Supporting Students with:
Developing & Using Models

Welcome to our Community!

Please introduce yourself & where you teach in the chat

Have a couple pieces of paper and a pencil/pen handy

RI Science Community of Practice

Tuesday, February 15, 2022

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Erin Escher, RIDE Science Specialist

Agenda

- Updates from RIDE
- Goals/Norms of our Community of Practice
- Overview of the SEP, *Developing and Using Models*
  - Engage in Modeling
  - Models in NGSS Instruction
  - How does Modeling Support other Practices?
  - Instruction and Assessment
- Resources
- Exit Ticket/Register for the next CoP

Updates from RIDE

Congratulations to 2020 PAEMST Awardees (K-6)

- **Nicole Lemire**,
  Samuel Slater Middle School
  Pawtucket (Science)
- **Nicolle Greene**,
  Holliman Elementary School
  Warwick (Mathematics)

Goals of our Community of Practice

- Examine teaching and learning strategies
- To engage in productive discussions with our peers that move our thinking forward
- Share strategies and resources
- To grow as reflective practitioners

Images: Schoolwires.net

Our Norms

NORM	WHAT IT LOOKS LIKE
Present	Engage in the conversation.
Respectful	Share air time with others. Keep an open mind to other's perspectives.
Positive Intentions	Maintain an optimistic mindset. Focus on productive solutions.

Science Community of Practice

Session Slide Decks | DL Strategies & Resources | Teacher Share

2021-2022 Science COP Calendar

Click on a session date to register, and Zoom information will be emailed to you.
All meetings will take place from **4:00 to 5:30 p.m. on Tuesdays**:

- ~~October 19, 2021~~
- ~~November 16, 2021~~
- ~~January 18, 2022~~
- ~~February 15, 2022~~
- March 15, 2022
- April 12, 2022
- May 17, 2022

Session Materials

SESSION DATE	SESSION MATERIALS
10/19/2021	Slide Deck: Engaging in the NGSS Science and Engineering Practices Session 1 [Google Slides] Session Recording [Google Drive]

[RI Science Curriculum Frameworks!]

Section 2: Implementing a High-Quality Curriculum

- Introduction ⊕
- College and Career Readiness ⊕
- The Science Standards ⊕
- How to Read the Standards ⊕
- Science and Engineering Practices ⊕
- Cross Cutting Concepts ⊕
- Engineering Design in the NGSS ⊕
- Disciplinar
- WIDA ELD

Section 3: Implementing High-Quality Instruction

- Part 1: Introduction & Overview ⊕
- Part 2: High-Quality Instructional Practices ⊕
- High-Quality Instruction in All Disciplines ⊕
- Assets-Based Stance ⊕
- Clear Learning Goals ⊕
- Student-Centered Engagement ⊕
- Academic Discourse ⊕

SEP: Developing & Using Models

A practice of both science and engineering is to use and construct models as helpful tools for representing ideas and explanations. These tools include diagrams, drawings, physical replicas, mathematical representations, analogies, and computer simulations.

NGSS.NSTA.org

Example of Initial Model

From the OpenSciEd Unit on Cells & Systems for Middle School

In Lessons 1-7, students:

- Unit introduces a student who had an injury to his knee (Anchoring Phenomenon for the unit)
- Investigated what **bones, skin** and **muscles** do.
- Observed medical images to find more structures in the body- blood and nerves.
- Investigated the structure & function of the **parts of blood.**
- Gathered information about the role **nerves** play.
- Compared microscope slides of bone muscle and skin to determine that **all body parts are made of cells.**
- Made observations of variety of substances to determine that **all living things are made of cells**.

What happened as the skin on the top of the foot healed?

