



Mathematical Agency
Improvement Community

Abolishing the phrase "I'm not a math person."

Resources for Those New to Lesson Study

This document: <https://bit.ly/31fCqGG>

Core Practices

If your team is new to lesson study and would like to dip their toes into some of the core practices to build capacity for engaging in a full research lesson in the future, we suggest trying out the following activities.

These practices are ideal for whole staff professional development workshops, discipline meeting activities, or to structure a sequence of PLC meetings. We have presented these in a suggested sequence, however, they can be done in any order or repeated individually until a group feels ready to try the next one.

- **Looking at student work protocol** - *Successful lesson study begins with selecting focus students - students whose thinking the host teacher would like to understand better. This is a 45 minute protocol that guides a group of educators through the process of more deeply understanding focus student thinking.*
- **Anticipating student thinking & determining a mathematical goal** - *Establishing a clear mathematical understanding goal helps focus a lesson and allows educators to more easily assess student learning.*
- **Determining an equity goal** - *Effective learning happens when students feel that they belong to their academic community, feel safe to share ideas, and feel that their ideas are valued and respected by their classmates. Creating these types of learning environments requires structures that support these types of interactions, clear community agreements and consistency in expectations. Equity goals can help maintain these structures.*
- **Planning a lesson: Anticipating Student Thinking & Scripting the Lesson** - *Part of planning a successful lesson is anticipating student thinking and determining what questions to ask to prompt students to grapple*

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with the mathematical understanding goal and make connections to prior learning. This is a two part series that can be spread over two consecutive meetings.

- **Observing student thinking & reflecting on learning** - A key way that educators can build their mathematical knowledge for teaching is to watch students engage in problem solving. This activity outlines considerations for observing students and includes a protocol for debriefing student observation data collected during a lesson.

Additional Resources:

The Lesson Study HUB Document: <http://bit.ly/2xtqZek>

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Looking at Student Work Protocol

(45 min)

This protocol is designed to support a group of teachers in looking at student work and assessing student understanding of key mathematical concepts. It can be done where one teacher brings work samples from a particular lesson from 1-4 focus students whose thinking they would like to understand better.

Goals:

- To more deeply understand the thinking of 1-4 focus students
- Determine if student learning connects to the mathematical understanding goal of a lesson
- To determine possible next tasks or questions to support students mathematical growth and understanding

Norms:

- **Seek to understand**... the underlying mathematical concept deeply and explore the many ways students might approach the concept
- **"Yes and"**... the goal is to generate lots of ideas, and not fixate on one
- **Share the air**... step up, step back, and make room for all voices
- **Hard on content, soft on people**... seek to push each other's thinking and understanding

Share the Mathematical Understanding Goal (2- 5 min)

The focus teacher shares their mathematical understanding goal for the task. It should be framed as what they hoped students **would understand about a particular mathematical concept** (*as opposed to what students can do*). More on mathematical understanding goals can be found [here](#) and [here](#). It may help to write this down where it can be seen throughout the rest of the protocol.

Presenting Teacher Shares Samples of Student Work (10 min)

The group looks at examples of student work. This works best when either:

- Each teacher looks deeply at one student's work, or
- Teachers partner up to look at and discuss one student's work

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As each person looks at a student's work sample they look for evidence of how that student was making sense of the mathematics related to the presenting teacher's mathematical goal.

Share Out (10 - 15 min)

Each teacher or partnership has 2-3 min to share how their student was making sense of the mathematics concept in relation to the mathematical goal, using evidence from the student thinking to provide additional details.

- What are this student's strengths as a mathematical thinker?
- What evidence do we see of their understanding of the mathematical understanding goal?
- What is an area for future growth?

Discuss Next Steps (10 min)

Each group member shares ideas for next steps.

- What questions might elicit deeper student thinking?
- What tasks might build on current understanding?

