Welcome!

Please join a group as you enter (3-4 people per table)

Making Sense of Three-Dimensional Teaching and Learning - HS ES

Day 1

July 23-24, 2024
8:30 am - 3:30 pm

Promoting excellence and innovation in science teaching and learning for all
Meet Today’s Presenter

Holly Hereau
Instructional Materials and Professional Learning Specialist
hhhereau@nsta.org
Meet Our Learning Community

Alone Zone (independent thinking time)

● Why do you think it is important for all students to learn science?

● What are your goals for your students in science?
  ○ What do we want our students to know and be able to do when they leave your classroom?
  ○ What you hope students might think/feel about science when they leave your classroom.
Meet Our Learning Community

Small Group

- Why do you think it is important for all students to learn science?
- What are your goals for your students in science?
- What patterns can you identify in your group’s goals? (What are similarities? What are differences?)
Portrait of a Graduate

North Carolina Graduates…

• Adaptability
• Communication
• Empathy
• Collaboration
• Critical Thinking
• Learner’s Mindset
• Personal Responsibility
“A major goal for science education should be to provide all students with the background to systematically investigate issues related to their personal and community priorities. They should be able to frame scientific questions pertinent to their interests, conduct investigations and seek out relevant scientific arguments and data, review and apply those arguments to the situation at hand, and communicate their scientific understanding and arguments to others.” (p. 278)
## Portrait of a Graduate

### Science Education Will Involve Less:
- Rote memorization of facts and terminology
- Learning of ideas disconnected from questions about phenomena
- Teachers providing information to the whole class
- Teachers posing questions with only one right answer
- Students reading textbooks and answering questions at the end of the chapter
- Pre-planned outcome for “cookbook” laboratories or hands-on activities
- Worksheets
- Oversimplification of activities for students who are perceived to be less able to do science and engineering

### Science Education Will Involve More:
- Facts and terminology learned as needed while developing explanations and designing solutions supported by evidence-based arguments and reasoning.
- Systems thinking and modeling to explain phenomena and to give a context for the ideas to be learned.
- Students conducting investigations, solving problems, and engaging in discussions with teachers’ guidance.
- Students discussing open-ended questions that focus on the strength of the evidence used to generate claims.
- Students reading multiple sources, including science-related magazine and journal articles and web-based resources; students developing summaries of information.
- Multiple investigations driven by students’ questions with a range of possible outcomes that collectively lead to a deep understanding of established core scientific ideas.
- Student writing of journals, reports, posters, and media presentations that explain and argue.
- Provision of supports so that all students can engage in sophisticated science and engineering practices.

### North Carolina Competency Set

#### Adaptability
- Demonstrate agility in thought processes and problem-solving.
- Accept feedback, praise, setbacks, and criticism.
- Balance diverse viewpoints and beliefs to reach workable solutions.
- Demonstrate flexibility when navigating challenging situations.
- Exhibit steadfastness despite difficulty, opposition, and/or failure.

#### Collaboration
- Contribute and respond to diverse perspectives to achieve a common goal.
- Leverage strengths to resolve conflict and foster teamwork.
- Interact respectfully with others in digital and in-person interactions.
- Embrace a variety of roles in a group as a participant and a leader.

#### Communication
- Articulate thoughts and ideas effectively using oral, written, and nonverbal communication skills.
- Listen to decipher meaning, values, attitudes, and intentions.
- Ask questions and synthesize messages to seek understanding.
- Engage in productive discourse to resolve disagreements.
- Craft communication for a range of purposes and audiences.
- Use storytelling and public speaking to express ideas and connect with others.

#### Critical Thinking
- Analyze, assess, and reconstruct personal thought processes.
- Apply thinking that is clear, rational, and evidence-based.
- Evaluate and prioritize solutions to difficult or complex problems.
- Employ creative improvements to systems, processes, and organizations.

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## A New Vision for Science Education

<table>
<thead>
<tr>
<th>SCIENCE EDUCATION WILL INVOLVE LESS:</th>
<th>SCIENCE EDUCATION WILL INVOLVE MORE:</th>
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### Less Like

- Pre-planned outcome for “cookbook” laboratories or hands-on activities
- Worksheets
- Oversimplification of activities for students who are perceived to be less able to do science and engineering

### More Like

- Multiple investigations driven by students’ questions with a range of possible outcomes that collectively lead to a deep understanding of established core scientific ideas
- Student writing of journals, reports, posters, and media presentations that explain and argue
- Provision of supports so that all students can engage in sophisticated science and engineering practices
Today’s Agenda

What does it mean to use phenomena and questions to support student sensemaking?

- **Introduction: (~1 hour)**
  - Reflect on our goals for science instruction
  - Share key elements of the OpenSciEd instructional model

- **Experience Anchoring Phenomenon Routine (~3 hours)**
  - Experience key pedagogical shifts
  - Reflect on Routine Elements

- **Lunch (12-1)**

- **APR continued (~1 hr)**
  - Experience key pedagogical shifts
  - Analyze your anchoring phenomenon elements

- **Closing (~1 hour)**
  - Reflect on the Anchoring Phenomenon Routines
  - Looking forward
Why are we using OpenSciEd?

Using High Quality Instructional Materials to understand the shift from students “learning about” to “figuring out”

- Experience Anchoring Phenomenon Routine
  - Experience key pedagogical shifts
  - Reflect on Routine Elements
  - Analyze anchoring phenomenon elements
  - Reflect on the Anchoring Phenomenon Routines

- Consider Coherence from the Student Perspective
  - Experience key pedagogical shifts
    - Navigation Routine
    - Connected Investigations

- Building and Sustaining Classroom Culture

- Productive Discourse, Facilitating Discussions, and Talk Moves
Teacher Driving Question Board

Add questions you have about the unit, the course, the program at any point.
OpenSciEd units are based on a science storyline.

- Each step is driven by students’ questions that arise from phenomena.
All units have an anchoring phenomenon or problem. This results in student-driven questions, ideas, and initial explanations that are then explored in future lessons.
Student Hat

At times throughout our sessions, we will ask you to participate with your “student hat” on—engaging in the activities by thinking as your students would.

How might sitting in the role of student help you support your students’ sensemaking when you teach this unit in the future?
Student Hat

Student hat allows you to:

- Experience the unit as students might, feeling both the excitement and frustrations of deciding what to investigate next and building important science ideas together.
- Get a feel for how all the moving parts work together in storylines.
- Feel more comfortable supporting your students in their sensemaking.
Exploring the Anchoring Phenomenon Routine
Examine Lightning Strikes

Watch this video of lightning together. What do you notice and wonder?
Examine Lightning Strikes

Make a chart to record what you notice and wonder about what you see in slow-motion videos of lightning.

Watch this first slo-mo video, then this second slo-mo video, and part of that second strike again even slower.

Be prepared to share your ideas with the class.
When does lightning occur?

Annual Lightning Flashes for the United States

1. What do each of these graphs show?
2. What patterns do you notice across the graphs?
3. What questions do you have about these data?

