The Vision for Ambitious Science Teaching

The ambitious science teacher is someone who "works with students' ideas" over time. In a classroom with an ambitious science teacher, you would see and hear

Teacher Actions:

1. **Teacher anchors their instruction by investigating the puzzling natural world as well as designing and building complex systems.**

2. **Teacher intentionally uses science terms and concepts when explaining natural events.**

3. **Teacher engages students in discovering, interacting, and exploring science concepts and ideas.**

4. **Teacher models sharing their thinking aloud about science and models how his/her thinking changes based on new learning.**

5. **Teacher uses strategic questioning to promote learning about science.**

6. **Teacher facilitates student sense making talk around science investigations, activities or readings.**

7. **Teacher uses a variety of discourse strategies with students to get them to think deeply by constructing explanations and to respond to each other's thinking.**

8. **Teacher scaffolds students' efforts to analyze and synthesize science ideas and press for evidence based explanation.**

9. **Teachers uses specialized tools and routines to support students who are not willing or able to participate without help.**

Ambitious 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*); they then focus on making visible what students currently know about the science being taught (*Eliciting students' ideas*); they help the teacher guide sense-making talk around investigations and other kinds of lab activities or readings (*Supporting on-going changes in thinking*); and finally they help the teacher scaffold students' efforts to put everything together near the end of a unit (*Pressing for evidence-based explanations*).

Ambitious Teaching — An overview

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The practices were developed through collaborations between teachers and researchers, and they are continually evolving as we learn more about how they work with young learners. There are several themes that are consistent across all examples such as a focus on puzzling and complex phenomena, opportunities to make sense through talk, making thinking visible, attending to who is participating, and using various forms of scaffolding and tools and much more.

Planning for engagement with important science ideas

The first of our core sets of practices 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. 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 as follows:

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 must be supported by scaffolding and guidance from the teacher).

3. Support students in using evidence to support different aspects of their explanatory models.

What can students do as a result of ambitious science instruction?

Student Actions:

1. **Students analyze, comment on, compare and share their thinking about science through learning- focused "talk.** Students speaking up about what information or reflect on experiences they need to move their thinking forward. Students prompting each other to engage in sense-making talk while obtaining, evaluating, and communicating information during investigations and other activities.

2. **Students engage in multiple rounds of creating and revising scientific models, explanations and evidence-based arguments.** Students engaging in multiple rounds of developing and using models, planning and carrying out investigations, constructing explanations, and engaging in argument from evidence.

3. **Students prompt each other to engage in sense-making talk during investigations and other activities.** Students striving to use high-level, content-specific vocabulary accurately and appropriately while engaging in argument obtained from evidence.

4. **Students make their thinking visible through drawing and writing.** Students using advanced organizers as a means of experimenting with the content prior to explicit instruction to make inferences as to the significance of the content.

5. **Students engage in a variety of activities to promote learning of science ideas such as: Hands-on work with materials, using computer simulations, conducting observations of phenomena, designing experiments or collecting and analyzing different types of data.** Students planning and carrying out investigations while constructing explanations (for science) or designing solutions (for engineering).

6. **Students share their thinking in class and also share when their thinking is changing based on new learning.** The students' ideas are represented publicly and worked on by the class