Observing Mathematics Lessons

What should we focus on?

Leader Guide

GOALS

The goal of this workshop is to explore, through the use of a practical, research-based framework, how the process of lesson observation can be optimized to provide support for principals or others, with or without a professional mathematics background, in identifying the key aspects of a mathematics lesson, and providing feedback that will help teachers support the development of students' understanding of the mathematics.

USERS

Principals, central office curriculum and instruction leaders in mathematics, and other math leaders.

INTRODUCTION

Collecting the right information, analyzing it and providing feedback are at the heart of evaluating and improving any system. In schools, classrooms are the systems that, together, determine the building's and to a great extent the district's overall performance. Thus, principals and other district mathematics leaders need to be deliberate and intentional when collecting, analyzing, and using information from classroom observations. They provide the best source of information about what is going on during lessons, but since a classroom is a complex group of interacting human beings, it is not easy to pick out what is most significant. This is particularly true for observers who do not have a deep background in mathematics. Observers may be impressed by a quiet class listening to a teacher explaining a concept, then working an example on the board, followed by the students working a bunch of very similar tasks. Is this good teaching? It may be excellent class management but with limited learning.

When observing lessons to understand how the learning is going, the key focus needs to be on '*What are the students doing'?* Research shows that few listen to the explanation; they focus on the worked examples, knowing that their role is to imitate what the teacher did. This they mostly do well - though for many their scores in a test later show the learning was transitory. Learning has levels of understanding summarized as: imitation, retention, explanation, adaptation, and extension. Robust long-term understanding depends on them all; the first two are not enough. Classroom observation needs to focus on what the students are doing and how teacher practice affects this. Are students asked to explain their reasoning, not just give answers? Are students given opportunities to apply their mathematics in new ways in order to solve a problem, and to persist if it is not immediately clear what to do? These are key *mathematical practices* set out in the Standards. Valid classroom observation needs to encompass them. This tool enables observers, with a strong math background or not, to develop those observational skills.

The tool supports a 90-minute workshop that, first, offers participants an opportunity to reflect on the various reasons for observing lessons, some issues around lesson observations, and how these issues can be tackled. They then learn and use a research-based framework to support them in the task of observing mathematics lessons, analyzing their qualities, and providing useful feedback to the teacher. The workshop tasks include providing feedback on video clips of lessons, discussing how observers decide where to place their attention when observing lessons, and how what is noted can be organized in a coherent way, that will also help them give feedback that will help teachers improve their practice.

SESSION OUTLINE

- Observing Classroom Activity 10 minutes
- Introduction to an Observation Framework 15 minutes
- Using the Framework to Look at Two Math Tasks 15 minutes
- Using the Framework to Look at Two Math Lessons (15 minute + 20 minutes) 35 minutes
- Comparing the Two Lessons 5 minutes
- The Context of a Lesson Observation 5 minutes
- Where to Go From Here 5 minutes

MATERIALS REQUIRED

- This Leader Guide, supported by a
- PowerPoint: 'Observing Mathematics Lessons.pptx'
- Session Handouts: One copy per person. 'Observing Mathematics Lessons Handouts.docx'

TIME NEEDED

1 hour 30 minutes

PREPARATION

The workshop leader(s) should carefully work through this Guide, referring to the Handouts. For the core Activity Sequence (below) it covers the same material as on the PowerPoint slides, including the notes below each slide.

It will help support productive discussions, if you can pair participants with a mathematics background with those from other backgrounds.

Participants, too, may find it helpful to read through mathematics tasks in the handouts before the sessions – particularly if they are not math specialists.

Try to anticipate the common concerns that participants may raise and write down those issues and your responses to them, below. The ones shown below are examples taken from trials of this session:

Common concern	Suggested responses
Elementary and secondary Evaluations are time consuming. It is not realistic to think principals could do more observations.	Observation is a key element in both teacher evaluation and, more important in the long term, feedback for professional learning. Whoever does it will benefit from this workshop.
Secondary Limited knowledge of school math means many principals do not feel qualified to provide math teacher advice beyond classroom management and noting if students are engaged.	This workshop, including the framework, is designed to equip non-math evaluators with the knowledge and skill to productively do math evaluations, and conduct a post lesson discussion with the teacher.

In an effort to help users understand more deeply how the designers envisioned the materials being used, and the rational for why certain information and activities were incorporated, the suggestions for the activity sequence that follow are specific and detailed.[1]

[1] People are often uneasy about giving such detailed 'instructions', feeling it is demeaning to fellow professionals.

On the left of each slide in this Guide are:

Notes to the session leader in italics

Comments the leader may choose to use when addressing attendees (in normal text).