Be prepared to share your ideas with the class.

Student Questions

What is lightning?
What makes lightning dangerous?
Why do you have to stay away from trees while it thunders?
Why doesn’t lightning always hit the ground?
Why stay away from water when raining?
Why does lightning look like it explodes?

Are we absolutely sure birds don’t affect or cause lightning?
Why when there is lightning does a loud thunder follow it?
Why is rain connected to lightning?
Why do trees get hit by lightning?
Why do you have to stay away from water when there’s lightning?

What is lightning?

Why does lightning spread like it does?
Why does lightning occur?
How is thunder created?
Can you freeze lightning?
Why is it dangerous to be under a tree when it’s raining?

How could answering these questions support figuring out key ideas about the structures and properties of matter?
Switching Hats

**Student hat:** Thinking like a kid. What do you anticipate a high school student might think? What might they say? Channel your inner high schooler.

**Teacher hat:** Reflecting on pedagogical approach, instructional routines, classroom culture, logistics/supports, NGSS, etc.

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**Public Opinion About the 30 by 30 Initiative**

Americans were asked: What is your opinion of setting a national goal of protecting at least 30% of America's land, ocean areas, and inland waters by the year 2030?

80% of Americans favor this initiative.

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**Teacher Driving Question Board**

Add questions you have about the unit, the course, the program at any point.
Facilitator Notes

Modified Student Hat Slides

Teacher Note: An aside during student hat that provides additional context or explains how your experience will differ from students’ experience.

Slide N

Develop Initial Models

- System
- What are we investigating?
- Components
- What are the living and nonliving parts of the system?
- Interactions
- How do the living and nonliving components interact?

Navigate

Exit Ticket

- What is one thing you figured out about your conservation profile?
- What is one question you still have about your conservation profile?

Stand up and find someone you haven’t spoken to yet and discuss the questions on the slide.

Next, have a class discussion to look for patterns in your noticings and questions.
Teacher Driving Question Board

Add questions you have about the unit, the course, the program at any point.
This is the first routine of the OpenSciEd curriculum to position students in making sense of a phenomenon, grounding all students in a common experience, and raising student questions.

**Element #1:** Explore the phenomenon

**Element #2:** Attempt to make sense

**Element #3:** Identify related phenomenon

**Element #4** Questions and next steps
### Anchoring Phenomenon Routine Tracker

<table>
<thead>
<tr>
<th>Element 1: Explore the Phenomenon</th>
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**Notes about what you or the students did:**

**How does this support figuring out?**

**How does this support a classroom culture where all students have access?**

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**How do the elements of the Anchoring Phenomenon Routine support all students in figuring things out?**
A New Phenomenon

At 8:14 p.m. on May 30, 2020, thousands of people stopped to watch the sunset in Manhattan, NYC.

#manhattanhenge
A New Phenomenon

Watch a video

Video clip 1: https://youtu.be/SbqmriPA1ck

Make a T-chart in your science notebook and record what you notice and what you wonder about.
Share Manhattanhenge Notice and Wonder

With Your Class

● Why do you think people feel connected to this phenomenon?
● What else did you notice in the Manhattanhenge phenomenon?
● What did you wonder about this phenomenon?
What is happening to cause Manhattanhenge?

With Your Class

Orient yourself with these two maps of New York City.
The best views of Manhattanhenge are said to be on 34th Street.
What is happening to cause Manhattanhenge?

On Your Own

Develop and use a model to explain how Manhattanhenge happens and why we don’t see it every day.

Initial Manhattanhenge Model

Standing at the corner of 34th Street and 5th Avenue and facing northwest, where people say you can get some of the best views of the Manhattanhenge phenomenon.

On the next page, develop two models on the different maps to help explain different aspects of this phenomenon.
What is happening to cause Manhattanhenge?

Turn and Talk

● What objects are interacting to cause us to see Manhattanhenge?

● What changes or interactions in the system can help explain why we only see Manhattanhenge on certain days of the year?

Initial Manhattanhenge Model

Standing at the corner of 34th Street and 5th Avenue and facing northwest, where people say you can get some of the best views of the Manhattanhenge phenomenon.

On the next page, develop two models on the different maps to help explain different aspects of this phenomenon.
Individually jot down some notes about what you did as students in **Element 1**.

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Related Phenomena and Patterns

With Your Group

- What other phenomena or patterns have we seen with other objects in the sky (either during the day or during the night)?
- Have you ever noticed something in the sky look totally different than any other time you have seen it?

Record each idea that your group comes up with on a sticky note in bold print so that everyone can see.

Be ready to post your sticky note on the Patterns and Phenomena in the Sky poster.
Home Learning

There might be stories our family or community knows about what they or others have observed in the sky.

Go home and poll your friends and family members:

1. What patterns or phenomena have they seen in the sky?
2. What stories have they heard from their family and community about patterns others have observed in the sky or about things on Earth that are connected to patterns and objects in the sky?

➔ First, share an example of a pattern or event. Explain that we are not curious about weather patterns right now.

➔ These ideas will be added on the next day to the Patterns and Phenomena in Sky poster at the start of class.

➔ Then, ask the questions on your Community Connections to the Sky handout and record their answers.
Adding to Our Patterns

Return to the Home Learning
Share the ideas you got from family and community members with the people at your table.

Record at least one new idea on a sticky note in bold print so that everyone can see.

Look for students to add things like these: Moon phases, eclipses, comets, airplanes, sunsets, planets, days, nights, moonlight, UFOs, origin stories, & Etc.

Be ready to post your sticky note on the Patterns and Phenomena in the Sky poster.
Individually jot down some notes about what you did as students in Element 3.

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Turn and Talk

How could we find out more about what phenomena and patterns people across the world have observed in the sky over thousands of years?

Might we be able to observe the same phenomena and patterns today or at some point in the future?

With Your Group

Each group will listen to a different podcast using the close listening protocol below.

<table>
<thead>
<tr>
<th>Before</th>
<th>During</th>
</tr>
</thead>
<tbody>
<tr>
<td>● Look at the title of your podcast and discuss it with your group. What does the title tell you about what will be in the podcast?</td>
<td></td>
</tr>
<tr>
<td>● What is a question you have that you hope the podcast will help answer?</td>
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</tr>
<tr>
<td>● Listen carefully, following along with the transcript.</td>
<td></td>
</tr>
<tr>
<td>● Highlight or underline words, phrases, and ideas that you have never heard before or that you want to know more about.</td>
<td></td>
</tr>
<tr>
<td>● Each person in your group will be allowed one pause request. When you hear something that you want to discuss or have clarified, raise your hand to use your pause request.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>After</th>
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<tbody>
<tr>
<td>● Look at the title of your podcast again. Now that you have heard the podcast, why do you think the podcast producers chose this title?</td>
</tr>
<tr>
<td>● Respond to these questions on the handout and be ready to share with the class.</td>
</tr>
</tbody>
</table>
Additional Patterns

With Your Group

Respond to the questions on your Podcast handout.