Debrief the Protocol (5 min)

Three quick whips, where each teacher shares:

- What new learning are you leaving with?
- How did the group do in sticking to the protocol?
- Considerations for the next time the group uses the protocol - *do any amendments/new norms need to be included or considered?*

Learn more about [looking at student work here](#).

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Determining a Mathematical Understanding Goal for a Lesson

(45 min)

This protocol is designed to support a group of teachers in determining a mathematical understanding goal for a lesson.

Goal

- Determine a mathematical understanding goal for a lesson

Norms:

- **Seek to understand...** the underlying mathematical concept deeply and explore the many ways students might approach the concept
- **"Yes and"...** the goal is to generate lots of ideas, and not fixate on one
- **Share the air...** step up, step back, and make room for all voices
- **Hard on content, soft on people...** seek to push each other's thinking and understanding

The Mathematical Understanding Goal (10 min)

1. Review the following explanation of a mathematical understanding goal as a group:

Note that many mathematical goals are phrased as what students can *do*, or a performance goal. This is different from a mathematical learning goal. Students can often mimic processes without deep understanding of the underlying concept. A more useful sentence frame for a mathematical understanding goal is **"Students will understand..."** This prompts us to think about what students will be *saying* or *doing* to indicate true understanding.

Mathematical understanding goal examples:

- *Students will be able to understand the structure of numbers up to 20 as sums or differences, and how to do calculations such as $10 + 5$ and $17 - 7$. They understand that they can use "10" as a benchmark in order to find the sum and difference.*
- *Or the example below. The second column is more useful for understanding what students understand:*

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Performance Goal	Mathematical Learning Goal
Students will write a linear equation to represent a pattern	<p>The rate of change or the constant multiple, m in the equation $y = mx + b$ is the amount that y changes when x changes by 1 unit. (adapted from NCTM)</p> <p>The constant, b, in the linear relationship $y = mx + b$ is the amount that does not change as the pattern grows and changes.</p>

- After reviewing the above information one teacher shares a task they are planning to use with students in the next day or two and shares what they think the mathematical understanding goal might be for the lesson.

Do the Math! (5-10 min)

Each person in the group does the math of the proposed problem individually, *anticipating the different ways that students might approach the problem.*

Determine the Mathematical Goal (15 min)

After completing the problem each team member fills out a response to the following prompt:

- What new understanding will students develop during the lesson?
 - Teacher 1...
 - Teacher 2...
 - Teacher 3...

What **student understanding** is emerging from the responses above? These are the potential **mathematical understanding goals** of the lesson. In order to focus the lesson and maximize student learning it is important to select one of these goals to be the primary mathematical understanding goal of the lesson.

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Discuss as a group which mathematical understanding goal makes the most sense for this lesson and record it here:

The mathematical understanding goal of your lesson

Students will understand...

Does your team's answer in the box above match what your team thought the mathematical goal for the lesson might be? If not, what task/problem would better achieve your mathematical goal? Discuss and revise if necessary.

Data Collection (10 min)

What evidence could the presenting teacher collect to determine if students understand the Mathematical Understanding Goal for this lesson?

- What might it sound like if students were grappling with this understanding?
- What would you see in the work samples?
- What question could you ask as an exit ticket/summary of learning?

Read more about determining [a mathematical understanding goal here](#).

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Determining an Equity Goal

This protocol is designed to support a group of teachers in determining an equity goal for a lesson.

Goal

- Determine an equity goal for a lesson

Norms:

- **Seek to understand...** the underlying mathematical concept deeply and explore the many ways students might approach the concept
- **"Yes and"...** the goal is to generate lots of ideas, and not fixate on one
- **Share the air...** step up, step back, and make room for all voices
- **Hard on content, soft on people...** seek to push each other's thinking and understanding

The Equity Goal (10 min)

Equity goals support the creation of equitable learning environments for all students. They often focus on creating the conditions necessary for students to see each other as resources and develop as independent learners.

Sample Equity Goals:

- *Students will participate in turn and talks and whole-class discourse to share mathematical thinking without fear of being incorrect or being judged by peers.*
- *Students will listen to, value, and build off of each other's ideas*

Each teacher writes down an equity goal they would like to focus on.