Users will, of course, adapt as necessary – though we recommend sticking with this activity sequence the first time or two. (Trials having shown it works well for others like them).

ACTIVITY SEQUENCE

Slide 1

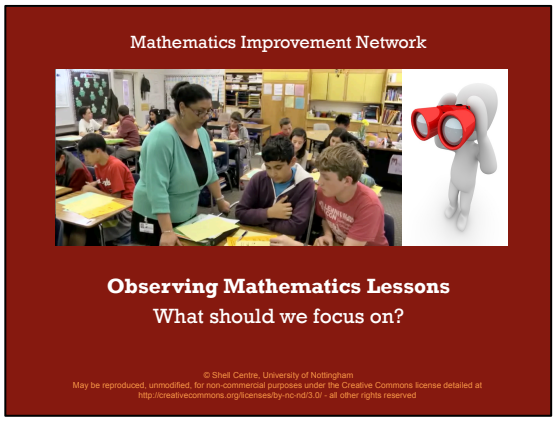
Title Slide

You may like to customize this slide and/or the last one with your own institutional and contact details. Please leave the copyright attribution, however.

Possible comments below are in plain text. *Suggestions are in italics.*

Users will, of course, adapt as necessary – though we recommend sticking with this activity sequence the first time or two.

The goal of the workshop is to explore, through the use of a practical, research-based framework, how the process of lesson observation can be optimized to support teachers and thus the development of students' understanding of the math.



Slide 2

This is how the workshop should go:

Rough timing

Observing Classroom Activity *10 minutes*

Introduction to an Observation Framework *15 minutes*

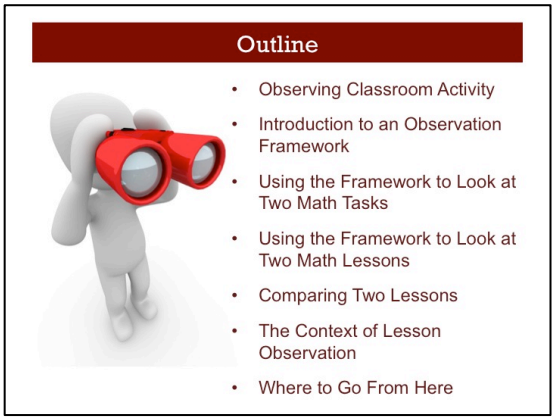
Using the Framework to Look at Two Math Tasks *15 minutes*

Using the Framework to Look at Two Math Lessons *35 minutes*
(split into a 15 minute, & then a 20 minute activity)

Comparing Two Lessons *5 minutes*

The Context of Lesson Observation *5 minutes*

Where to Go From Here *5 minutes*



Feedback from trials has shown this feeling is unfounded; the general reaction of users is to ask for *more* detail.

Observing Classroom Activity (10 minutes)

In this session we will be focusing on the features of lessons that make for powerful math teaching.

Let's begin by looking at observing what happens in the classroom.

Slide 3

*Give out **Handout 1.***

Introduce the session by asking participants to discuss these three questions.

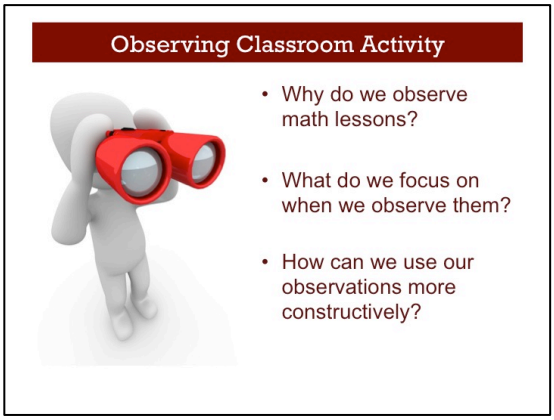
Discuss the three questions on this slide with your partner, then we'll share. Write down your ideas under each question using **Handout 1.**

Allow time (3-4 minutes) for discussion in pairs, then bring everyone together. Collect and discuss responses as a whole group.

Make a list of the things that are typically observed.

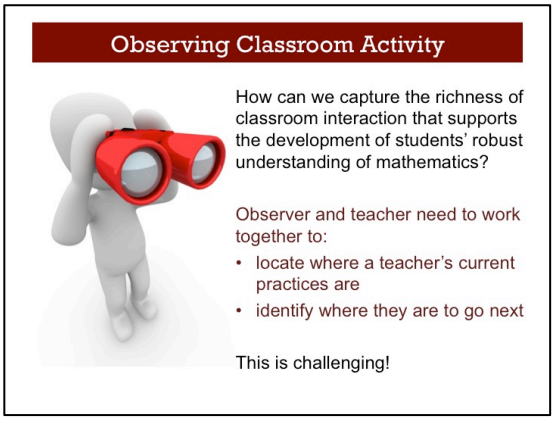
Draw out the differences between observations primarily intended to help teachers improve and those that are intended to assess teaching quality.