As you work, record any new patterns in the sky that you heard about while listening to the podcast.

Record each idea that your group comes up with on a sticky note in bold print so that everyone can see.

Be ready to post your sticky note on the Patterns in the Sky poster.
Notice and wonder about podcast phenomena

With Your Class

- Share the patterns your group recorded on sticky notes and post them to the *Patterns in the Sky* poster.
- What did your group wonder about the phenomena in the podcast?
- Why was it important to the people you learned about to study the sky?
Exit Ticket

Record your answers to the following questions on a blank piece of paper.

- Are there any patterns or phenomena in the sky that you feel personally connected to? Explain your connection.
- How are your views about space and science similar to the views you heard about in the podcast? How are they different?
- Did listening to the podcast change any of your views about space and science? If so, how? If not, why not?

Individually reflect the questions on the slide, you may record your ideas in writing.
Turn and Talk

- Choose a **pattern** for which you want to develop a model and share that pattern with a partner.

- Tell your partner what **parts** you think will need to be in the system you model to explain your pattern.
On Your Own

First, choose one pattern to model. Write what the pattern is in the title of your handout. Then:

1. Show and describe what the pattern phenomenon looks like from Earth and when it happened/happens.

2. Change perspective. Draw and/or describe a model to help explain why that pattern happens. Identify the important parts, motions, and interactions in the system and the perspective you are taking in this model.

3. Describe what is happening with the parts and interactions in your system that is causing us to see your pattern or phenomenon.
Feedback on Initial Models

Turn and Talk

● **With your partner:** Each person gets 2 minutes to present their model.

● **On your own:**
  ○ Go back and make any changes to your model you would like after hearing about other people’s models.
  ○ Prepare for the gallery walk by posting your model in the room.
## Gallery Walk

→ Visit at least 2 other models recording what you notice on the *Initial Models Gallery Walk*.

### On Your Own

Visit at least two models recording what you notice on the *Initial Models Gallery Walk*:

<table>
<thead>
<tr>
<th>What pattern or phenomenon is the model trying to explain?</th>
<th>What parts, movements, and interactions are represented in the system model that are similar to the ones you included in your model?</th>
<th>What parts, movements, and interactions are different?</th>
</tr>
</thead>
</table>
Initial Consensus Model Discussion

With Your Class
Develop a record of what we agree on and where we have competing ideas across the initial models.

Be ready to share:

- What similarities and differences did you see among parts that were represented in the models you visited?
- What similarities did you see among the motions and interactions of objects represented in the models you visited?
- What similarities and differences did you see among perspectives that were represented in the models you visited?
Sample Initial Consensus Model

- Sun
- Earth
- Moon
- Other planets
- Stars
Initial Consensus Model

* * Stars

Sun

goes around Sun

Moon

* Earth

* Are they moving too?

Sun

goes around Sun

Moon

* Earth

* Is it a circle or an oval?

KEY

→ motion direction

<path of motion>

shadow

other planets

Perspective:
Looking down at the Sun from above

other planets
Individually jot down some notes about what you did as students in Element 2.

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<td>What do we notice?</td>
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- Notes about what you or the students did.
- How does this support **figuring out**?
- How does this support a classroom culture where all students have access?
Scientists Circle

What kinds of questions could we ask about these phenomena/patterns and the systems that we think cause them that we could investigate as a class?
Scientists Circle

What questions do we have about:

- phenomena and patterns in the sky?
- objects and interactions in the system(s) that might cause them?

Write one question per sticky.
Write in marker—big and bold.
Write your initials in pencil on the back of each sticky.
Driving Question Board (DQB)

The first student reads their question aloud then posts it on the DQB.

Students who are listening should raise their hand if they have a question that relates to the question that was just read aloud.

The first student selects the next student whose hand is raised.

The second student reads their question, says why or how it relates, and posts it near the question it most relates to on the DQB.

That student selects the next student, who may have a related question or a new question.

We will continue until everyone has at least one question on the DQB.
Ideas for Investigations and Data

What kinds of investigations could we do, and what additional sources of data might we need to figure out the answers to our questions?

Add your ideas to a new notebook page titled:

“Ideas for Future Investigations and Data We Need.”

Be prepared to share these with the whole class.
Individually jot down some notes about what you did as students in Element 4.

### Anchoring Phenomenon Routine

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02:00
Observing What We See in the Sky

- Look back at our Patterns and Phenomena in the Sky poster for some objects you could be looking for in the sky.
- Then, over the next few weeks, look up at the sky, if you can, and keep track of what you notice!
- Take this Community Guide for Looking at the Sky home and use it with another person.
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Welcome!

Making Sense of Three-Dimensional Teaching and Learning - HS ES

Day 2

July 23-24, 2024
8 am - 3 pm

Promoting excellence and innovation in science teaching and learning for all
Meet Today’s Presenter

Holly Hereau
Instructional Materials and Professional Learning Specialist
hhereau@nsta.org
Today’s Agenda

How do we build and sustain coherence over the course of a unit?

● Navigation:
  ○ Reflect on APR
  ○ Looking forward - Consider how storyline routines build and maintain coherence

● Experience Navigation and Investigation Routines (~3 hours)
  ○ Experience key pedagogical shifts
  ○ Investigation Immersion
  ○ Reflect on Routine Elements

● Lunch (12-1)

● Introduction to Talk Moves (1 hr)
  ○ Facilitation Tools to move learning forward
  ○ Creating a culture for ALL students to contribute to knowledge building

● CMS Lesson 1 facilitation (~1 hour)
  ○ Reflect on the implementation of elements of the Anchoring Phenomenon Routine
  ○ Closing/Reflection (.5 hr)
Teacher DQB

Add questions you have about the unit, the course, the program at any point.
OpenSciEd units are based on a science storyline.

- Each step is driven by students’ questions that arise from phenomena.
How can the steps of the Anchoring Phenomenon Routine support all students in figuring things out?

- Work with a partner to reflect on each element using the Anchoring Phenomenon Routine Tracker.
### Anchoring Phenomenon Routine

<table>
<thead>
<tr>
<th>Whole-Group Discussion</th>
<th>How did each element of the Anchoring Phenomenon Routine support all students in figuring things out?</th>
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<td>Element 2:</td>
<td>Attempt to Make Sense of the Phenomenon</td>
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<tr>
<td>How can we explain this?</td>
<td>How does the support for figuring things out help us understand the phenomenon?</td>
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<td>Identify Related Phenomena</td>
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<tr>
<td>Where else does something similar happen?</td>
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<td>Element 4:</td>
<td>Develop Next Steps and Questions</td>
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<td>How does the support for figuring things out help us understand the phenomenon?</td>
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Day 1: What does it mean to use phenomena and questioning to support student sensemaking?

