Practices of Science: Student Reasoning at the Core of Science Instruction

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Think About...

• How do you surface and reveal students’ thinking in your classroom?
  – For you as a teacher?
  – For your students?

• Why might featuring student thinking a central focus of instruction support students’ reasoning in your classroom?
Next Generation Science Standards

• Three dimensions
  – Disciplinary Core Ideas (DCIs)
  – Cross Cutting Concepts (XCCs)
  – Science and Engineering Practices (SEPs)
Practices of Science

• Authentic scientific reasoning for *ALL students* that features developing *explanations* supported by *evidence* using:
  – Experimentation
  – Argumentation
  – Data and observations
  – Physical models, conceptual models, mathematical models
  – Communication
  – Mathematical thinking
Science Teachers Learning with Lesson Analysis (STeLLA)

- Video-case-based lesson analysis
- Comparison of STeLLA vs more traditional professional development
- Research on teacher learning and practice
- Research on student learning
Videocase-Based Lesson Analysis: Two Lenses to Guide Instruction

Student Thinking Lens
Teaching practices to reveal, support and challenge student thinking

Science Content Storyline Lens
Teaching strategies to support students construction of a coherent science content
The Student Thinking Lens

• Draw out and work with the preexisting understandings that students bring with them

• Teach for understanding (e.g., help students organize science knowledge into conceptual frameworks that enable them to use and apply that knowledge)

• Integrate the teaching of metacognitive skills into the science curriculum
Video Viewing Basics

- Viewing Basic #1: Look past the trivial, the little things that “bug” you.

- Viewing Basic #2: Avoid the “this doesn’t look like my classroom” trap.

- Viewing Basic #3: Avoid making snap judgments about the teaching or learning in the classroom you are viewing.
Video Analysis: Would I know it if I saw it?

- Classroom video of 5th grade classrooms engaging in lessons related to the Sun’s effect on climate and seasons.

- Watch the video and take notes:
  - Focus on student thinking: What ideas do the students have? What reasoning is occurring in the clip? (mark on your transcript)
  - Where do you see evidence of science practices being used?
Video Analysis: Would I know it if I saw it?

• Take a minute to review the transcript.
• Make a **claim** connecting student ideas to their use of a science practice.
• Support your claim with evidence from the transcript (use timestamps).
• Share and compare your claim and evidence with a partner.
Would I know it if I saw it?

• Share your claim and evidence at your table – without comment or discussion.

• What evidence do you see of science practices being supporting student reasoning?
Treatments

**STeLLA**
Lesson Analysis + Content Deepening

88.5 hours
(2 week summer institute & monthly meetings)

**COMPARISON**
Content Deepening

88.5 hours
(2 week summer institute & monthly meetings)

Same learning goals
Theory of Change

STeLLA Professional Development Program

Teacher Science Content Knowledge

Teacher Pedagogical Content Knowledge

Teaching Practice

Student Science Content Knowledge
Preliminary STeLLA Results

• STeLLA teachers learned more science content than the comparison group teachers despite having half as much traditional content deepening PD! And, the difference was statistically significant.

• Students of STeLLA teachers learned more than students of comparison teachers and the difference was over twice as much as what is typically seen for an elementary school intervention. This difference was also statistically significant.