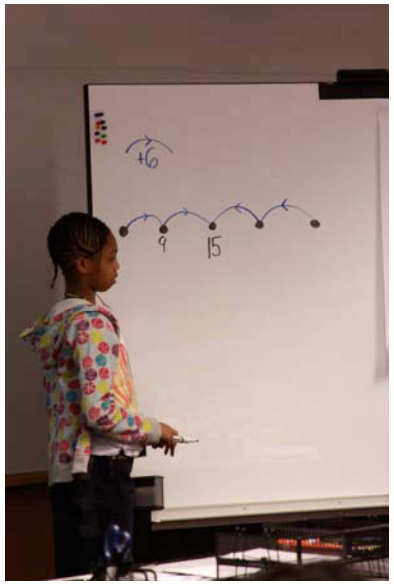


- Envisioning of how content-based interactions might unfold during a lesson and the types of material resources that might be used to support these interactions
- Designing and/or locating resources such as board sized copies of a representation, previous mathematical work, overhead manipulatives

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Findings: Types of design work

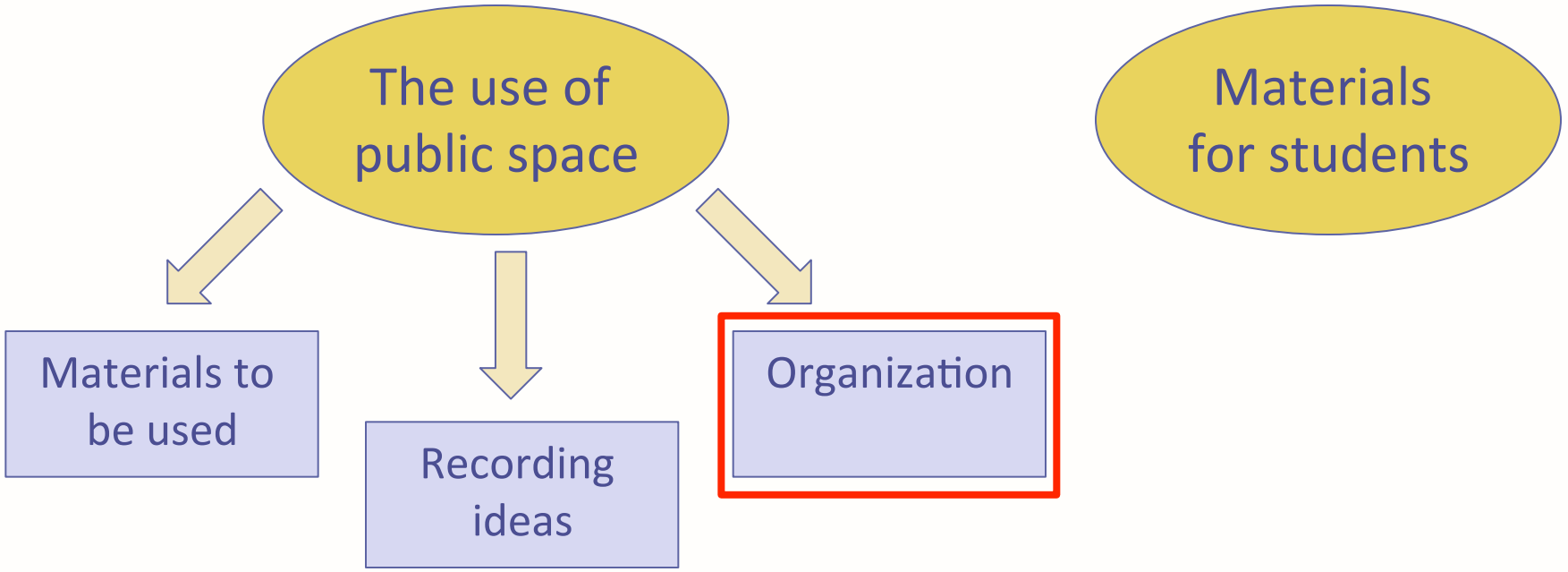




- Identifying the ideas that will need to be represented in the public space as an instructional segment unfolds
- Selecting the medium(s) for recording those ideas
- Deciding about who (teacher and/or students) will be representing the mathematical ideas