Individually (1 min)

- Jot down ideas in row1 in terms of what you have figured out and what you wonder and have questions about.
- Reflect on how starting with an anchoring phenomenon can support your students’ sensemaking.
Day 1: What does it mean to use phenomena and questioning to support student sensemaking?

Small Group (2 min)
- What have you figured out?
- What do you wonder? What questions do you still have?

Whole Group (4 min)
- Share key ideas from your small group.
# OpenSciEd Instructional Model

<table>
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<tr>
<th>Question</th>
<th>Routine</th>
<th>Purpose</th>
</tr>
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<tbody>
<tr>
<td>How do we kick off each unit?</td>
<td>Anchoring Phenomenon Routine</td>
<td>Common experience of a phenomenon, develop student curiosity, and connect to students’ lives.</td>
</tr>
<tr>
<td>How do we work with students to motivate the next steps?</td>
<td>Navigation Routine</td>
<td>Motivate the next lesson from gaps in what the class figured out so far.</td>
</tr>
<tr>
<td>How do we help students use practices to build science ideas?</td>
<td>Investigation Routine</td>
<td>Support students in using science and engineering practices to make progress on our questions and problems.</td>
</tr>
<tr>
<td>How do we help students put science ideas together?</td>
<td>Putting Pieces Together Routine</td>
<td>Help students assemble ideas from multiple lessons and apply them to the class's questions.</td>
</tr>
<tr>
<td>How do we push students to go deeper?</td>
<td>Problematizing Routine</td>
<td>Help students uncover limitations and unanswered questions in the explanations, solutions, and models so far.</td>
</tr>
</tbody>
</table>
Elements of the Anchor in the Microwave Unit

Watch a classroom video of students sharing what they notice about the microwave phenomenon.

Individually:
- How was your experience similar or different from what is happening in this classroom during the Anchoring Phenomenon Routine?
Guidelines for Watching Videos of Teaching*

- These are real classrooms, which means there are also students who did not give consent.

- Ground Rules:
  - Teaching and the classrooms we will see are complex. There is much we don’t know about the students and teacher and their history together.
  - Presume expertise on the part of the teacher.
  - Assume what the kids are saying makes sense to them.
  - Focus on how what the teacher and students are doing is serving the learning goals of the lesson and providing access for diverse learners.

Elements of the Anchor in the Microwave Unit

- Watch a classroom video of students sharing what they notice about the microwave phenomenon.
Elements of the Anchor in the Microwave Unit

Watch a classroom video of students sharing what they notice about the microwave phenomenon.

**Whole Group:**
- Share key ideas.
Reflecting on the Anchoring Phenomenon Routine

A few field test teachers reflect on their rationale for using an anchoring phenomenon in their classroom.
Reflect on what/who is driving instruction
Vignettes: What/who is driving instruction?

- Individually read 2 vignettes from two units on carbon cycling. Silently jot down your answers to the following question:
  - What is driving the figuring out that students are doing?

A Vignette of Science Instruction

**Unit 1: The Carbon Cycle**

Mr. Quadri’s class recently started a new science unit. In Lesson 1, Mr. Quadri introduced the unit by telling his class they were starting a unit on “The Carbon Cycle.” A good context for seeing the carbon cycle at work is analyzing ecosystems and creating food webs. Since all ecosystems have different organisms as part of their system, let’s begin by watching a video on ecosystems in the Arctic. Students make a food web from using the organisms they see in the video.

In Lesson 2, Mr. Quadri said that they would be learning about how matter cycles within ecosystems by tracing the movement of carbon. He asked the class, “Where have you heard the word matter before?” One student said, “Like what’s the matter?” Another student said, “Matter has another meaning too—it is like what all stuff is made of.” Mr. Quadri built off that idea and wrote a definition on the class word wall: Matter is everything around you. Matter has mass and takes up space (volume). He then had the class watch a video about matter with examples. During Lesson 2, Mr. Quadri said, “Now that we know what matter is, how does it cycle in an ecosystem?” He explained that matter cycles between living and nonliving parts as he drew on the board a model of carbon cycling in a forest ecosystem. He then had students play a carbon cycle board game where they saw carbon moving through an ecosystem.

In Lesson 3, the topic for the day on the board is photosynthesis. Mr. Quadri tells the class that photosynthesis is an essential part of matter cycling. Mr. Quadri explains that when photosynthesis a plant makes its own food, called glucose, through a chemical reaction that uses sunlight to turn water and carbon dioxide into glucose and oxygen. As he explains, he writes the formula for photosynthesis on the board and students copy it. Mr. Quadri then tells the class that they can see for themselves how this works through a lab he has set up with a small plant, a baggie, and a carbon dioxide and water detector. Mr. Quadri explains that they will put the plant in the baggie and then record the carbon dioxide and water levels. Then they will graph the results and answer questions about how the data relate to the photosynthesis formula.

**Unit 2: What causes fires in ecosystems to burn?**

The students in Ms. Velaquez’s class recently started a new science unit. In Lesson 1, the students analyze an image of burn scars in Alaska. Near the burn scars there are new fires burning which are increasing in frequency and intensity. They notice that scientists have named these “zombie fires” because some of the fires don’t seem to die or go out. Many students have questions about how a fire can keep burning, especially in a place that is cold and covered by ice. In order to analyze more data about zombie fires in the Arctic, students work with their small groups, analyzing a set of images from the Arctic. From images of the ecosystem, students notice zombie fires burn underground throughout the winter. They read that the Arctic is covered by permafrost but it has now begun to thaw. The stuff burning underground is called “peat.” They also find that smoke is coming from these fires and travels very long distances and that tons of CO₂ is going into the air. They also wonder what peat is and how it can keep burning under ice in such a cold place.

In Lesson 2, Ms. Velaquez brings in some peat and other materials that burn – grass, charcoal, and wood – for students to investigate. Students compare the different materials. A few students wonder aloud about wanting to burn the different materials to see how they compare to peat. Ms. Velaquez asks how burning the materials will help them figure out more about the zombie fires. One student says that if they burn these materials, they can see how long they burn. Another says, “Yeah and maybe we can keep track...”
Vignettes: What/who is driving instruction?

- **Small-Group Discussion:**
  Discuss the following questions:
  - What is driving the figuring out that students are doing?

- **Whole-Group Discussion:**
  Share key ideas from your small group.

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**A Vignette of Science Instruction**

**Unit 1: The Carbon Cycle**

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In Lesson 2, Ms. Velaquez brings in some peat and other materials that burn - grass, charcoal, and wood - for students to investigate. Students compare the different materials. A few students wonder aloud about wanting to burn the different materials to see how they compare to peat. Ms. Velaquez asks how burning the materials will help them figure out more about the zombie fires. One student says that if they burn these materials, they can see how long they burn. Another says, "Yeah and maybe we can keep track..."
Coherent for Students

Organize and enact curriculum that is:

● “. . .designed to help children continually build on and revise their knowledge and abilities, starting from their curiosity about what they see around them and their initial conceptions about how the world works.” (NRC, 2012)

● “Impactful science teaching happens when we start in the lives of the children and empower them to make sense of the world in their own voice.” (Brown, 2019)
“By attending closely to what students actually say and do in science, teachers can expand the relationships that are possible among themselves, their students, and science. In this way, they can begin to create more equitable opportunities to learn in science for historically underserved students.” (p. 33)

-Bang, Brown, Calabrese Barton, Rosebery & Warren (2017)
OpenSciEd Instructional Model

OpenSciEd units are based on a science storyline.

