Our slides available here:


MODELING THE WORLD AROUND YOU

A way for ALL students to make sense of experiences that matter to them

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Standards, by themselves, have never changed “who gets to participate or how” in our classrooms.

We must expand ENGAGEMENT & PARTICIPATION—will require shifts in our practices, tools, vision.

Who in your classroom participates?

- Can I participate?
- Will I participate?
- Can I see my interests in the science?
- Will people care about my ideas?
Students motivated by events that are **important, relevant**, connected to things they’ve **experienced** or **care about**, problems that are **interesting, realistic**

Sophomore biology: Why did my aunt get breast cancer and will it spread?

Kindergarten: How can someone little push someone big off the end of a slide?

5th grade: Why are solar eclipses predictable and so rare?

2nd grade: An apple tree starts to grow on a hillside, where did it come from?

AP Chemistry: Where does the heat go when I pour out my coffee?

8th grade: Why are killer whale populations in Puget Sound declining?

Essential question: How could the re-introduction of a small number of wolves cause dramatic changes in the Yellowstone ecosystem?

What the arc of a unit looks like...

**Ecosystems: Yellowstone**

- Habitats
- Carrying capacity
- Trophic pyramids: How does energy flow?
- How social behavior helps survival
- Inter-dependence of different species
- Competition for resources
- Changing population data
What relationships BETWEEN ideas does this student seem to understand or have an awareness of? Using ideas as tools?
Essential question: How could the re-introduction of a small number of wolves cause dramatic changes in the Yellowstone ecosystem?

Eliciting ideas, initial models, what do we know? Want to find out?

Revising models; new ideas? Info? Arguments?

Final evidence-based models & explanations. Apply knowledge to new situation, other assessment approaches.

Unobservable ↔ Observable

AP Chemistry thermodynamics: Where does the heat go when I pour out my coffee and why?

Homeostasis is topic: Why did one runner get heat stroke, the other did not?
Why is modeling an equitable and effective practice?

- It makes all students’ thinking visible to you
- Allows all students to show more of what they currently know in variety of ways
- Makes their reasoning available to their peers
- Helps students see that it is valuable to change their thinking in response to new evidence and ideas

Studying the “energy story” behind sound
Inside Ashley’s 6th grade classroom

- Diverse urban K-8 school
- 80% Low income, 47% English Learners
- 20% Homeless
For real? Can people “break glass” with the sound of their voices?

Let’s do some observations…

BEFORE, DURING, AFTER
• Before anything happened, I noticed this…
• While ___ was happening, I noticed this…
• After it happened, I noticed this…

SAW, HEARD, FELT
• I saw something happen…
• I heard this...it sounded like...
• I felt this…

SHAPE, COLOR, SIZE
• Something was this shape, this color, this size, it was in front of, it was behind…

HOW FAST IT HAPPENED
• Something happened slow…
• Something happened fast…

SMALL DETAILS
• I saw a detail, maybe its not important but I want to state it anyway…
• Something seemed missing…

OTHER?
• Your choice!
“Straw inside the glass was freaking out.”

“Flicked the glass, that maybe made a crack…”

“Sound of his voice vibrated the cup and straw.”

Framing: What’s expected of your modeling?

How might the teacher framing be thought of an equity move—increasing participation?
Goal: With your partner, create an initial model. The model is just to get your first ideas out on paper, we are not aiming for “correct answers”. We’ll make our models better and more accurate as we learn more. There are MANY different ways to show your theories.

Directions:
1. Talk together and agree on some things to include before anyone starts drawing.
2. In each phase - before, during, after - draw and label with words what you see and what you think might be happening that is unobservable.

Puzzle Box: What questions are you asking about this? What would you like to know to improve your model for next time?

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Initial Ideas - Sound Breaking Glass

Before

During

After

Puzzle Box: What questions are you asking about this? What would you like to know to improve your model for next time?

the glass made or does it have to be higher?
Modeling to make thinking visible: Is this share-out more than just sharing?

What do you see here vs. what she shares verbally? Are there ideas or puzzlements from Kelanie that could be used as resources for reasoning by her peers?

Day 6

Student created data display
I think that our experiment shows sound energy moves out in all directions.

Our experiment showed that the decibel reading right next to the horn was 100.

Claim: statement about a process or event that can explain patterns in observations or data

Student A

Student B

Is student “A” stating a scientific claim? Say why you think so, or not.

Is student “B”? Say why you think so, or not.

Puzzlement about sound moving through box, but not air particles

Day 8
Making sense together

What observations and patterns did we see?

What caused these patterns?