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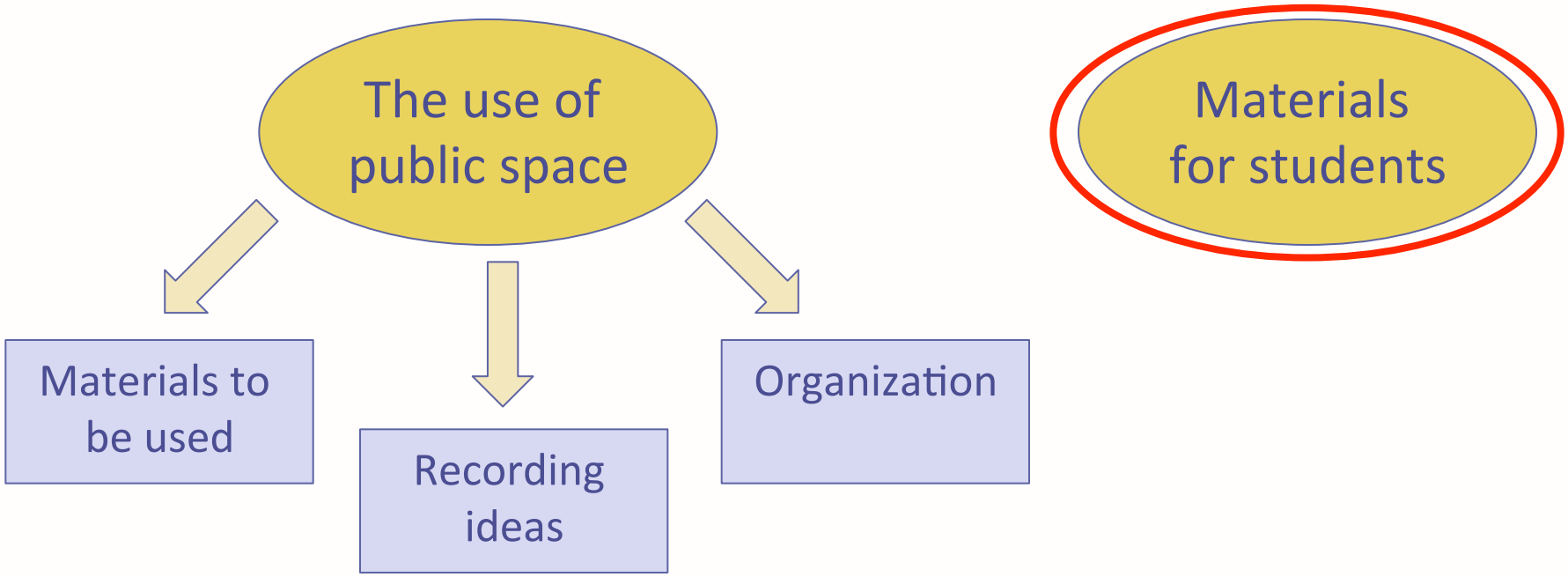
Findings: Types of design work



- Considering what the public recording space should look like at the end of an instructional segment
- Planning for content-based interactions in ways that allow that vision to be achieved

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Findings: Types of design work



- Considering what students need to have in front of them in order to work on the focal mathematics
- Designing and or locating such resources

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② The brown rectangle problem

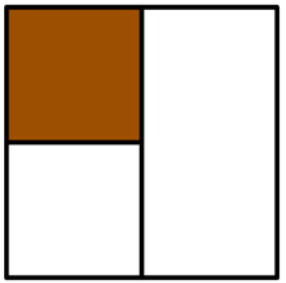
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The brown rectangle problem