- Each step is driven by students’ questions that arise from phenomena.
OpenSciEd Instructional Model Routines

- ANCHORING PHENOMENON ROUTINE
- NAVIGATION ROUTINE
- INVESTIGATION ROUTINE
- PUTTING THE PIECES TOGETHER ROUTINE
- PROBLEMATIZING ROUTINE
All units have an anchoring phenomenon or problem. This results in student-driven questions, ideas, and initial explanations that are then explored in future lessons.
OpenSciEd Instructional Model Routines

Navigation occurs within and between lessons so that students see why they are doing each activity or investigation and how what they are learning connects to previous and upcoming lessons.
Navigation Occurs Within a Lesson & Across a Unit

- Students often experience science class as a series of disconnected activities that lack coherence both within lessons and across the unit.

- We are going to watch a classroom video and think about how the teacher is supporting coherence within the lesson and across the whole unit.
Vignettes: Navigation Routine

- Individually Re-read the 2 vignettes from two units on carbon cycling. Silently annotate, highlight or jot down examples of the Navigation Routine in each classroom.

### A Vignette of Science Instruction

**Unit 1: The Carbon Cycle**

Mr. Quadri’s class recently started a new science unit. In Lesson 1, Mr. Quadri introduced the unit by telling his class they were starting a unit on “The Carbon Cycle.” A good context for seeing the carbon cycle at work is studying ecosystems and creating food webs. Since all ecosystems have different organisms as part of their system, let’s begin by watching a video on ecosystems in the Arctic. Students make a food web from using the organisms they see in the video.

In Lesson 2, Mr. Quadri said that they would be learning about how matter cycles within ecosystems by tracing the movement of carbon. He asked the class, “When have you heard the word ‘matter’ before?” One student said, “Like 3.14, the stuff that makes up?” Another student said, “Matter has another meaning too—it is like what all stuff is made off.” Mr. Quadri built off the idea and wrote a definition on the class word wall: Matter is everything you touch, feel, see, or eat (which looks, feels, is). He then had the class watch a video about matter with examples. During Lesson 3, Mr. Quadri said, “Now that we know what matter is, how does it move in an ecosystem?” He explained that matter cycles between living and nonliving parts as he drew on the board a model of carbon cycling in a forest ecosystem. He then had students play a carbon cycle board game where they saw carbon moving through an ecosystem.

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**Unit 2: What causes fires in ecosystems to burn?**

The students in Mr. Wespas class recently started a new science unit. In Lesson 1, the students analyze an image of a burn area in Alaska. Near the burn scars there are new thin burning which are increasing in frequency and intensity. They notice that scientists have named these “zombie fires,” because some of the fires don’t seem to die or go out. Many students have questions about how the fires can keep burning, especially in a place that is cold and covered in snow. In order to analyze more data about zombie fires in the Arctic, students work with their small groups and analyze a set of images from the Arctic. From images of the ecosystem, students notice zombie fires burn underground throughout the winter. They realize that the Arctic is covered by permafrost but it has no longer in thaw. The stuff burning underground is called “peat.” They also find that smoke is coming from these fires and travels very long distances and that tons of CO2 is going into the air. They also wonder what put it out and how it can keep burning underground in such a cold place.

In Lesson 2, Mr. Wespas brings in some peat and other materials that burn – grass, charcoal, and wood – for students to investigate. Students compare the different materials. A few students wonder about wanting to burn the different materials to see how they compare to peat. Mr. Wespas asks how burning the materials will help them figure out more about the zombie fires. One student says that if they burn these materials, they can see how long they burn. Another says, “Yeah and maybe we can keep back Navigation occurs within and between lessons so that students see why they are doing each activity or investigation and how what they are learning connects to previous and upcoming lessons.
Vignettes: Navigation Routine

Small Group:

● Share some of the examples of the Navigation Routine from the vignette.

● How can these strategies support coherence for students?

Whole Group:

Be ready to share.

Navigation occurs within and between lessons so that students see why they are doing each activity or investigation and how what they are learning connects to previous and upcoming lessons.
Switching hats

**Student hat:** Thinking like a kid. What do you anticipate a middle school student might think? What might they say? Channel your inner middle schooler.

**Teacher hat:** Reflecting on pedagogical approach, instructional routines, classroom culture, logistics/supports, NGSS, etc...

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**Native American Sky Story: Navajo Nation**

*In Your Notebook*

Record what you notice and wonder as you watch the video about the Navajo Nation sky story.

Be ready to share your ideas with the class.

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**Analyze Lesson 1 for UDL Principles**

With a partner:

- How were the 3 UDL principles evident in your anchoring phenomenon routine?
- How might you need to modify Lesson 1 to meet the needs of your diverse learners?
Observing What We See in the Sky

- Look back at our Patterns and Phenomena in the Sky poster for some objects you could be looking for in the sky.
- Then, over the next few weeks, look up at the sky, if you can, and keep track of what you notice!
- Take this Community Guide for Looking at the Sky home and use it with another person.
Navigation: Preparing to Observe the Sky

**Turn and Talk**

What were some of the things in the sky that we were interested in observing to figure out more about some of these patterns?
Native American Sky Story: Navajo Nation

In Your Notebook

Record what you notice and wonder as you watch the video about the Navajo Nation sky story.

Be ready to share your ideas with the class.
Native American Sky Story: Navajo Nation
Native American Sky Story: Paiute

In Your Notebook

Record what you notice and wonder as you watch the video about the Paiute sky story.

Be ready to share your ideas with the class.
Native American Sky Story: Paiute
What similarities did you notice in each of the two Native American sky stories?

What differences did you notice in each of the two Native American sky stories?
Your Observations of the Night Sky

With Your Class

- Have you heard of or seen the North Star?
- Are there other things you have noticed in the sky that don’t appear to move over time?
Observe the Sky

In Your Notebook

Record what you notice and wonder as you watch the video about the sky.

Be ready to share your ideas with the class.
Observe the Sky

The video is separated into two parts; January through June and July through December using two different points of view.

Group 1: Start at 0:08

Group 2: Start at 9:00

Be ready to share your ideas with the class.
Identifying Patterns

With Your Group

- What patterns did your group notice while observing the video of the sky?
- Were there any objects that did not follow a pattern?

Record each idea that your group comes up with on a sticky note in bold print so that everyone can see.

Be ready to post your sticky note on the Patterns in the Sky poster.
Add Questions to the DQB

Scientists Circle

- What questions do we have about our observations of the sky?

