

# Mathematics Improvement Network



## Observing Mathematics Lessons

What should we focus on?

# Outline



- Observing Classroom Activity
- Introduction to an Observation Framework
- Using the Framework to Look at Two Math Tasks
- Using the Framework to Look at Two Math Lessons
- Comparing Two Lessons
- The Context of Lesson Observation
- Where to Go From Here



# Observing Classroom Activity

# Observing Classroom Activity



- Why do we observe math lessons?
- What do we focus on when we observe them?
- How can we use our observations more constructively?

# Observing Classroom Activity



How can we capture the richness of classroom interaction that supports the development of students' robust understanding of mathematics?

Observer and teacher need to work together to:

- locate where a teacher's current practices are
- identify where they are to go next

This is challenging!





# **Introduction to an Observation Framework**

# 5 Dimensions of Mathematically Powerful Classrooms

## **Formative Assessment**

We want instruction to be responsive to students' actual thinking.

- We can craft tasks and ask purposeful questions that give us insights into the strategies students are using, the depth of their conceptual understanding, and so on.
- We can then use those insights to guide our instruction, to build on student thinking.



# Mathematical Practice Standards

1. Make sense of complex problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.



# Agency, Authority and Identity

## **Sense of Agency**

Does the student feel that he or she owns the mathematics, and can take the initiative?

## **Sense of Authority**

The roots of 'authority' come from the word 'to author', or to write mathematics.

Can the student explain and write about mathematics?

## **Sense of Identity**

Does the student come to see him or herself as someone who can do mathematics - a 'math person' - or as someone who doesn't like it and can't do it?

# The Five Dimensions of Mathematically Powerful Classrooms

## The Mathematics

How do mathematical ideas from this unit/course develop in this lesson/lesson sequence? How can we create more meaningful connections?

## Cognitive Demand

What opportunities do students have to make their own sense of mathematical ideas? How can we create more opportunities?

## Access to Mathematical Content

Who does and does not participate in the mathematical work in the class, and how? How can we create opportunities for each student to participate meaningfully?

## Agency, Authority, and Identity

What opportunities do students have to see themselves and each other as powerful doers of mathematics? How can we create more of these opportunities?

## Formative Assessment

What do we know about each student's current mathematical thinking? How can we build on it?



# Using the Framework to Look at Two Math Tasks

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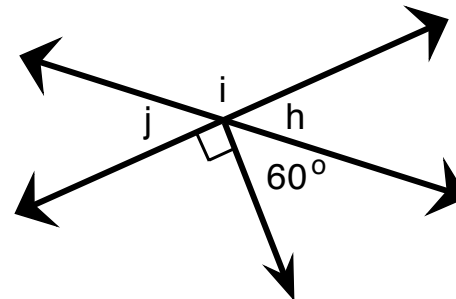
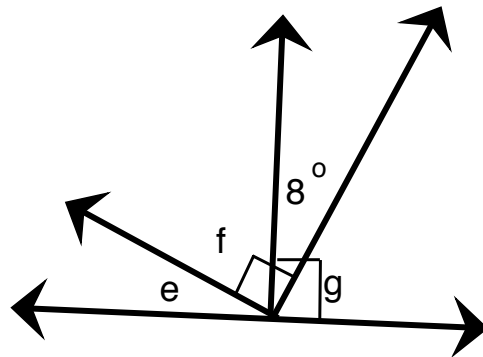
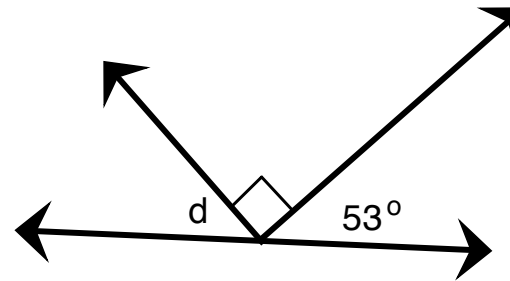
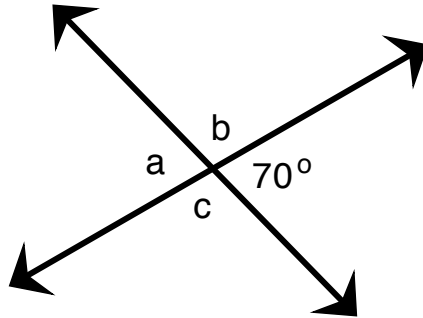
We're going to observe some math teaching.  
But first, what will the students be facing?