Slide 4



From your contributions to the discussion, and the list we have just constructed, it is clear that the answer to the question on this slide is key to supporting productive discussions between teacher and observer, and ultimately effective classroom activities.

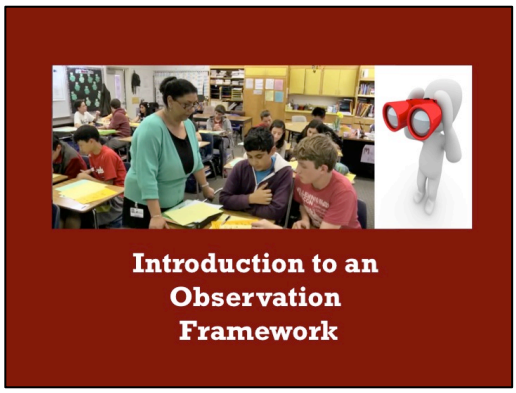
Slide 5



Introduction to an Observation Framework (15 minutes)

Let's now take a look at a framework for observing math classrooms.

Slide 6



Ask participants to look at **Handout 2.**

Alan Schoenfeld and his team have been working for many years on a research-based framework that will help focus observations and guide feedback. As I play the audio file, Alan will introduce us to the framework: TRU Math, the Teaching for Robust Understanding Framework. TRU is a framework for describing learning environments.

As Alan speaks, try to relate the foci of your classroom observations to the various categories in the framework. As you listen to Alan, if there is something he references that you are unsure about, jot it down and we can clarify afterwards terms or issues addressed in the audio.

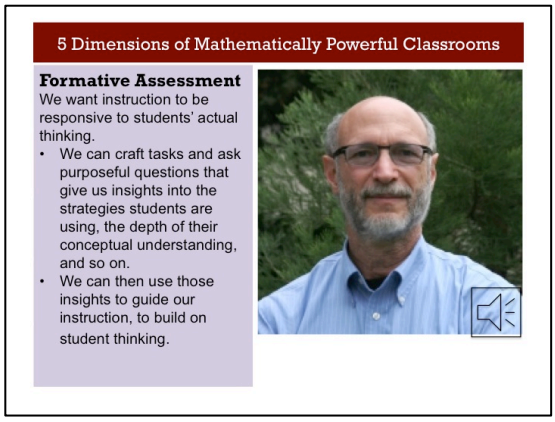
Click on the picture of Alan to hear the audio file and then click the space bar each time he talks about a new dimension (this will change the text on the slide). ***(This animation only works in Slideshow mode)*** *To ensure all participants have time to read the text you could, at times, pause the video and restart it in the same position.*

TRU Math was developed to highlight critical components of teaching and learning mathematics. It provides a means of structuring observations and discussions with teachers and will be the framework we use throughout this workshop.

Was there anything said in the audio that needs clarification?

Some participants may not know what Alan means by the 'Mathematical Practices'. Be prepared to quickly explain these. The optional Slide 8 may help. You also may want to expand on Alan's description of Agency, Authority and Identity. Slide 9 is an optional slide to support your explanation.

Slide 7

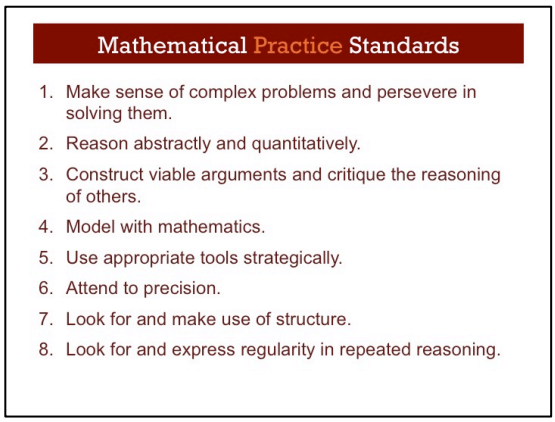


This is an optional slide. Use it if participants are unfamiliar with the Practices.

The Mathematical Practices are the main new feature of the Standards. They describe what really doing (i.e. practicing) mathematics involves – so they have always been there, implicitly, but have often been neglected.