Write one question per sticky.
Write in marker—big and bold.
Write your initials in pencil on the back of each sticky.
Break

10 min
Building Understanding

With Your Class

- What do the patterns we identified from observing the sky help us determine about the interactions of:
  - the Earth and Sun?
  - the Earth and Moon?
  - the Earth and North Star?
  - the Earth and other stars?
Model Patterns in the Sky

With Your Class

- What objects should we include in our models?
- What movements should we include in our models?

In Your Notebook

Create a model to help explain why these objects appear to move the way they do.
You drew a model on a piece of paper today instead of working with 3D manipulatives to represent the movement of the objects in the system.

If we wanted to explain patterns that occur over the course of a year (e.g., changes in amount of sunlight each day), let's consider the following:

- What would be some possible advantages in developing a 3D model of the system?
- What are some possible disadvantages or limitations you think we may encounter with such a model?
Brainstorm Activities

Turn and Talk
What are some changes in activities that occur during certain times of the year that are related to changes in the amount of sunlight?

Have participants share out as a whole group to the question. Record on chart paper.

Introduce the word “solar”
Observe Changes in the Sun

**With Your Class**

What patterns do we think we are going to see related to the Sun over one day (24 hours) when we speed up time in the software?
Making Predictions

With Your Class

What about if we speed it up even more and watch the Sun over a year? What patterns will we see?
Making Observations

With Your Team

Divide your team into smaller groups that will make the measurements over three to four months.

After the groups have made their measurements, share them with the rest of the team.

➔ Be ready to share these with the class.
Making Observations
Making Observations

Collect data for your respective months:


Be ready to share these with the class.
Share Measurements

Scientist Circle
Share your team’s measurement with the other team.
Observing Solar Patterns

With Your Class

• What yearly patterns do you observe?
• What evidence do you have for these patterns?
• What relationship do you think there is between these solar patterns?
Connections to Other Cultures

With Your Class

Think back to the stories we have heard in the previous lessons.

- What connections can you make between those stories and changes in the Sun during a year?
Do you think these year long patterns have happened over thousands of years? Why or why not?
Collect Data About Changes in the Sun Over Time

With Your Group

Use two websites to record the following:

- Sunrise, sunset and length of daylight
- Solar elevation

Each group will be responsible for the same four dates but in a different year.

- March 20, June 20, September 22, and December 21
- Year spans: 1000, 1500, 2000, 2500

Be ready to share these next class.

NOAA Solar Calculator

My Location Now - GPS Coordinates
Collect Data About Changes in the Sun Over Time

Each group is responsible for the same four dates:
March 20, June 20, September 22, and December 21
...but in a different year

Group 1: Year 1000
Group 2: Year 1500
Group 3: Year 2000
Group 4: Year 2500

NOAA Solar Calculator:

My location now GPS coordinates:
Share Data About Changes in the Sun Over Time

With Your Class

As the groups share their data, record the information in your handout.

We would share data and look for patterns.... But for today and to save a bit of time....
Data About Changes in the Sun Over Time

Lesson 3: Teacher Reference 2

Data from NOAA websites

<table>
<thead>
<tr>
<th>Year</th>
<th>Date</th>
<th>Sunrise</th>
<th>Sunset</th>
<th>Solar elevation at noon</th>
</tr>
</thead>
<tbody>
<tr>
<td>For this year:</td>
<td>March 20</td>
<td>06:39</td>
<td>18:47</td>
<td>45.33 degrees</td>
</tr>
<tr>
<td>1000</td>
<td>June 20</td>
<td>05:03</td>
<td>20:04</td>
<td>64.14 degrees</td>
</tr>
<tr>
<td>1000</td>
<td>September 22</td>
<td>06:21</td>
<td>18:32</td>
<td>44.37 degrees</td>
</tr>
<tr>
<td>1000</td>
<td>December 21</td>
<td>07:55</td>
<td>17:15</td>
<td>22.95 degrees</td>
</tr>
</tbody>
</table>

Building Understanding

With Your Class

- How has the amount of daylight changed over 500 years? over 1,000 years? over 1,500 years?
- How has the solar elevation changed over 500 years? over 1,000 years? over 1,500 years?
- How does this compare to the data you recorded using the videos of the simulation?
- In what ways does this data help to explain why different communities created rituals to mark changes in the patterns of daylight during a year?
Making Connections

With Your Class

- What connections can we make between the patterns in the data collected in this lesson back to the patterns identified by other civilizations we studied in earlier lessons?

- Look back to the model of the Earth-Sun-Moon system you made in Lesson 2. How could we use that model to see if the data we’ve collected can be explained by the model?
Modeling the System

With Your Group

● What parts of the system do we need to include in our 3D model in order to explain the patterns of the Sun from one year to the next that we collected in this lesson?

● What could we use to represent them?

● What changes could we make to the parts of the 3D model to see if the data we’ve collected can be explained by it.

➔ Be ready to share these with the whole class.
### Model Map

**With Your Class**

<table>
<thead>
<tr>
<th>Feature of the representation ...</th>
<th>is like this feature of the real world ...</th>
<th>because ...</th>
<th>and is not like it because ...</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light bulb</td>
<td>Sun</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Large foam ball on a stick</td>
<td>Earth and its axis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Round pushpin (with twist tie around it)</td>
<td>Person on earth</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rubber band</td>
<td>Path the person follows over 24 hours (latitude line)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Modeling the Earth-Sun System in 3-D

With Your Class

1. Position your observer (round pushpin), and mark the observer’s path with a rubber band. Place the sphere on the wire stand, and push it down until it is level with the lightbulb.

2. One group member should move the foam Earth slowly around the lamp Sun while keeping the North Pole pointed at Polaris in the classroom. Pause at each of the positions illustrated on the handout and use pushpins to mark sunrise and sunset.

3. For each position, record the length of the observer’s path between the two pushpins (to the nearest half-inch). The shorter the measurement, the less time the observer spends in the light and the more time the observer spends in the dark. Then on the image of the horizon in the table draw what you predict the path of the Sun will look like for this observer at each position.
With Your Class

Make sure your model map is filled out.

Based on the measurements you have made, are our models accurate? How well does what you measured with our 3-D model match the data we recorded from the NOAA websites?
In Your Progress Tracker

- Write the question we are working on in the left column: How can we explain the Sun’s path change over time?

- Write what you figured out in the middle column. Use words and/or pictures. Take as much space as you need to record your thoughts.

- Write how this connects to or influences you, your community, or other communities in the right column.
Navigating from Lesson 4-10

Lesson 4: How do these changes in sunlight impact us here on Earth?

We analyze seasonal temperature data from 2 U.S. cities and argue that changes in Earth's distance from the Sun do not explain seasonal temperature differences.

Using a physical model we figure out Earth's tilt changes in solar elevation resulting in seasonal temperature changes.
Navigating from Lesson 4-10

Lesson 5: How can we explain phenomena like Manhattanhenge?