What fraction of the rectangle below is shaded brown? _____



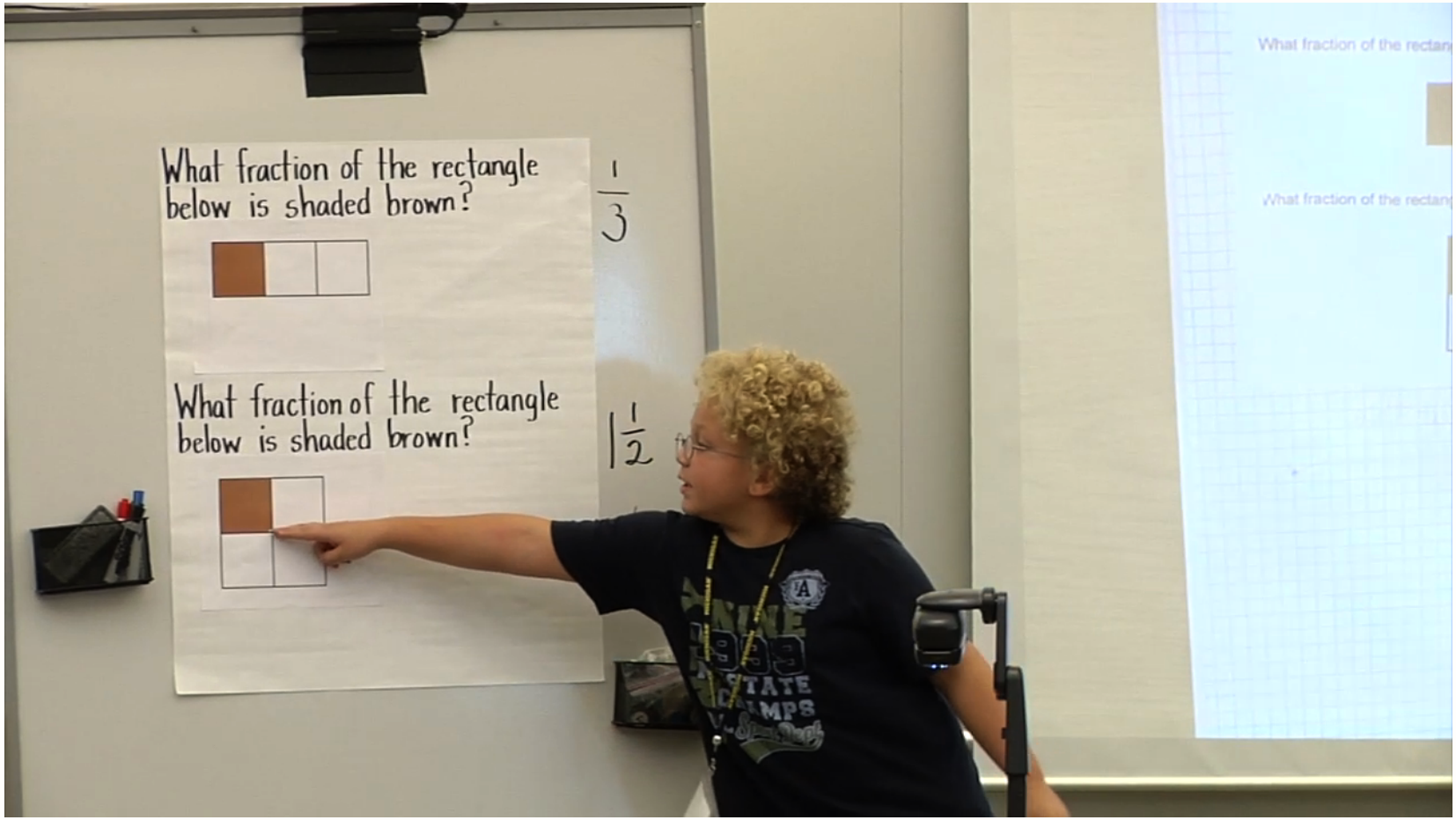
What fraction of the rectangle below is shaded brown? _____



Instructional goals:

- Students will begin to understand and use the concepts of “the whole” and “equal parts”
- Students will begin to use elements of a definition of a fraction to name parts of areas
- Students will begin to use the language of the whole and equal parts

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What do you notice about how content-based interactions may be been anticipated and designed for?

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Summary of the design work

The use of public space

Materials to be used

Task is written on poster paper
A removable sticky line
Multiple copies of the representations
Multiple copies of the brown part and the backs have adhesive added so that they function like a sticky note
An additional unequally partitioned area representation is prepared

Recording ideas

The recording will be done by both Ss and the T.
Ss will be invited to come to the class to show the whole.
Ss may come to the board to add the removable black line
Ss may come to the front of the class to use the brown parts to show that one brown part is ¼.
T may record important fraction ideas as they emerge in the discussion.

Organization

A small copy of the task is pasted into a notebook and projected.
A poster with the task is located on a rolling whiteboard which is in the front of the room towards the left side.
There is space to record solutions on Brown Rectangle Poster Paper
Whiteboard space is available for recording

Materials for students

Small copy of the task

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Conclusion

- Identified two types of design work
- Focused on anticipating and designing for content-based interactions, but the actual act of pulling off the content-based interaction is also key
- Implications for curriculum development and teacher education

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Discussant comments

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Related session

The Elementary Mathematics Laboratory:
Designing and Studying Mathematics Instruction

Structured Poster Session

Wednesday, May 1 at 2:15 p.m.

Parc 55, Cyril Magnin I

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The 2013 Elementary Mathematics Laboratory (EML)

July 29 – August 9

- A program for entering fifth grade students
- A lab for the study of mathematics teaching practice
- Professional development opportunities for educators

http://www.teachingworks.org/training/LaboratoryClasses

TeachingWorks, at the University of Michigan



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