The practices clarify the depth of understanding that students need to have. They emphasize that understanding a mathematical topic means students can use the concept to **make sense, reason, construct arguments, and solve non-routine problems.**

Slide 8

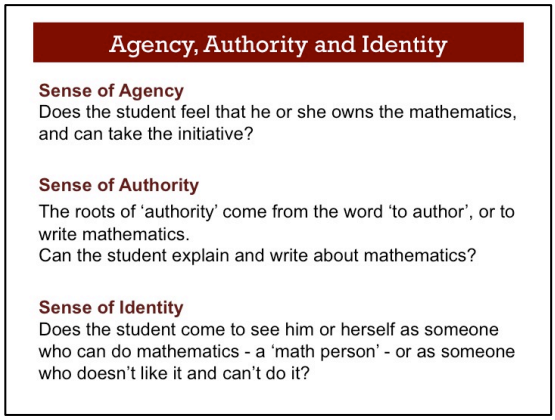


This is an optional slide. Use it if participants are unsure of the meaning of agency, authority and identity. Ask participants to read through the slide.

Acquiring a sense of agency, authority and identity are shaped by students' experience in their mathematics classrooms.

Do students get to use their mathematical initiative, to speak and write mathematics?

Slide 9



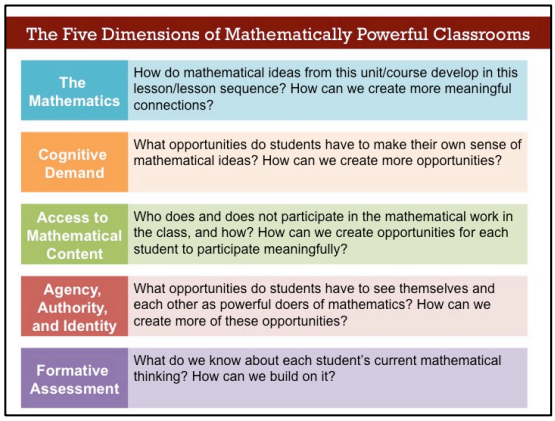
*Allow time for each participant to read the framework on **Handout 2**.*

This framework offers a comprehensive way of identifying a powerful classroom that supports students' learning.

With your partner, discuss how far your own classroom observations have focused on the ideas listed.

Allow 5 minutes for reading and any discussion.

Slide 10



Using the Framework to Look at Two Math Tasks

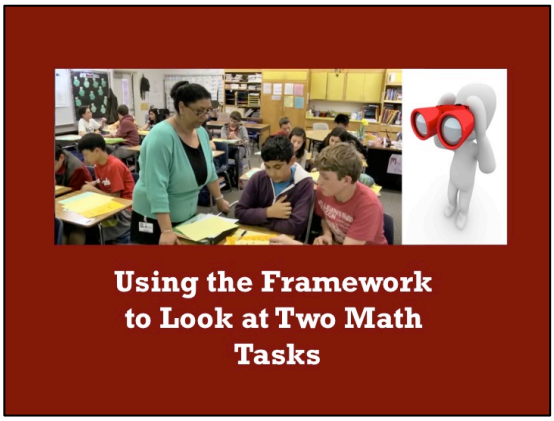
(15 minutes after 25 minutes)

We're going to look at two short videos of teaching, as an exercise in observation.

But first, to observe effectively you need to know the tasks the students will be tackling. The best way to do this is to think about and work on the task yourself before observing a teacher using the task and students trying to work through the task.

There's no real substitute for trying them yourself before the observation.

Slide 11



Ask participants to look at **Handout 3** *containing the two tasks.*

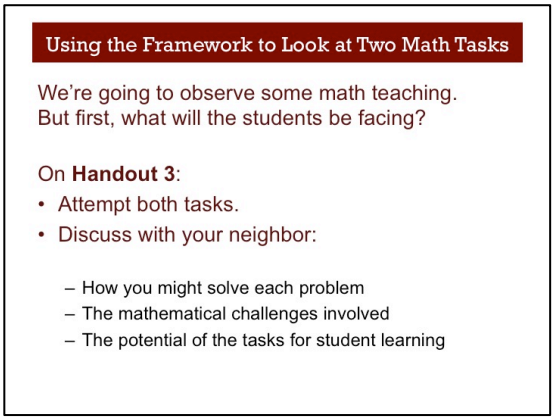
Read over the tasks and then work with a partner.

After you have worked on both tasks, discuss the three questions listed on the slide.

Watch out for participants who are themselves insecure about math and reassure them.

Give participants about 5 minutes to look at the two tasks.