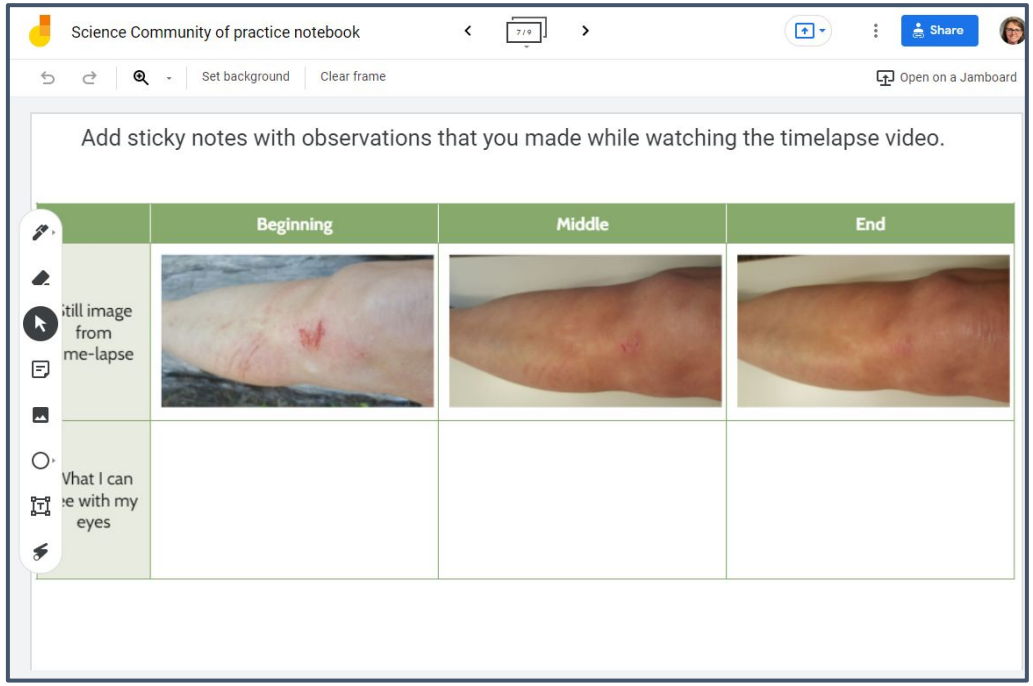
- Create a Notice and Wonder T-chart
- Add ideas as you watch the video.
- Think like a 6th grader!

Observing a Phenomenon

From OpenSciEd Unit 6.6 *How Do Living Things Heal?*

Share Your Observations

Add sticky notes to the Jamboard (frame 7) with your observations from the video.



Create your Initial Model (5 minutes)

- Develop a model that represents what you think was happening with the cells at the site of injury in the time-lapse.
- Using what we have figured out about different parts of the body and the structure and function of these parts, develop a model to predict how cells help make new skin form on the foot.
- Use words, pictures, symbols, or zoom-ins.
- Be sure to include how the cells fill the gap caused by the injury.

Sharing Models in Small Groups

Talking Stick Round 1:

- When given the start signal, pass around a pencil as a talking stick and take turns. Each person uses their model to explain how skin cells form new skin on the foot (1 minute per person).
- As each person shares, think about how their idea compares with other models you've seen (including your own).

Talking Stick Round 2:

- Pass the talking stick again, each person share at least one similarity, difference, or question they noted about the models that were shared (1 minute per person).
- You can also share what you might revise about your initial model based on what your peers shared.

Initial Ideas Discussion

- Follow up in Whole Class Discussion.
- Teacher creates a poster "How Does Skin Fill the Gap?" to record ideas that are shared.
- Students can share their own ideas or ideas that they saw in other students' models.
- Teacher facilitates discussion and asks for clarification but does not correct ideas.
- Students determine new questions that class needs to answer.

Reflect on the Process

How does this help the teacher?

How does this help the student?