## On **Handout 3**:

- Attempt both tasks.
- Discuss with your neighbor:
  - How you might solve each problem
  - The mathematical challenges involved
  - The potential of the tasks for student learning

# A Geometry Problem

Find the measure of all angles



What opportunities does this task appear to offer students to think and reason mathematically?

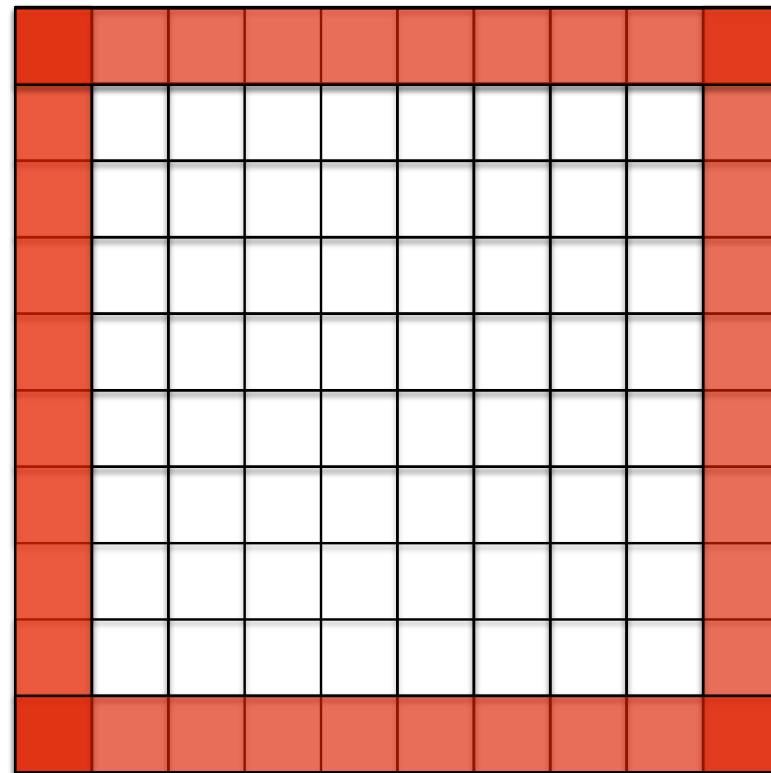


# The Border Problem

Here's a 10 x 10 grid.

Without counting them all one by one, how can you figure out the number of border tiles?

What about the number of tiles around other size squares?



What opportunities does this task appear to offer students to think and reason mathematically?

# Looking at a Task

## The Mathematics

- Does the task address important mathematics?
- Are there opportunities for meaningful connections?

## Cognitive Demand

- Is the task challenging?
- Does the task require reasoning or only recall?

## Access to Mathematical Content

- Does the task have an easy entry point?
- Does it have a ramp of difficulty?

## Agency, Authority, and Identity

- Does the task offer opportunities for students to make choices and decisions?

## Formative Assessment

- Does the task offer opportunities for students to compare and assess a range of different methods?



# Using the Framework to Look at Two Math Lessons

# Looking at a Lesson

## The Mathematics

- Are students learning important mathematics?
- Are opportunities made for meaningful connections?

## Cognitive Demand

- How long do students spend on each prompt?
- Do they engage in productive struggle?
- Do teacher questions invite explanations or answers?

## Access to Mathematical Content

- Does the teacher ask a range of students to respond?

## Agency, Authority, and Identity

- Who explains most: the teacher or the students?
- Do the students give extended explanations?

## Formative Assessment

- Does the teacher follow up student responses?
- Does the teacher vary the lesson in the light of student responses?

# The Geometry Lesson





# Looking at a Lesson

- Think about the lesson from the students' perspective.
- Note down your answers to the questions on **Handout 5**.