- *Teacher 1...*
- *Teacher 2...*
- *Teacher 3...*

Review & Brainstorm (20 min)

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There are a number of different structures that educators can use to create a safe and rigorous learning environment. Take a moment to explore some of the options below and then have each teacher share out which one they are most interested in trying out to get at their equity goal above. Alternatively they could generate a new idea to support equity in their classroom.

A number of practices focused on more [equitable group work](#) and making [student thinking visible](#) promote equitable learning environments, in particular check out:

- [Establishing class & group work norms](#)
- [Participation quiz](#)
- [Group roles](#)
- [Accountability quiz](#)
- [Status interventions & Assigning competence](#)
- [Safe cold calling](#)

Each teacher shares a strategy they plan to use to move their class closer to their equity goal – either one from the list above or a new one they'd like to test out

- *Teacher 1...*
- *Teacher 2...*
- *Teacher 3...*

Data Collection Plan (10 min)

Brainstorm as a group what data could be collected by each teacher to determine if progress is being made on their equity goal.

The sample reflection questions can be used to guide data collection or reflection after the lesson.

- Who feels comfortable sharing their ideas? How do you know?
- Which student's ideas are valued? How do you know?
- Which students feel like they belong? How do you know?
- Which students feel like they are a math person? How do you know?

Read more about [setting up equity goals here](#).

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Anticipatory Planning Protocol

(part I - Anticipating Student Thinking)

This protocol is designed to support a group of teachers in planning for a lesson that will provide a context to think and learn about their own teaching practice.

Norms:

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- **Share the air...** step up, step back, and make room for all voices
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Protocol Pre-work:

It is helpful if the focus teacher completes the following steps before meeting with the group to plan.

- **Identify a Mathematical Understanding Goal & Select a Task**
 - What mathematical understanding is the focus of this lesson?
- **Identify an Equity Goal**
 - How are you working to build a respectful learning culture?
 - What practices are you working on to support your students in becoming critical mathematical thinkers and problem solvers?

Part I: Thinking Through the Math & Anticipating Student Thinking

1. Do the Math (10 min)

The focus teacher shares what they hope students will understand at the end of the lesson and the task that they have selected. (2 min)

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- Individually group members do the task silently, trying to anticipate how a student might approach the problem. (6-8 min)

2. Share Strategies and Anticipate Student Thinking (20 min)

Select one teacher to share their strategy for solving the problem. **Anyone who has a significantly different method then also shares.** *Avoid repeating strategies that have already been shared.* (5 min)

The group brainstorms together around the following prompts:

- What types of **student thinking** might this task provoke?
- What might it **sound like** if a student were justifying or generalizing about the mathematical idea/concept?

Revisit the mathematical goal

Each person answers the following question for themselves silently for one minute, followed by a quick whip/share out.

- *Revisit the mathematical goal for the lesson. Does it still hold? Or is a new mathematical goal emerging that should be the focus of this lesson?*

3. Prepare Key Questions and Prompts To Push Student Thinking (20 min)

Looking at the strategies/thinking discussed in the prior step, and considering what it might sound like if students were justifying or generalizing about the mathematical concept, group members individually brainstorm prompts/questions that feel useful for exploring the underlying mathematical concepts.

Table whip: each person shares a question/prompt along with a brief description of why they chose it.

The group then discusses the questions/prompts generated in relation to the following:

- How do the questions/prompts **promote student-student dialog about the concept** (as opposed to 'funneling' towards an answer?)
- What questions/prompts **evoke a deeper understanding of the mathematical concept?**

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- What questions/prompts might the teacher ask to **promote connections to other strategies, previous concepts, or real life situations?**

Scripting the Lesson

(Part II - Designing the Lesson)

This protocol is designed to support a group of teachers in planning for a lesson.

