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The Vision of Transformational Science Teaching

The transformational teacher is someone who "works with students' ideas" over time. What would you experience in classrooms where ambitious teaching was the focus? You would see and hear:

- Teachers anchoring their instruction in complex and puzzling natural events
- Students engaging in multiple rounds of creating and revising scientific models, explanations and evidence-based arguments
- Teachers using a variety of discourse strategies with students to get them to think deeply and to respond to each other's thinking
- Students prompting each other to engage in sense-making talk during investigations and other activities
- Students' ideas being represented publicly and worked on by the class
- Teachers using specialized tools and routines to support students who are not willing or able to participate without help
- Students speaking up about what information or experiences they need to move their thinking forward.

Transformational teaching is supported by four sets of core practices that work together throughout every unit of study. These practices start with:

- Designing units of instruction **(*Planning for engagement with important science ideas*);**
- Focus on making visible what students currently know about the science being taught **(*Eliciting students' ideas*);**
- Guiding sense-making talk around investigations and other kinds of lab activities or readings **(*Supporting on-going changes in thinking*);** and
- Scaffolding students' efforts to put everything together near the end of a unit **(*Pressing for evidence-based explanations*)**.

We use the term "practices" because, as in other professions like medicine, law, engineering, and architecture, there are *principled ways of doing the work that can be identified, learned, and continually improved over time*. The idea of ambitious teaching is now being used to support the development of a common vision so that teaching and learning can improve.

Planning for Engagement with Important Science Ideas

Here are *planning practices* for designing a unit of instruction. Important ideas in science are about the relationships between a natural phenomenon and a causal explanation that helps us understand why something in the world unfolds the way it does (phenomena are events or processes— things that happen). Studying events or process rather than "things" or abstract ideas intrigues students. Highly skilled teachers sort through their curriculum as well as the standards, in order to select which ideas to focus on during a unit. They then select a phenomenon to anchor their units of instruction and develop a rich causal explanation for that event or process. Finally, they use this explanation to sequence a set of learning experiences for students.

Eliciting students' ideas

If our main objective as a science teacher is to change students' thinking over time, then we need to know what our students understand about the target science ideas in the first place. This set of practices—eliciting students' ideas—is used at the beginning of a unit of instruction. This practice is designed to 1) reveal the range of resources that students use to reason about a set of science ideas (working theories, everyday experiences, language), 2) activate their prior knowledge about the topic, and 3) help you to adapt upcoming instruction, based on how students reason about the anchoring event.

Supporting On-Going Changes in Student Thinking

Throughout any unit of instruction, students are frequently engaged in different types of activity. For example, students might do hands-on work with materials, use computer simulations, conduct observations of phenomena, design experiments, or collect and analyze different types of data. Research on learning shows that it is the types of sense making talk, orchestrated by the teacher, that prompts productive puzzlement, reasoning, and learning by students. The purpose of this set of practices is to help students develop new ideas to use in revising explanations and models for the anchoring phenomena.

Pressing Students for Evidence-Based Explanations

This final set of practices will help students construct a final, evidence-based explanatory model for an anchoring event. The goals of this practice are:

1) Engage all students in authentic disciplinary discourse around using evidence to support explanations.
2) Hold students accountable for using multiple sources of information to construct final explanatory models for the anchoring event (this accountability of course must be supported by scaffolding and guidance from you).
3) Support students in using evidence to support different aspects of their explanatory models.