The Mathematics	<ul style="list-style-type: none"><li>• Are students learning important mathematics?</li><li>• Are opportunities made for meaningful connections?</li></ul>
Cognitive Demand	<ul style="list-style-type: none"><li>• How long do students spend on each prompt?</li><li>• Do they engage in productive struggle?</li><li>• Do teacher questions invite explanations or answers?</li></ul>
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# The Border Problem Lesson



# Looking at a Lesson

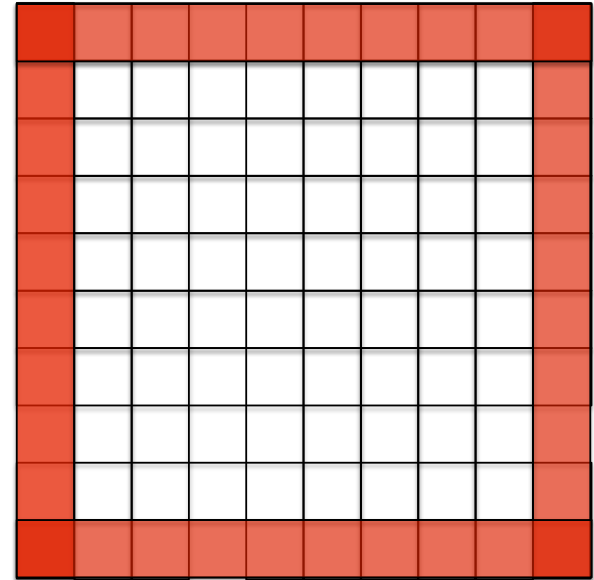
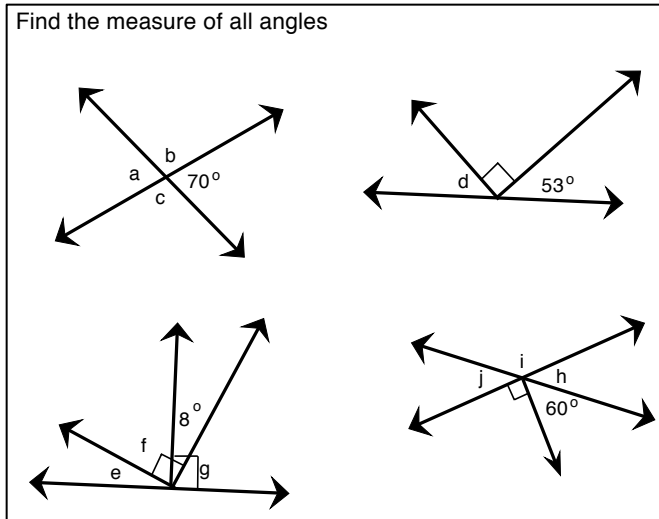
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# Comparing Two Lessons

# Comparing the Two Lessons



What differences did you observe?

What feedback could be useful for each teacher?



# Observing Classroom Activity



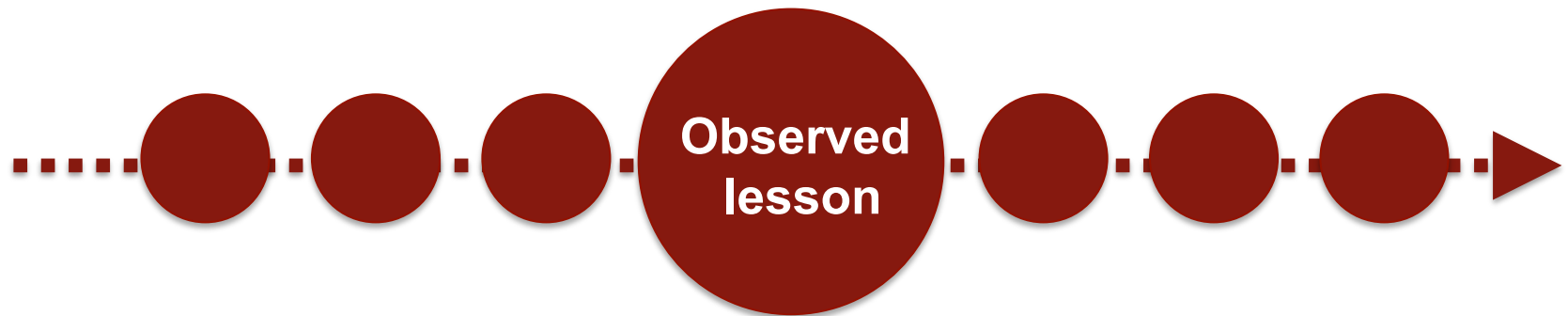
- **Why do we observe math lessons?**  
TRU explicitly frames observations around supporting professional learning.
- **What do we focus on when we observe them?**  
TRU helps structure the discussion before the lesson, on what to focus on in the lesson.
- **How can we use our observations more constructively?**  
TRU helps structure the post-lesson discussion about what the teacher did well and how the teacher might improve their practice.  
TRU also helps frame the decisions about the math department's long term goals.