Norms:

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Protocol Pre-work:

It is helpful if the focus teacher completes the following steps before meeting with the group to plan.

1. **Identify a Mathematical Understanding Goal & Select a Task**
 - What mathematical understanding is the focus of this lesson?
2. **Identify an Equity Goal**
 - How are you working to build a respectful learning culture?
 - What practices are you working on to support your students in becoming critical mathematical thinkers and problem solvers?
3. **Anticipate Student Thinking**
 - How might students solve this problem?
 - What different strategies could be compared/contrasted so students can make sense of the underlying mathematics?

Script the Lesson (35 min)

Group helps the focus teacher brainstorm around the Launch, Explore, Discuss framework. *Note: A single lesson may include multiple loops of the launch, explore, discuss lesson structure!*

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- **Launch (10 min)**
 - i. How could the teacher introduce the task in a way that provokes student curiosity, ensures access, and **maintains cognitive demand**?

It should be noted that the following Explore and Discuss phases might happen once in sequence during a lesson or multiple times, depending on what aspects of the task need to be discussed and understood by the entire class.

- **Explore (10 min)**
 - i. Determine whether students will work alone, in pairs, or groups, or in different combinations of these groupings during the problem solving portion of the class.
 - ii. What could the teacher do to promote equitable student-student interaction?
 1. *Multiple abilities treatment*
 2. *Participation quiz - with a focus on: ?*
 3. *Accountability checkpoints*
 4. *Group roles*
 5. *Assigning competence*
 6. *Other: ?*
 - iii. What key questions or prompts could be used during this phase to support student thinking?
- **Discuss (10 min)**
 - i. Which of the key questions/prompts might be useful during this phase of the lesson?
 - ii. Which parts of the problem might the teacher have students share their thinking for?
 - iii. **What data can the teacher collect to give them more information about their students' thinking?**

Debrief the Protocol (5 min)

How did group members do upholding the norms? How might this protocol be adjusted in the future?

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Observing Focus Student Thinking During a Lesson

One of the best ways to build our [mathematical knowledge for teaching](#) is to observe students as they engage in problem solving.

We have found that observing **one focus student closely** during a lesson provides the most meaningful data about that student's thinking and experience of the lesson. Jotting down what they say and do, and how they respond to their classmates, provides concrete evidence about which aspects of the lesson moved understanding forward, and which aspects did not facilitate learning. Particularly useful is noticing when a student revises their thinking, or has an "a-ha" moment. Below is a quick reference list of things to look for:

- *Focus on one student for the entire lesson –what do they say and do?*
- *How are they making sense of the problem?*
- *Do they have any 'a-ha' moments? What contributed?*
- *How are they thinking about the mathematics?*
- *How do they relate to their group members/partner?*
- *How do their group mates/partner relate to them?*

It can be beneficial to use a graphic organizer for data collection. Some items that may come in handy include:

- Space for capturing objective observations - direct quotes and/or the flow of thinking or actions of the focus student
- A 'cheat sheet' of sound bites or behaviors the team thinks they may hear and see to expedite note-taking
- Space to write down wonderings or inferences

It is useful to go over observation data and student work samples after observing a lesson. Below is a sample debrief protocol and discussion prompts.

Initial Reactions (5 minutes)

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The teacher whose class was observed has a chance to share any initial reactions from the lesson. Remaining participants are silent.

Looking at the Data (30 - 45 minutes)

The group then shares the observation data and student work data in the following "rounds":

- **Round 1** - Participants each take 2 minutes max to share the data they collected **verbatim** about their focus student's **thinking and actions**. No inferences, comments, or judgements.
- **Rounds 2-6** - Participants discuss the following prompts using evidence from the data shared to back up their ideas. What did the team learn about:
 - The mathematical concept?
 - Student thinking about the mathematical understanding goal?
 - Equitable teaching & pedagogy?
 - What do individual team members want to implement in their own practice?
 - What is going to happen tomorrow?

Read more about [observing student thinking here](#), and [reflecting on learning here](#).

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