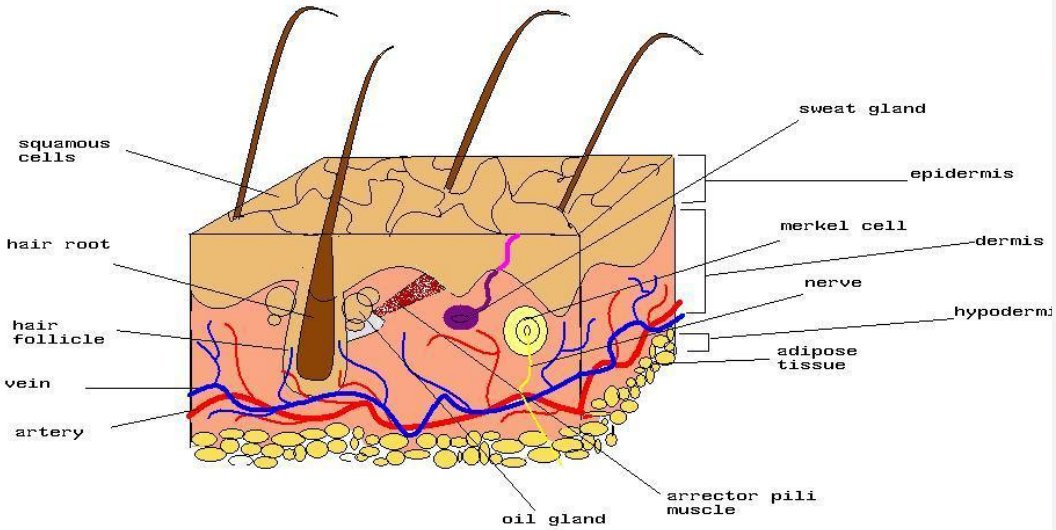
How can the model be used?

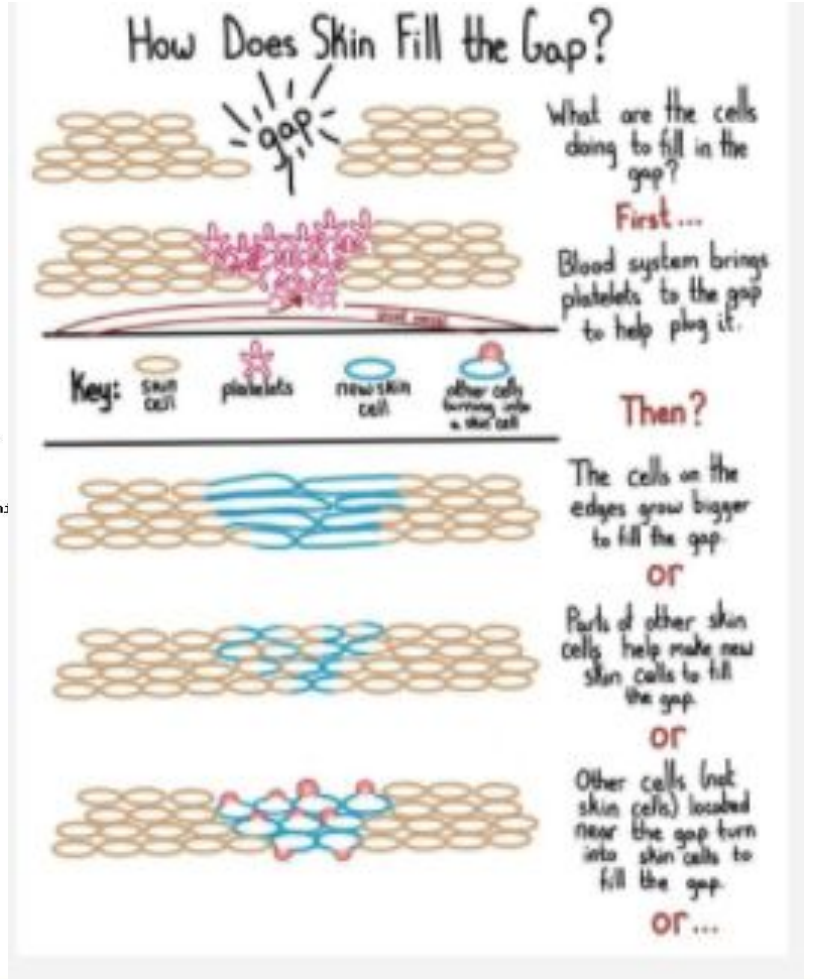
How can future lessons build from the model?