Slide 12



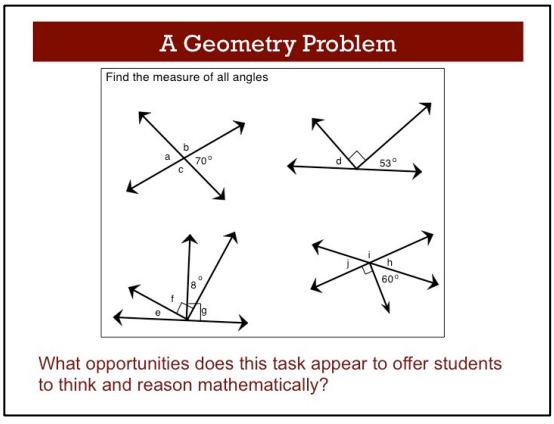
Let's come together and look at the Geometry task.

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

This task is focused on the knowledge that the angle in a complete rotation is 360° and on a straight line is half that, 180°.

Knowledge of the notation for a right angle is also required.

Slide 13



Now let's look at 'The Border Problem'. What opportunities does this task appear to offer students to think and reason mathematically?

There are many approaches available here. E.g.

$4 \times 10 - 4$ $\quad$ $2 \times 10 + 2 \times 8$

$10 \times 10 - 8 \times 8$ $\quad$ $4 \times 8 + 4$

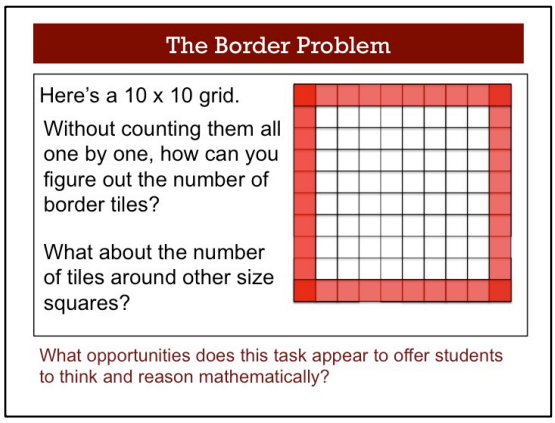
4×9

There are mathematical possibilities for generalizing to any size grid. This would take students into algebra.

There are opportunities for exploring the connections between different representations of calculations or of different algebraic expressions, such as $n^2 - (n - 2)^2 = 4n - 4$.

How far and where the conversation goes will depend on the mathematical background of participants.

Slide 14

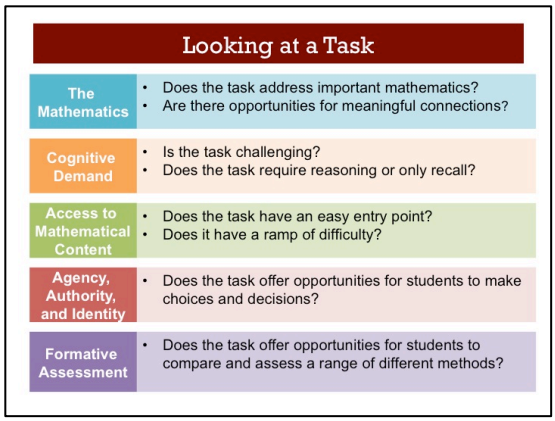


Before looking at short videos of each lesson, we would like you to consider the opportunities offered with each task by analysing them using the five dimensions of the TRU framework, including the questions on this slide.

Write down your ideas under each heading using **Handout 4.**

After participants have completed the handout, ask them which of the two tasks they consider stronger, for each of the dimensions and why.

Slide 15



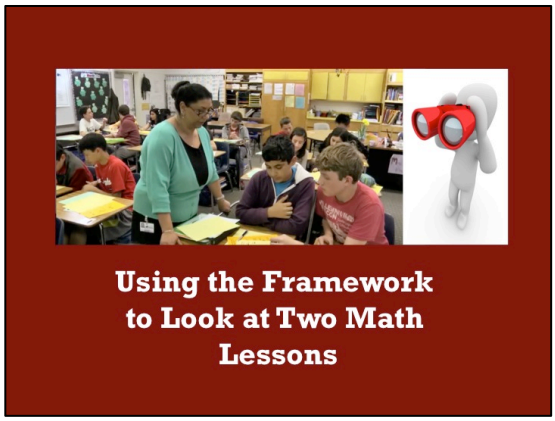
Using the Framework to Look at two Math Lessons

(35 minutes after 40 minutes)

First lesson activity takes 15 minutes; second lesson activity, 20 minutes

We're now going to watch two short lesson videos, one on each task.