We use a video simulation to investigate patterns we think might be responsible for Manhattanhenge and revise a model to explain the phenomenon.

We then problematize the model to see where and how the moon fits in based on the DQB questions about the moon.
Unit Questions by Lesson

Driving Question: How are we connected to the patterns we see in the sky and space?

Lesson Set 2: How can we explain the patterns of the Moon we see and connect to in the sky and space?

Lesson 6-7

Students investigate patterns they and others have noticed in the shape of the moon over time for lunar phases and eclipses and develop a physical model of the earth, sun, moon system to explain and predict these patterns.

Lesson 6: Why do we see the shape of the Moon change?

Lesson 7: Why do we see eclipses and when do we see them?
Lesson 12: Revised Consensus Model

A model to support an explanation for why the moon looks red 1 hr before and 1 hr totality in lunar eclipse.
Constructing Knowledge as a Class Requires Productive Discourse
Reflect on Current Science Talk

Quick-Write:

- What kinds of science talk happen most frequently in your classroom?
- What kinds of science talk would you like students to engage in more?

➡️ Be prepared to share your thinking with the whole group.
Scientific Discourse

- **Discourse** is the verbal exchange of ideas, or simply, talking. **Scientific discourse** involves argumentation based on evidence to persuade colleagues—or classmates—that ideas are valid. The NGSS calls for science learning to be mediated by productive argumentation supported by evidence, collaboration, and analysis. (NSTA 2015)

- “Skill and persistence are required to help students grasp the difference between scientific argument, which rests on plausibility and evidence and has the goal of shared understanding, and everyday argument, which relies on power and persuasiveness and assumes that the goal is winning,” the NRC says in *Taking Science to School: Learning and Teaching Science in Grades K—8*. (NRC 2007, 187–188)
How do we support equitable sensemaking?

● “All students know things. However, they may not express their knowledge in academic language” (Brown, 2019, p. 43).

● “If we fail to recognize the diverse nature of language and cognition, students who bring a wealth of knowledge but communicate it in vernacular language will never be heard because the nature of classroom conversations privileges only one type of communication” (Brown, 2019, p. 39).

● We want to hear and support the brilliance of students as they make sense of phenomena during classroom discussions.

Why is discourse so central to OpenSciEd?

Framework-designed curricula requires a classroom culture of public reasoning to build students’ science ideas across a unit.

Being able to identify and support productive talk is an important part of building this culture.

Productive talk allows students to:

- make their thinking public in an equitable way.
- reason about complex ideas.
- develop arguments and evidence-based explanations.
Goals for Productive Talk

To support productive talk, there are four conditions that need to be in place. These can be expressed as goals or challenges.

- **Goal 1**: Help individual students share, expand, and clarify their own thinking.
- **Goal 2**: Help students listen carefully to one another.
- **Goal 3**: Help students deepen their reasoning.
- **Goal 4**: Help students think with others.
Goals and Talk Moves

Individually:

Read through the Goals and Talk Moves Handout.

### Productive Talk Goals and Moves

<table>
<thead>
<tr>
<th>Goal One: Help individual students share, expand, and clarify their own thinking</th>
<th>Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Time to think: Partner talk; writing as think time; wait time</td>
<td>Observations</td>
</tr>
<tr>
<td>2. Say more: “Can you say more?”; “What do you mean by that?”; “Give an example”</td>
<td>Observations</td>
</tr>
<tr>
<td>3. So, are you saying...? “So, let me see if I’ve got what you’re saying. Are you saying...?” (always leaving space for the original student to agree or disagree and say more)</td>
<td>Observations</td>
</tr>
</tbody>
</table>

| Goal Two: Help students listen carefully to one another | Observations |
| 4. Who can rephrase or repeat? “Who can repeat what Jamal just said or put it into their own words?” (After a partner talk) “What did your partner say?” | Observations |

| Goal Three: Help students deepen their reasoning | Observations |
| 5. Asking for evidence or reasoning: “Why do you think that?” “What’s your evidence?” “How did you arrive at that conclusion?” | Observations |
| 6. Challenge or Counterexample: “Does it always work that way?” “How does that idea square with Soria’s example?” “What if it had been a copper cube instead?” | Observations |

| Goal Four: Help students think with others | Observations |
| 8. Add On: “Who can add onto the idea that Jamal is building?” “Can anyone take that suggestion and push it a little further?” | Observations |

Other Observations: Adapted from TERC (2012), Talk Science in the Inquiry Project
Goals and Talk Moves

With a Partner:

- Which Goal is **most** in place in your own classroom?
- Which Goal is **least** in place in your own classroom?

### Productive Talk Goals and Moves

<table>
<thead>
<tr>
<th>Goal One: Help individual students share, expand, and clarify their own thinking</th>
<th>Observations</th>
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<tr>
<td>1. Time to think: Partner talk; writing as think time; wait time</td>
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<td>2. Say more: “Can you say more?”, “What do you mean by that?”, “Give an example”</td>
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<td>3. So, are you saying...?: “So, let me see if I’ve got what you’re saying. Are you saying...?” (always leaving space for the original student to agree or disagree and say more)</td>
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<th>Goal Two: Help students listen carefully to one another</th>
<th>Observations</th>
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<tr>
<td>4. Who can rephrase or repeat?: “Who can repeat what Jason just said or put it into their own words?” (After a partner talk) “What did your partner say?”</td>
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<th>Goal Three: Help students deepen their reasoning</th>
<th>Observations</th>
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<td>5. Asking for evidence or reasoning: “Why do you think that?” “What’s your evidence?” “How did you arrive at that conclusion?”</td>
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<td>6. Challenge or Counterexample: “Does it always work that way?” “How does that idea square with Sonia’s example?” “What if it had been a copper cube instead?”</td>
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<th>Goal Four: Help students think with others</th>
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<td>8. Add On: “Who can add onto the idea that Jamal is building?” “Can anyone take that suggestion and push it a little further?”</td>
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Other Observations:

Adapted from TERC (2012), Talk Science in the Inquiry Project
Using the Talk Goals and Moves
OpenSciEd Discussion Types

- Consensus Discussion
- Building Understanding Discussion
- Initial Ideas Discussion
- Building Discussion

Discussion Types:
## Three Types of Discussions in OpenSciEd

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<tr>
<th>Type</th>
<th>Purpose</th>
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| **Initial Ideas Discussion** | • Share initial ideas and experiences  
• An initial tentative chance at sense making  
• Realize there are gaps in understanding and support wondering how to figure these out |
| **Building Understanding Discussion** | • Share claims and reasoning based on evidence  
• Connect, critique and build on each others’ findings |
| **Consensus Discussion** | • Collectively work towards a common model  
• Take stock and capture areas of agreement |
Discussion Step in the Teacher Guide

Individually:

- Read through Step 9 of the teacher guide.
- Reflect on purpose of the discussion.