We take the position that models are not merely depictions of science facts, but are tools for reasoning. This first point means that *we cannot really decide if something is or is not a model without also attending to how it is being used.* A model is used *in service of* making sense about an observable phenomenon in the world. Often, models are referred to as being of a system or phenomenon. For example, we sometimes talk about a model *of* the solar system. It is a convenient shorthand, but one that sometimes focuses us on the wrong relationship. Models in science are not merely *of* things in the world; rather, they are best thought of as tools *for* making sense of something in the world. So, the model, if it is truly a reasoning tool, is not *of* the solar system but something that can be used *for* explaining why, for example, we can only see Venus from Earth low in the sky just before and after sunrise and sunset. To be used as a reasoning tool, the model needs to be constructed *for* some sense-making purpose; it needs to be linked to a phenomenon. If something is merely shown to students or constructed for the purpose of depicting the parts of the system, but not how they interact in ways that help us understand why we see particular things in the world, then it is not truly operating as a model in the scientific sense. This is the distinction between learning science as sets of facts versus learning science as models that can be used to understand and explain our world. This is what the focus on Developing and Using Models in the *Framework* and the *NGSS* is all about

From *Helping Students Make Sense of the World Using Next Generation and Engineering Practices.* (NSTApress, 2017)

Models OF vs. Models FOR





Progressing from K-12

Modeling can begin in the earliest grades, with students' models progressing from concrete "pictures" and/or physical scale models (e.g., a toy car) to more abstract representations of relevant relationships in later grades, such as a diagram representing forces on a particular object in a system.

(NRC Framework, 2012, p. 58)

Evaluating the Progression from K to 12

What do you notice about how students should progress in developing and using models?

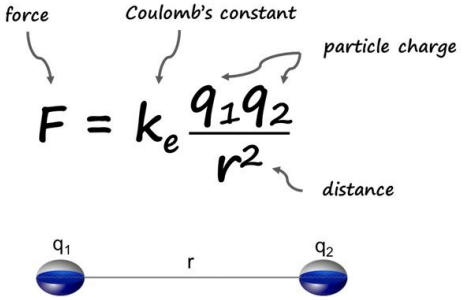
What are Goals of Modeling?

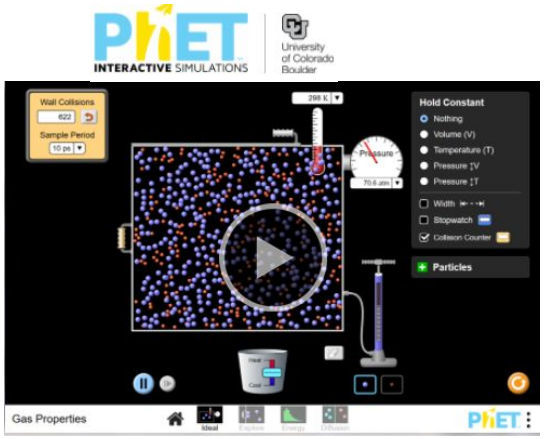
- To represent current understanding, based on current evidence
- Dynamic, revised as new evidence is introduced
- Based on a specific phenomenon (showing both observable and unobservable parts)
- Focuses on relevant components of the system

Caution about Modeling Activities

Other types of Modeling/Models

- Computational Modeling
- Mathematical Representations
- Simulations





Computational Modeling

How Can Computational Modeling Help Explain the Spread of COVID-19? (written by NSTA for middle school)

Students use a computational model (from StarLogo) to investigate how a virus such as COVID-19 spreads through a community. Students identify patterns of two conditions that contribute to the spread of the virus:

- people's mobility
- virus transmissibility

Students evaluate the benefits and limitations of the computational model for explaining the phenomenon of viral spread.