How does this help explain the anchoring event?

Revising models: How has our thinking changed?

Revise: We think [evidence from activity/reading] supports PART of our model, but we want to change ____ to make it more accurate.

Add: We think [evidence from summary table] supports PART of our model, but we want to add ____ to make it more accurate.

Remove or find out more: We think [evidence from activity/reading] contradicts _____ in our model, and we want to remove it or find out more about it.

Questions: We still have questions about ________.
I would change how I show the singer voice vibrating around the room and glass by changing the representations of sound to make it more meaningful because that just shows the music notes that you would see in a music class.

I'm going to add air molecules because the singer's voice bumps into air molecules to help hit the glass.
The question we are answering by drawing this model and writing our explanations: How did the singer break the glass with his voice?

Directions:
1. In the three panels below, draw what is happening that you can and cannot see that is causing the glass to shatter. Use ZOOM-INS.
2. Use the drawings to help you write an explanation about what is happening at each point in time.
3. For each picture, be sure to include the ideas from the Gotta-Have Checklist:
   - How compression waves move energy
   - How frequency and amplitude play a role in the glass breaking
   - The full story of energy transfers from person to glass
   - How resonance plays a role in the story
4. After completing your model, provide evidence from one class activity that supports one of your claims. Write the evidence on a sticky note and place on the relevant drawing.

Names __________________________________________ ____________ ____________

Period ____________________

Gotta-Have checklist: in each of the three panels:

☐ How compression waves move energy
☐ How frequency and amplitude play a role in the glass breaking
☐ The full story of energy transfers from person to glass
☐ How resonance plays a role in the story

AP Chem: Where does heat go in my coffee?
How can we stop a hurricane? (6th)
Energy on roller coaster

Posterizing = not modeling

- Rock cycle: nothing puzzling or complex
- No context or situation
- Has a “correct answer”
- Everyone’s representations look the same
Is this beautiful drawing (of a wound healing) an example of modeling or posterizing?

Consensus model by kindergarteners: How can someone little bump someone big off the end of a playground slide?
Clementina: Using 3 models simultaneously

**Coach**: Do you think scientists are ever finished with their drawings?

Clementina: No—and they just keep going and keep going

**Coach**: Why do you think they keep adding stuff?

Clementina: Because they have a lot of ideas so they put it in their papers, and um, if they (teachers) don’t pick you (call on you) then it’s okay because they can do it (kids can show it) in their papers.

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**What can we start working on?**

What big questions about modeling and sense-making talk do we have?

What can we experiment with in terms of using modeling and sense-making talk with students?

How can we use the power of a professional community to shift practice in classrooms?
Selecting an anchoring event: use these criteria

- It is a phenomenon, something that unfolds over time; it's not a topic, not a question.
- Students will be able to relate this to their interests, everyday experiences; it is authentic to real life and not a lame lab activity.
- It is a contextualized situation, takes place at a particular time, under unique circumstances, involves people. Local if possible.
- Explanation is challenging, requires students to put together at least 4 or 5 big science ideas in ways that tell a causal story.
- Explanation cannot be found in a textbook or on-line.
- Phenomenon can have multiple legitimate types of explanations
Principle 1 for expanding participation

Create links between science topics and students’ everyday experiences, interests, use their ideas as resources.

Principle 2 for expanding participation

Make student thinking visible, use multiple modalities. Encourage drawing + talking + gesturing + writing.
Principle 3 for expanding participation

Make explicit 1) the structure of authentic science practices, 2) “hidden rules” about science talk.

Principle 4 for expanding participation

Design safe spaces for talk in small groups and whole class settings.
5. Provide opportunities for students to use new academic language in the context of science conversations (don’t front-load vocabulary).

Expanding opportunities to be smart

1. Create links between science topic and students’ everyday experiences, use their ideas as resources.
2. Make student thinking visible, use multiple modalities.
3. Make explicit 1) the structure of authentic science practices, 2) “hidden rules” about science talk.
4. Provide opportunities for students to use new academic language in the context of science conversations (don’t front-load vocabulary).
5. Design safe spaces for talk in small groups and whole class settings.
Planning units of instruction (2-4 weeks)

Can’t talk about PLANNING without paying attention to how students LEARN

- Students learn best if the content is clearly connected to their lives and/or interests
- Students learn best if the content is “embedded” in a highly-contextualized problem, event, process
- Students learn best if ideas are revisited several times in increasing depth over a unit and explicitly inter-connected with other ideas
- Students learn best if they are allowed to revise ideas over time in response to evidence, new info, and feedback from others