Discussion Step in Lesson 1 of the Lightning Unit

Included below is a copy of the teacher guide from Lesson 1 of the Lightning Unit. This is step 9 from the lesson and it takes place at the end of Day 1. This is the part of the teacher guide that aligns with the discussion we saw in the video. Below is what the teacher was provided in the teacher guide to prepare to support the facilitation of this discussion.

- What kinds of supports do you see in this section of the teacher guide?
- What were some similarities you saw in the discussion that is also in the teacher guide?
- What were some differences?

9 - DEVELOP OUR INITIAL CLASS CONSENSUS MODEL

MATERIALS: Initial Model, science notebook, chart paper, markers

Gather in a Scientists Circle. Display slide T and remind students of your classroom protocol for sitting or standing in a circle where everyone can be seen and heard. Direct students to bring their science notebooks and Initial Model with them to the circle.

**SCIENTISTS CIRCLE**

You will form a Scientists Circle in this lesson and many future lessons. Having students sit in a circle so they can see and face one another can help build a sense of shared mission and a community of learners working together. Returning to this Scientists Circle throughout the course of the unit to take stock of what the class has figured out and where they need to go next will be an important routine to help the class take on greater agency in steering the direction of their learning. This circle will also help students build a sense of pride in their work. You may want to inform students that professional scientists also collaborate with one another to brainstorm, discuss, and review their work.

If you have not already established expectations and practiced logistics for forming your Scientists Circle, take the time to do that now (see suggestions in the OpenSciEd Teacher Handbook). Then, take time at the end to practice breaking it down. After a few more times, the protocol you have for forming a Scientists Circle will become routine.

You will then work in a Scientists Circle to develop an initial class consensus model for what causes lightning. Tell students that the goal of this discussion is to capture areas of agreement and disagreement about our individual initial models. Knowing where we agree and disagree will help us establish what we need to figure out about what causes lightning and possibly how to prevent injuries and damage from it. Be explicit with students about the shift of your role in this discussion type. See the Consensus Discussion callout for more guidance.

Facilitate a Consensus Discussion while you record the initial class consensus model on a piece of chart paper or shared digital space titled "What causes lightning and why are some places safer than others when it strikes?"
Guidelines for Watching Videos of Teaching*

- These are real classrooms, which means there are also students who did not give consent.

- **Ground Rules:**
  - Teaching and the classrooms we will see are complex. There is much we don’t know about the students and teacher and their history together.
  - Presume expertise on the part of the teacher.
  - Assume what the kids are saying makes sense to them.
  - Focus on how what the teacher and students are doing is serving the learning goals of the lesson and providing access for diverse learners.

Use the handout to record any of your observations related to the Goals and Moves.

Video Context:

- This video is from a high school chemistry class. This is at the end of day 1 of the Lightning Unit.

- After previously brainstorming with a partner, students now share ideas and then co-develop a class consensus model to explain what causes lightning.
Observing Productive Talk
Individual Analysis:

- **What talk moves do you notice the students and teacher using?**

- **How did using these talk moves and discourse support the class in reaching the purpose or goal of this Consensus discussion?**

Use the transcript and teacher guide to support your analysis.
Observing Productive Talk

Small-Group Debrief:

● What talk moves do you notice the students and teacher using?

● How did using these talk moves and discourse support the class in reaching the purpose or goal of this discussion?

● How did the talk moves and other strategies support all students in engaging in equitable sensemaking?

Whole-Group Share:

● Share some key ideas from your small group.
Community Agreements to Support a Culture of Figuring Out

Individually:

● Read the Classroom Agreements to Support Productive Discussion resource.

Community Agreements to Support a Culture of Figuring Out

Two common problems with the ways community agreements, or norms, are often implemented are 1) they tend to be focused on behavior rather than sensemaking and 2) they often align with dominant cultures.

OpenSciEd materials rely on students collectively figuring out science ideas through productive talk. This requires a classroom culture where all students feel like it is safe to participate and productively struggle together as we make sense of phenomena and build science ideas over time. The development and ongoing use of community agreements focused on figuring out can support collaborative sensemaking.

We also know students come to our classrooms with a variety of cultural and linguistic experiences and ways of knowing. These resources are essential to the community and should be leveraged to help develop and push all students’ learning forward. However, often particular modes of communication and demonstrations of knowledge are valued over others. Those modes are often associated with behaviors of dominant cultures (white, male, cisgender, English speaking, etc.).

OpenSciEd supports an approach to agreement-building that encourages students to share ideas in the modes that work for them. As we develop these agreements with our students, we need to keep two key questions in mind:

- How can we co-construct agreements that productively move our science ideas forward AND make all of our students feel respected and valued?
- How can we co-construct agreements that reflect the experiences and values of all students versus only reflecting norms and values of dominant cultures?

Agreements to Support Productive and Equitable Participation


Respectful

For students to take the risk of making sense of complex ideas with their peers, they need to feel safe and know that they will not be ridiculed or mocked. Establishing and enforcing agreements that work to make the classroom a safe space to share is a prerequisite for productive talk. Providing each other with support and encouragement, sharing time to talk, and critiquing the ideas we are working with (but not the people we are working with) are some agreements that can support respect. One way to support students is to have a discussion with them about what might prevent someone from participating in a discussion. Then brainstorm together agreements the class can make that might help all students feel comfortable sharing ideas. Explicitly addressing the idea that disagreements are an essential part of making sense in science, that these disagreements can sometimes feel like conflict, and then brainstorming ways that we can disagree with others’ ideas is also essential.

Equitable

If we are serious about the importance of discourse in helping us figure out science ideas together, then all students need to have access to the conversation. This does not mean that every student has to talk during every
Small-Group Discussion:

● What strategies did you just read about or did your facilitator use during your unit to establish these agreements?
● What strategies might you use to establish Community Agreements at the beginning of the year to support productive discussions in your OpenSciEd unit?

→ Be prepared to share your thinking with the whole group.
Listen to two high school teachers reflect on classroom discussion. Pay attention for any of the agreements from the reading.
NSTA Survey

- Location:
  Charlotte, NC ESS
- Presenter 1:
  Holly Hereau
- Leave Presenter 2 and Presenter 3 blank
- Scroll down and answer the last 2 questions (17 and 18) then hit "submit"

Link out to CM L1 Unit 1

https://docs.google.com/presentation/d/1QXVBt_K1B-uSTCnMGeUrS30IaRZ7ekQwJudqQmZKmyk/edit#slide=id.g21214093394_0_0
Individual Reflection

How can we support students in sensemaking discussions?

- Jot down ideas for day 3 in terms of what you have figured out and any lingering questions.

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<tr>
<th>PD Questions</th>
<th>What have you figured out?</th>
<th>What do you wonder? What questions do you still have?</th>
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<tr>
<td>Day 1: What does it mean to see phenomena and questioning to support student sensemaking?</td>
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<tr>
<td>Day 2: How do we help students see coherence across the curriculum?</td>
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<tr>
<td>Day 3: How can we support students in sensemaking discussion?</td>
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