

## Facilitator Guide

### Examine Student Thinking Protocol

**Time:** Protocol - 120 minutes (2 hours)

Preparation – 2 hours

**Purpose:** To collaboratively explore student work to:

- Investigate research into learning a specific scientific concept,
- Examine students' thinking about that concept,
- Differentiate instructional actions for different levels of understanding.

**Description:** A detailed protocol that combines many elements from Looking at Student Work (LASW). Participants complete a probe into student thinking, look at the big ideas and misconceptions identified by literature, predict how students will answer the probe, construct a rubric for sorting student work, sort student work by High-Medium-Low conceptual understanding, and develop specific instructional strategies to deal with all three groups.

**Time:** Preparation (2 hours)

Protocol (2 hours)

**Overall logistics notes:** In this protocol, the presenting teacher brings in ten different examples of student responses to a specific assessment probe. The intention is to focus on the thinking of the students and to develop actions to improve student understanding. This protocol is not designed to evaluate and/or refine the probe itself, or to evaluate the effectiveness of the presenting teacher.

#### **Source Materials notes.**

Probe. The protocol refers to an “assessment probe” of students’ thinking regarding a specific scientific concept. An excellent source for these probes comes from, “Uncovering Student Ideas in Science”<sup>1</sup>. However, any type of prompt or question which reveals student thinking about a single idea in science could work. The example pieces refer to the “Is it Matter?” probe in volume 1 of the aforementioned book.

Connecting to research literature. This protocol specifically refers participants to refer to the Curriculum Topic Study (CTS). Participants use the CTS to identify and research about learning a topic from other ancillary materials. If those materials are unavailable, then the facilitator should procure another research-based source material.

#### Background and resources.

For additional information on protocols and LASW, visit [www.lasw.org](http://www.lasw.org)

#### Materials to prepare ahead of LASW session

*Handouts (you may wish to color code each for easy reference)*

- Roles sheet – 1 copy per group
- Recorder Notes – 1 copy per group
- Protocol: Examining Student Thinking – 1 copy per participant
- Blank Assessment Probe + Support Protocol Questions (copied on back of blank probe) - 1 copy per participant (double sided)
- Connect with Research\* – 1 copy per participant
- Student Work packets\*\* – 10 examples of student work, collated into paper-clipped packets, reflecting a wide variety of responses. Each student's work should be clearly identified by number (or other suitable identifier). If necessary, maintain confidentiality. - 1 packet per participant.
- H-M-L grid – 1 copy per participant

\*Connect with Research - Before copying the handout, type the title of the probe into electronic template, and if available, insert a paragraph describing a "Scientist's Ideas" to give the scientifically accepted thinking behind the probe.

\*\* Student Work packets – 10 examples of student work, collated into paper-clipped packets, reflecting a wide variety of responses. Each student's work should be clearly identified by number (or other suitable identifier). If necessary, maintain confidentiality.

*Research on Learning Literature - (see note on page 1 about "Connecting to Research" if Science Curriculum Topic Study is unavailable)*

- *Science Curriculum Topic Study*. Keeley, P, (2005) Corwin Press.  
CTS resources online: <http://www.curriculumtopicstudy.org/> - 1 copy per participant
- *Uncovering Student Ideas in Science*. Vol. 1-4. Keeley et al. NSTA Press.
- *Benchmarks for Science Literacy*, AAAS - Project 2061 (1993) Oxford University Press Online:  
<http://www.project2061.org/publications/bsl/online/bolintro.htm> - or 1 copy per group.
- *Children's Ideas in Science*. Driver, R., Guesne, E. & Tiberghien, A. (1985) Open University Press. 1 copy per group.
- *Making Sense of Secondary Science*. Driver, R., Squires, A., Rushworth, P. & Wood-Robinson, V. (1994) Routledge. 1 copy per group.
- *Atlas of Science Literacy*. AAAS – Project 2061. Volume 1 (2001) and Volume 2 (2007). 1 copy per group.
- *National Science Education Standards*, NRC, National Academy Press.  
Online: <http://www.nap.edu/readingroom/books/nses/> - or 1 copy per group.
- *Science For all Americans* (1990): Project 2061. American Association for the Advancement of Science (AAAS). Oxford Press.  
<http://www.project2061.org/publications/sfaa/online/sfaatoc.htm> - or 1 copy per group.

**Process for using protocol:**

*Logistics:* Walk participants through an overview of the protocol so participants know what to expect in the next two hours. Since this protocol is so long, you may wish to plan in a short break in the middle. It may be advantageous for the presenting teacher (the person who brought student work) to be different from the facilitator. However, it is imperative that the facilitator have a working knowledge of the protocol and its intended purposes.