Slide 16



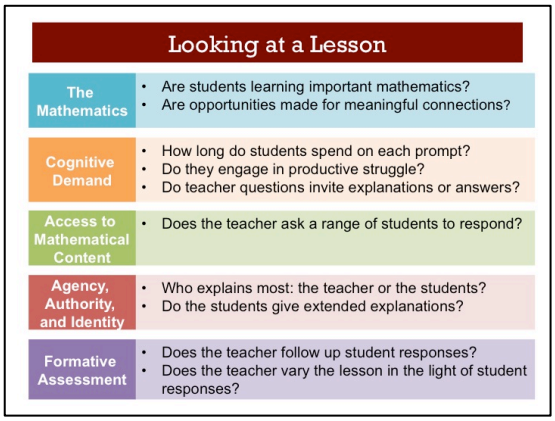
Look carefully at **Handout 5**. As you watch the two videos you are going to answer these questions about each lesson.

Notice how each question relates to the heading. For example:

- How long do the students spend on each prompt?
- How is this an indicator of cognitive demand?

Longer periods of working on a prompt may indicate productive struggle and/or constructing longer chains of reasoning. Quick responses mean short chains of reasoning and/or recall. You may want to raise this issue during the discussions that follow the watching of the videos.

Slide 17

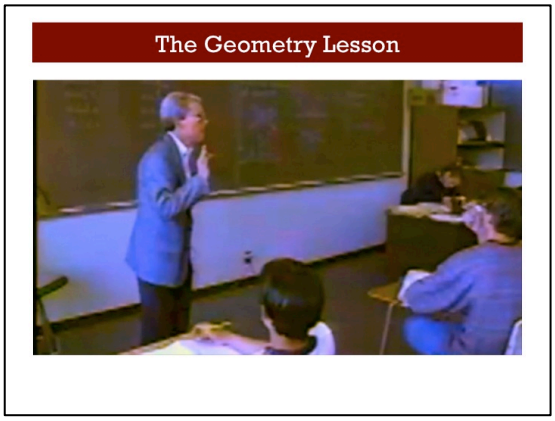


The Geometry Lesson *(5 minutes)*

Let's watch this lesson together and then we'll do a 'think, pair, share' around what you observed and the guiding questions in the framework outlined on **Handout 5**. Think about the lesson as an observer but also as a student in this classroom.

This lesson was released from the Third International Mathematics and Science Study. It took place in 1995 and was chosen as a sample of typical math teaching in the US.

Slide 18



(10 minutes for discussion of this question slide)

Write down your responses to the questions on **Handout 5.** Remember to think about the lesson not only from an observer's point of view but also the students' perspective.

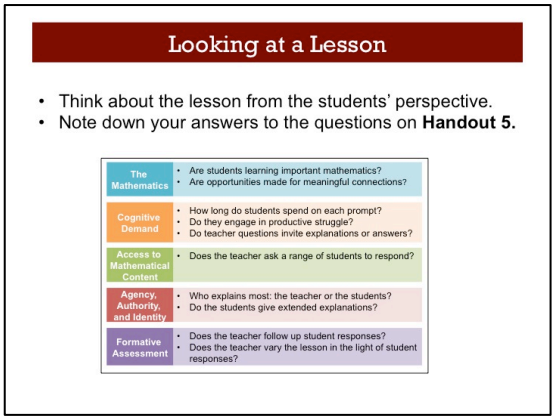
Share what you have written with a partner.

Afterwards, collect some thoughts from everyone. This video exemplifies what we call IRE sequences:

- *Initiation (teacher asks a question)*
- *Response (from the student)*
- *Evaluation (from the teacher)*

A key feature of the lesson is that it focuses on small bite-size pieces of knowledge – primarily answers.

Slide 19



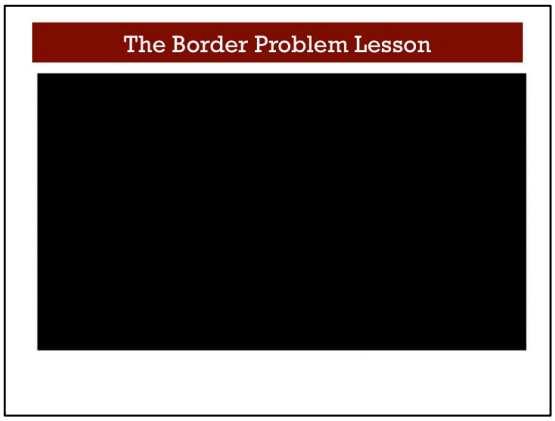
The Border Problem Lesson *(8.5 minutes)*

Now we'll watch this lesson together. And then do another 'think, pair, share' around what you observed and the guiding questions in the framework. Again, think about the lesson as an observer and also as a student in this classroom.