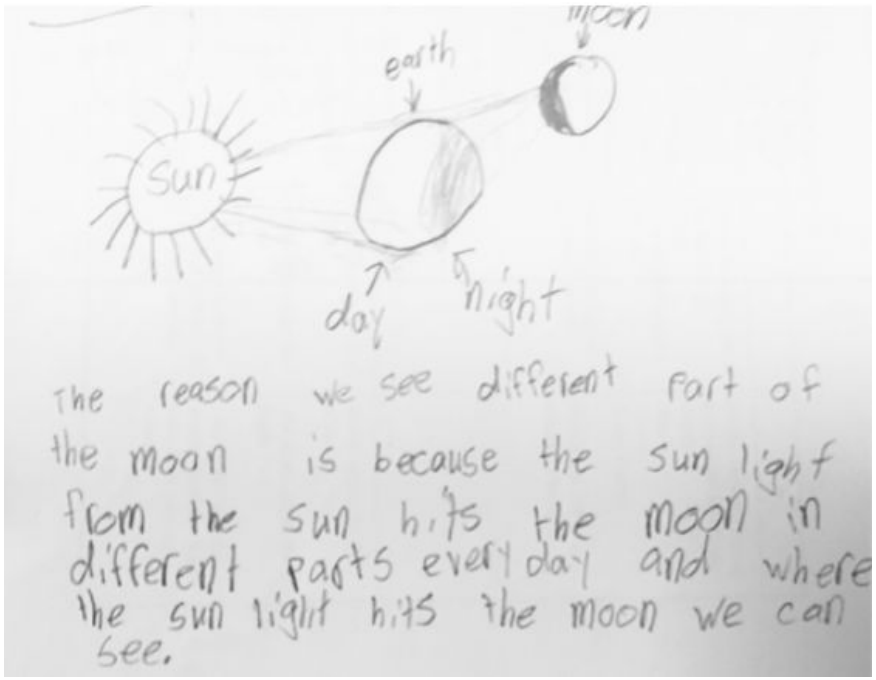
How does Modeling Support other Practices?

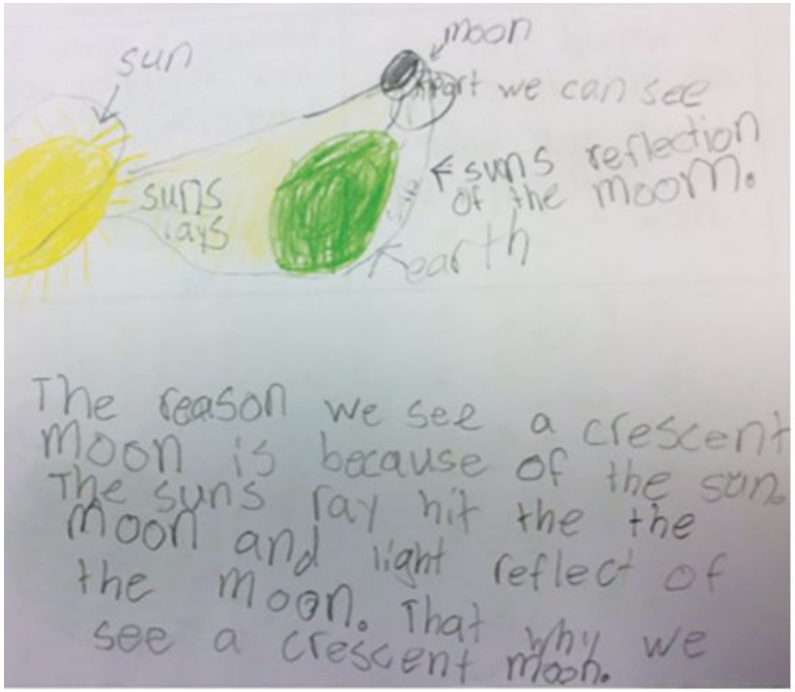
Assessment

- Initial Models and intermediate models should only be used as formative assessment.
- If a final model is graded, give students criteria and a rubric (NGSS Evidence Statements are helpful)
- Summative assessment can require the use of models. ex- NGSA provides simulations for students to use. Students use the model to gather data in order to develop explanations.
- Summative assessments may ask students to evaluate a model to determine ways to improve it.