# **The Context of a Lesson Observation**

# The Context of a Lesson Observation

- TRU does shift the focus away from teacher or student performance in an individual lesson.
- However, how a lesson is embedded in a sequence of lessons needs to be also considered.

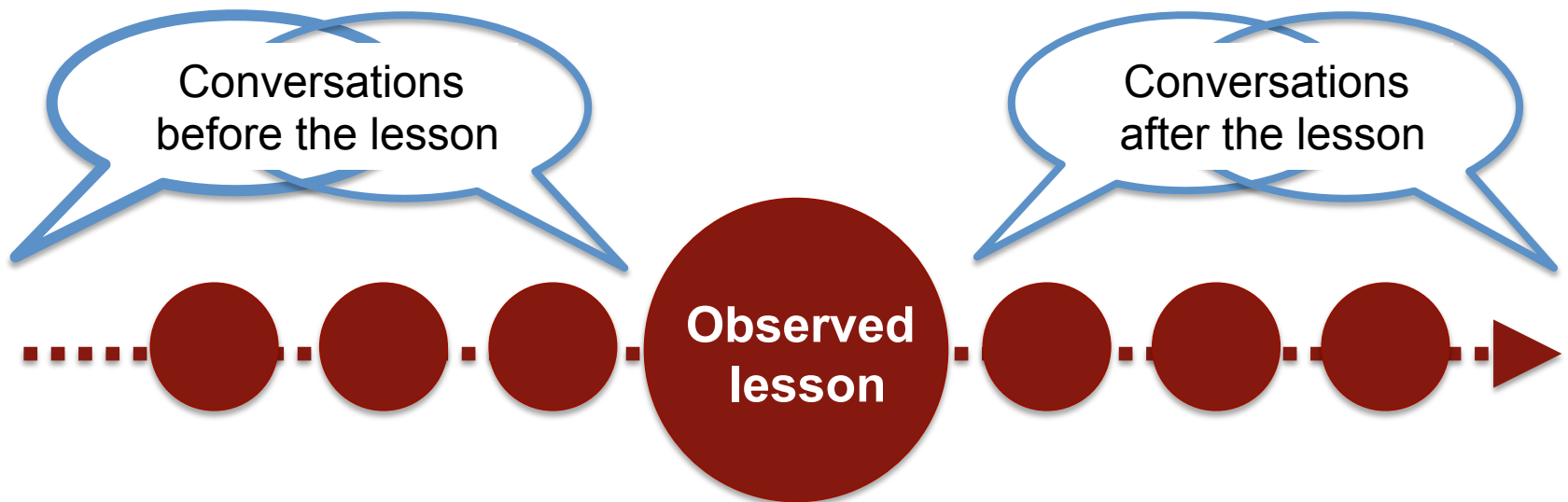


# The Context of a Lesson Observation



# The Context of a Lesson Observation

‘The chapter’ is the appropriate unit for analysis.



TRU provides:

- a focus for an observation
- a framework for monitoring progress over time for individual teachers and the math department






**Where to Go From  
Here**

# Where to Go From Here

**Mathematics Assessment Project**  
TEACHING FOR ROBUST UNDERSTANDING OF MATHEMATICS  
TRU Math Suite

MARS  
Mathematics  
Assessment  
Resource  
Service

 Home

About

News

Lessons


Tasks

Tests

PD Modules

**TRU Math Suite**

Standards



**TRU Math**

Overview

- ▶ The TRU Framework

**Teaching for Robust Understanding of Mathematics (TRU Math)**

Part of the Math Assessment Project has invested research into how the materials are used in classrooms, their effective teaching practices, and how Professional Development can be used to achieve the goals of the Mathematics Assessment Project materials. One strand of this has been a joint effort with the [Algebra Teaching Strategies](#) project at Berkeley and Michigan State to develop *Teaching for Robust Understanding of Mathematics (TRU Math)* suite of tools for Professional Development and research.

**The Teaching for Robust Understanding of Mathematics (TRU) Framework**

<http://map.mathshell.org>

# Mathematics Improvement Network

**Thank you**

**< insert contact details >**