Welcome!

Making Sense of Three-Dimensional Teaching and Learning: Supporting All Students in Learning Science

Portland Public Schools
August 13-14, 2024
Today’s Presenter

Kate Soriano
NSTA Standards Implementation Specialist
ksoriano@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?
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?

Small Group
❖ Share your thinking with your group.
❖ What is your group’s top science goal for students in your district?
❖ Record your goal and post.
The Vision for Science Education

The framework is designed to help realize a vision for education in the sciences and engineering in which students, *over multiple years of school*, **actively engage in science and engineering practices** and apply **crosscutting concepts** to deepen their understanding of the **core ideas** in these fields.

The learning experiences provided for students should **engage students with their own fundamental questions about the world** and with how scientists have investigated and found answers to those questions.
Learning Goals

● Build an understanding of what phenomenon-driven, three-dimensional teaching and learning (the *vision*) looks like, feels like, and sounds like in the classroom.

● Be able to foster a community of evidence-based thinkers and position students as the “knowers” in the classroom.

● Gain strategies to leverage students’ assets (experiences, prior learning, curiosity, etc.) and resources to learn science.

● Be able to apply workshop experience to identify characteristics of high-quality instructional materials that support equitable sensemaking.
### Collection of Resources

**Portland Public Schools: Making Sense of Three-Dimensional Teaching and Learning Collection**

- **PRIVATE**
- **17 items**

Making Sense of Three-Dimensional Teaching and Learning: Supporting All Students in Learning Science workshop, Portland Public Schools, August 13-14, 2024

- Earth & Space Science
- Life Science
- Physical Science
- High School
- Engineering
- Middle School

### Resources in “Portland Public Schools: Making Sense of Three-Dimensional Teaching and Learning” Collection

<table>
<thead>
<tr>
<th>Title</th>
<th>Resource Type</th>
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<tbody>
<tr>
<td>STEM Teaching Tool 42: Using Phenomena in NGSS-Designed Lessons &amp; Units</td>
<td>Web Page</td>
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<td>STEM Teaching Tool 3: Cases of Practices</td>
<td>Web Page</td>
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Meet Ms. Katsanos’ Third-Graders

Students experienced the phenomenon of kidney beans **germinating**. (The beans look like kidney beans one day and then a few days later some kidney beans look like plants.)

Students have **completed an investigation** in which kidney beans with water and kidney beans without water were placed in **sunny** places and **dark** places.
Elementary Students Sensemaking

Students complete two tasks in this classroom video

Task 1. **Reach a consensus using patterns in data** on what it means for a seed to *germinate* (0:44-1:19)

Task 2. **Make a claim** in answer to the question about the phenomenon, “What do kidney beans need to successfully germinate?” (3:52-6:00)
Elementary Students Sensemaking

Alone Zone

1. What are the students doing?

2. What is the teacher(s) doing?

3. Based on what you observed, what is sensemaking?

https://www.teachingchannel.org/video/lesson-claims-evidence-reasoning
Elementary Students *Sensemaking*

**Alone Zone**

1. What are the students doing?
2. What is the teacher(s) doing?
3. Based on what you observed, what is *sensemaking*?
High school biology students experience the phenomenon of populations changing over time and students’ questions about the phenomenon lead the class to wonder, “Can nature change populations?”

Students have used a computer simulation to “hunt” bacteria moving at different speeds due to differences in physical characteristics (number of flagella).
Students complete two tasks in this classroom video.

Task 1: Use a **simulation** to identify **cause-and-effect relationships** between an organism’s ability to avoid prey and changes in that organism’s population over time.

Task 2: **Construct an explanation(s)** using **science ideas** and **cause-and-effect relationships** to help answer the question about what causes populations change. (2:53-7:11)
High School Students Sensemaking

Alone Zone

1. What are the students doing?

2. What is the teacher doing?

3. Based on what you observed, what is sensemaking?

Video not available to public (not open source).
Alone Zone

1. What are the students doing?

2. What is the teacher doing?

3. Based on what you observed, what is sensemaking?
What is Sensemaking?

Small Group

• Discuss with your group members:
  
  o What were the students doing? What was the teacher doing? *Cite specific examples from the classroom video.*
  
  o What are the patterns of similarity between the 3rd-grade and high school classrooms?

• As a group, describe *sensemaking*.

Set your poster aside; we’ll revisit these ideas later.
Why does a lot of hail, rain, or snow fall at some times and not others?

Lesson adapted from OpenSciEd Unit 6.3 Weather, Climate & Water Cycling, Lesson 5
Research: Science and Language Integration

Science

- **Traditional views:** Individual learners master academic content (*the knowledge of; what knowledge is*)
- **Contemporary views:** Students make sense of phenomena and design solutions to problems as scientists and engineers do in their work (*knowledge for; what knowledge does; knowledge-in-use*)

Language

- **Traditional views:** Individual learners internalize vocabulary and grammar (*the language of; what language is*)
- **Contemporary views:** Students use language for a particular purpose (*language for; what language does; language-in-use*)
Student Hat/Teacher “Hat”

Student Hat: Think like a student.

Student/Teacher Hat: Think like a student, but note teacher guidance.

Teacher “Hat”: Reflect on student experience and educator moves.
Learning Community Norms

- We use and build on other’s ideas.
- We use evidence to support our ideas, ask for evidence from others, and suggest ways to get additional evidence.
- We are open to changing our minds.
- We challenge ourselves to think in new ways.