*Discussions:* There are numerous stopping places for discussion. If your group has more than 3 members, it may be useful to establish a structure for sharing in which every member's input is heard and valued. For instance, some groups follow a prescribed order in which each group member shares, followed by a strictly limited time for clarifying questions from the group.

**Step 1. Roles** (5 min) Work in small groups and divide up roles of facilitator, timekeeper, and recorder. Use 'role' sheet to define.

**Step 2. Reading the Probe** (5 min) Participants complete the probe and answer Step 1 questions on the back (Protocol Support Questions). The intention of these questions is to get participants to put themselves in the place of the learner. The questions are:

1A) What prior knowledge did you access as you completed this probe?

1B) What difficulties did you encounter or what content might be confusing?

1C) How and when might your students have encountered the idea(s) targeted in this probe (in current or prior school year/classes)?

**Step 3. Probe Clarification** (10 min) Facilitator distributes 'Connect to Research' handout with a "Scientists' Ideas." If using one of NSTA's assessment probes<sup>2</sup> the "Scientists' Ideas" appears in the discussion pages after the probe (e.g. "Connect to Research' Example 'Is It Matter?'.doc" sample on NCOSP website<sup>3</sup>).

**Step 4. Connection with Standards** (25 min) Participants look for big ideas in the Research on Learning resources. After identifying the correct Guide in Curriculum Topic Study, each participant should choose the relevant section from one of the source materials (National Science Education Standards, Benchmarks, etc.) Each group member shares the relevant ideas from the resource they examined with the rest of the group. The presenter could choose to expedite this step by selecting an appropriate reference for the group to read.

**Step 5. Data-Driven Dialogue** (15 min) Participants answer questions 4A and 4B on the Support Protocol Questions (back of the probe) and discuss with group members. This step in the protocol is important, and models the scientific process. Participants basically form hypotheses statements about how students

will think about the concept. Be sure to get participants to commit to assumptions and quantitative predictions, and to record those predictions so they may be referenced later. The remaining explorations of student work will be much more interesting because of the work participants put into this step. The specific questions are:

- 4A) What assumptions do you have about how your students might respond to this probe? What misconceptions do you anticipate your students might have?
- 4B) What “quantitative” predictions can you make about what you expect to see in the student work? (e.g. What percentage of students will choose a particular answer or answers?)

The questions ask about “your students.” This statement was left purposefully vague so that the protocol could be used with different groups (teacher PLCs may consider their students, district science teams may consider students district-wide). Generally, “your students” should refer to one consistent age band.

**This may be a good time for a break since you are 1 hour into the protocol.**

**Step 6. Quick Scan off Student Work (15 min)** Participants scan the packet of student work and select two samples of student work that interest them. Each person shares what was surprising or interesting in their samples without analyzing. The intention of this step is just to familiarize the participants to the packet of student work, and to collectively highlight areas which may be potentially confusing to students.

**Step 7. Using H-M-L to Analyze Student Work (15 min)** Participants sort work into piles to indicate high, medium, and low. They share their results with the rest of the group. After papers are sorted, discuss discrepancies and commonalities. Group members agree on and record criteria for sorting student work and note any trends or patterns observed in students’ thinking in each of the three groups. It may be interesting to compare quantitative high-medium-low results to the predictions in Step 4.

At this point, the facilitator can lead the discussion in different directions based upon the intended outcome. If the group needs to work on how to evaluate student understanding in a consistent fashion, then the focus could stay upon establishing consistent criteria for high-medium-low sorting. If the group wants to focus their exploration on student thinking then the facilitator should ask the group to address the following questions:

- How does student understanding compare with the research you read in step 3?

- Were there any ideas not described in the research that you found to be common in your students' work?

**Step 8. Analysis** (25 min) Participants discuss the following questions and record their instructional strategies:

- How do the results from step 6 inform classroom instruction?
- What instructional strategies could help the **Low** students understand the concepts better?
- What instructional strategies could lead the **Medium** students to a more complete conceptual understanding?
- What instructional strategies could help challenge the **High** students?

The recorder should document specific strategies identified by the group. In a group of practitioners (i.e. teachers), there should be some commitment made at this point to trying different strategies prior to the next meeting.

Debrief protocol. Facilitator should lead the group in addressing the following questions:

- What did you gain by using this protocol?
- In what ways did the structure of this protocol help you and your group understand student thinking?