Showing Growth

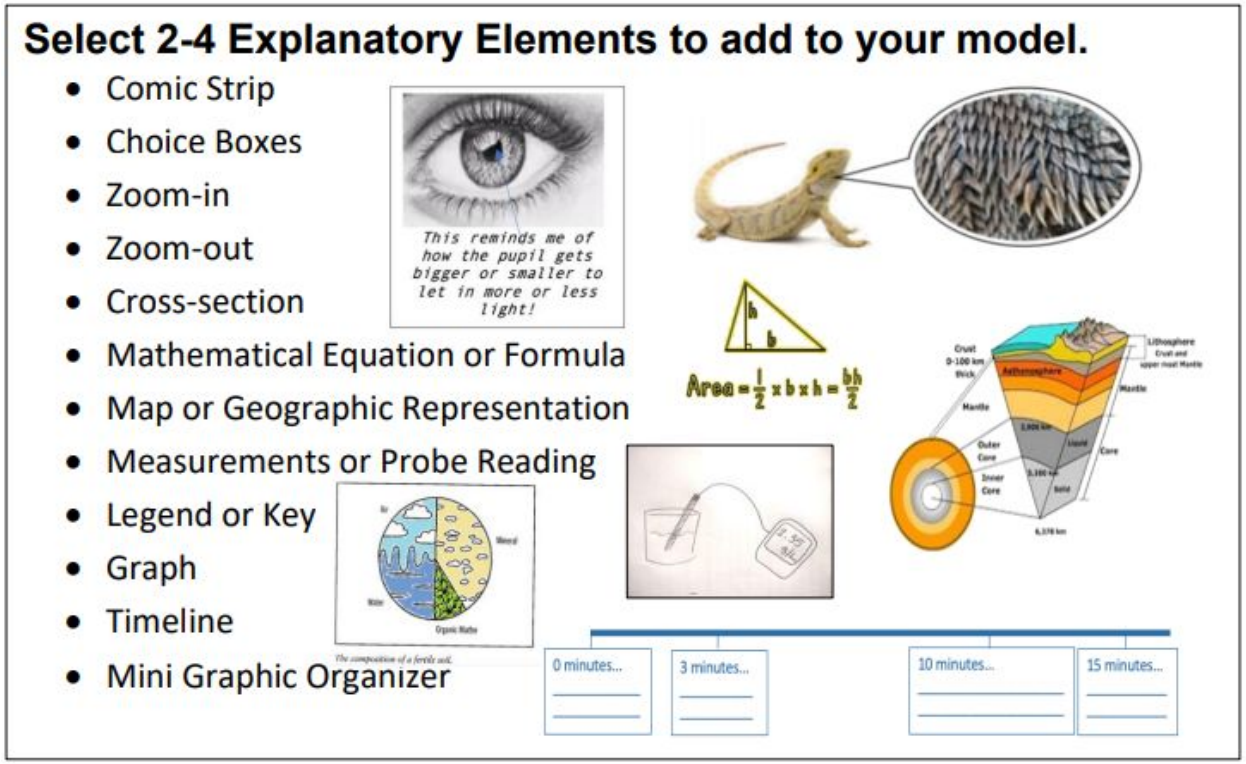
Why do we see a waxing crescent Moon in the sky every month?





Resources for Modeling

Table Tent for scaffolding the process from [Ambitious Science Teaching]



Save the Dates!

Each meeting will start at 4:00 pm. Registration for each is found on the RIDE Science Page in the Science Community of Practice section.

- March 15
- April 12
- May 17

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RIDE Rhode Island Department of Education

Wrap up:

1. Complete the exit ticket for this session.
2. We will send a letter documenting your attendance.
3. Don't forget to to bookmark and utilize the [RI Science Curriculum Frameworks!]