This lesson was taken from the work of Cathy Humphrey's*. It is a Grade 7 heterogeneous class in a school in California.

**Boaler and Humphreys (2005) Connecting Mathematical Ideas: Middle School Video Cases to Support Teaching and Learning.*

Slide 20



(12 minutes for discussion of the same question slide)

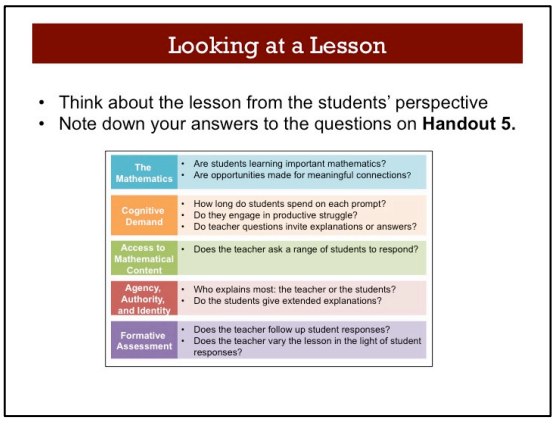
Write down your responses to the questions on **Handout 5.** Again, think about the lesson from not only an observer's point of view but also the students' perspective.

Share what you have written with a partner.

Afterwards, collect some thoughts from everyone.

The teacher skillfully orchestrated the discussion. Many students participate in the discussion, students use a range of strategies and there appears to be an underlying assumption that there is reasoning behind each strategy. The teacher holds students accountable for their own reasoning by asking them not just to state an answer but to explain how they arrived at it. There are also attempts to make mathematical connections between ideas.

Slide 21



Slide 22

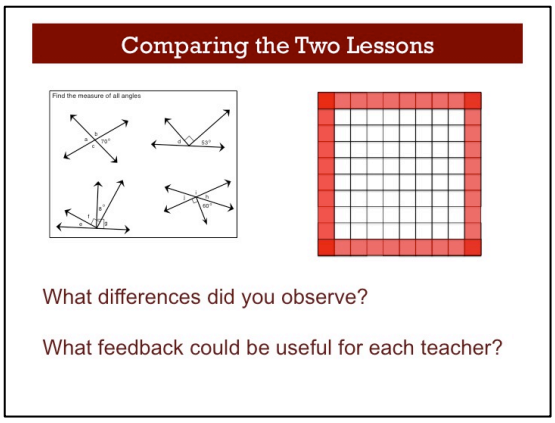
Comparing Two Lessons
(5 minutes after 75 minutes)

Let's now compare the two lessons.

Start with these open questions and note what people say. Then turn to the specific indicators on Handout 5 (Slide 21). Depending on how participants respond you may want to draw their attention to the following:

- *Notice that the second lesson provides more opportunities than the first for both student agency, authority and identity, and productive struggle.*
- *Although one might consider the math is technically more advanced in the first lesson, it is only asking students to demonstrate their understanding of the definitions of supplementary angles and right angles and then perform some basic arithmetic. 'The Border Problem' involves arithmetic, but is moving towards algebra by asking students about generalizations and making connections between responses. The challenge in 'The Border Problem' is in deciding on an approach, visualizing calculations in context, generalizing to a different number of squares, and so on.*

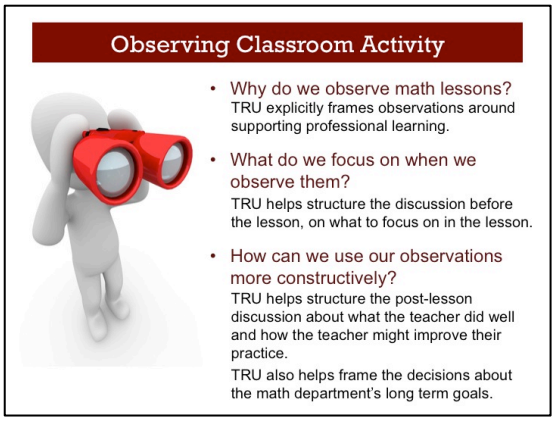
Slide 23



Quick slide

Returning to the set of questions you considered at the beginning of this workshop, let's consider how we can now summarize how the five dimensions of TRU can support observing classroom activity.

Slide 24

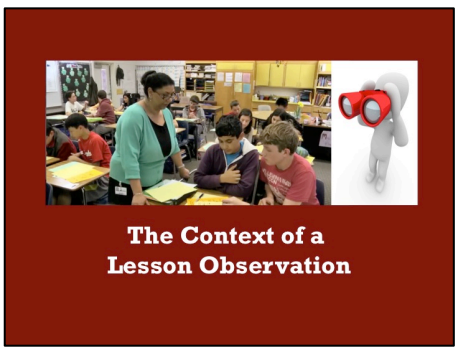


Slide 25

The Context of Lesson Observation
(5 minutes after 80 minutes)

We've been focusing on how one can recognize the critical qualities of an individual math lesson.

However, there is always a risk, when observing just one lesson, that the focus is on performance rather than learning opportunities.

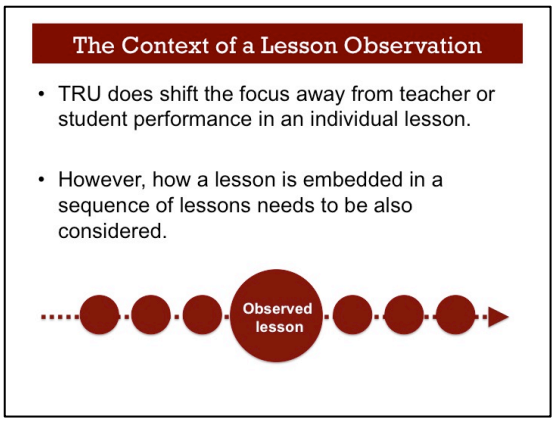


Slide 26

The purpose of using the TRU framework is to recognize the critical qualities of classroom activity, and to mitigate any distractors.

However, any lesson you observe is part of a sequence, usually organized as a chapter or unit.

This lesson may well not show the range of learning activities.



Slide 27

Let's now hear Phil Daro, lead author of the Standards, talk about how a lesson is embedded within a sequence of lessons.

Play the video clip.

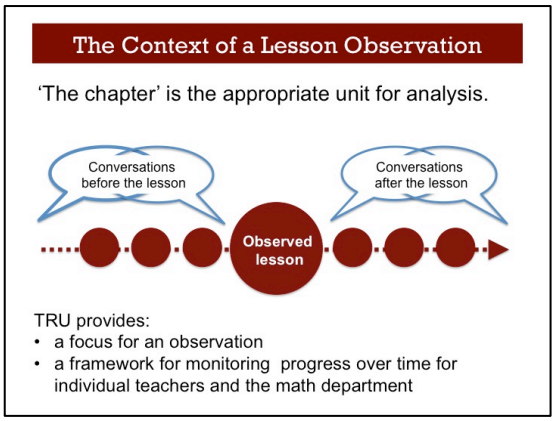
It is important to know what part each lesson plays in the unit and to choose a lesson for observation that has the greatest opportunities for the observer to gain a credible sense of students' learning, and the activities they engage in to build on this learning. This choice is best planned through conversations with the teacher, and others in the math department.

Slide 28

TRU math framework, and the questions we used here is this workshop, can support professional learning. They can:

- help frame the discussions about a teacher's long-term goals and lesson goals
- help you to discuss with a teacher the focus for the lesson observation
- support a post-lesson discussion on what was noticed; what the teacher did well and how the teacher might improve their practice

Observation notes framed by TRU can be used to identify, as well as recognize, changes in a teacher's practice over time. These insights can also be integrated into the math department's long term goals. This deep level of observation and analysis is at the heart of valid and fair evaluation of teaching.



Slide 29

Where to Go From Here
(last 5 minutes)

So, where do we go from here?

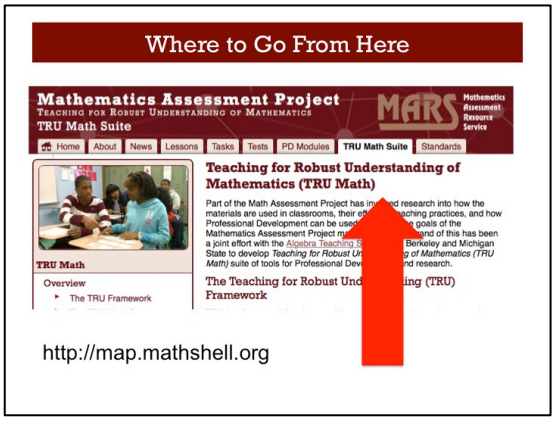
Slide 30

We hope that this session has provided a useful framework for observing math lessons.

Handout 6 gives more detail on the TRU Math framework. You might like to read it later.

There's more, of course, to observation than this, and those of you who are not 'math people' will gain from joint observations with those who are more involved with the teaching and learning of mathematics.

Yet, all of you might like to continue thinking about and expanding your understanding of 'teaching for robust understanding' by looking at the link on the listed website, and then perhaps, working with some math experts in your schools.



Slide 31

Thank you

Customize the final slide with your own contact details.