From OpenSciEd Classroom Norms
Phenomenon

Helium balloon hovering just above the floor

https://youtu.be/Fj0hj_28lqs?t=133
Phenomenon

Partner Talk
Share with your partner
✔ Two observations
✔ One question

Helium balloon hovering just above the floor
Phenomenon

Helium balloon hovering just above the floor

Partner Talk
Share with your partner
✔ Two observations
✔ One question

Whole Group
Share one question and what you observed that caused you to ask that question.
Related Phenomenon: Investigation
Related Phenomenon: Investigation

We’re going to observe what happens to the soap-bubble film when the bottle is placed in warm water and in cold water.

Don’t forget to observe the bottle before you place it in the warm and cold water.
Can we create a model to explain our observations of the soap-bubble film when the bottle is on the table, in hot water, and in cold water.

**Alone Zone**

Make a “must have” list for this model. Consider

- What are the **parts** of the model?
- How might the **parts** work together to cause what we observed?
Initial Consensus Models (Small Group)

Create a group consensus model to explain your observations of the soap-bubble film when the bottle is on the table, in hot water, and in cold water.

Use words, pictures, symbols, etc. to help communicate your thinking.

- Bottle in **hot** water
- Bottle on the table
- Bottle in **cold** water
Gallery Walk

Gather your group members and go on a gallery walk. Stop at each model and look for

- 2 things that are the same or similar compared to your group’s model.
- 2 things that are different compared to your group’s model.
Looking for Patterns

Place 1-3 yellow sticky notes on your own group’s model to identify things that are the same or similar on many or most of the models.

Place 1-3 pink sticky notes on your own group’s model to show things that are different from most of the models.
Gather your group members and join the whole group in a scientist circle.
Where We’re Going Next

Create an individual model to explain our observations of the balloon (formatively assess students’ understanding).

Connect our explanatory models for the balloon to what happens to air in contact with Earth’s surface as it warms up over the course of a day (weather science idea).
**Phenomenon:** A helium balloon hovering just above the ground on its own is placed on a heating pad and then rises and falls on its own.

<table>
<thead>
<tr>
<th>Science and Engineering Practices</th>
<th>Disciplinary Core Ideas</th>
<th>Crosscutting Concepts</th>
</tr>
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<tbody>
<tr>
<td><strong>Planning and Carrying Out Investigations</strong></td>
<td><strong>PS1.A: Structures and Properties of Matter</strong></td>
<td><strong>Cause and Effect</strong></td>
</tr>
<tr>
<td>● Conduct an investigation and/or evaluate and/or revise the experimental design to produce data to serve as the basis of evidence that meet the goals of the investigation.</td>
<td>● In a liquid, the molecules are constantly in contact with others; in a gas, they are widely spaced except when they happen to collide. In a solid…</td>
<td>● Cause-and-effect relationships may be used to predict phenomena in natural or designed systems.</td>
</tr>
<tr>
<td><strong>Developing and Using Models</strong></td>
<td><strong>PS3.B Conservation of Energy and Energy Transfer</strong></td>
<td><strong>Energy and Matter</strong></td>
</tr>
<tr>
<td>● Develop a model to describe unobservable mechanisms.</td>
<td>● When the motion energy of an object changes, there is inevitably some other change in energy at the same time.</td>
<td>● The transfer of energy can be tracked as energy flows through a designed or natural system.</td>
</tr>
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**Building toward** MS-PS1-4. Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed. AND MS-PS3-5. Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.
## Disciplinary Core Ideas (DCIs, science ideas)

<table>
<thead>
<tr>
<th>Life Science (LS)</th>
<th>Physical Science (PS)</th>
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<tr>
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<td><strong>PS1. Matter and Its Interactions</strong></td>
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<tr>
<td><strong>LS2. Ecosystems: Interactions, Energy, and Dynamics</strong></td>
<td><strong>PS2. Motion and Stability: Forces and Interactions</strong></td>
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<tr>
<td><strong>LS3. Heredity: Inheritance and Variation of Traits</strong></td>
<td><strong>PS3. Energy</strong></td>
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<tr>
<td><strong>LS4. Biological Evolution: Unity and Diversity</strong></td>
<td><strong>PS4. Waves and Their Application in Technologies for Information Transfer</strong></td>
</tr>
<tr>
<td><strong>Earth and Space Sciences (ESS)</strong></td>
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<tr>
<td><strong>ESS1. Earth’s Place in the Universe</strong></td>
<td><strong>ETS1. Engineering Design</strong></td>
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<td><strong>ESS2. Earth’s Systems</strong></td>
<td><strong>ETS2. Links Among Engineering, Technology, Science, and Society</strong></td>
</tr>
<tr>
<td><strong>ESS3. Earth and Human Activity</strong></td>
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Disciplinary Core Ideas

How this set of big ideas in science and engineering were chosen to include in the national science standards:

• Broad importance within or across science or engineering disciplines

• Provide a key tool for understanding or investigating complex ideas and solving problems

• Relate to societal or personal concerns

• Can be taught over multiple grade levels at progressive levels of depth and complexity.
Science/STEM and language integration is achieved through “doing science, using language”

1) Identify Compelling Phenomena or Problems
2) Engage Students in Disciplinary Practices
3) Engage Students in Productive Discourse and Interactions with Others
4) Encourage Students to Use Multiple Registers and Multiple Modalities
5) Leverage Multiple Meaning-Making Resources
6) Focus on How Language Functions in the Discipline
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Research: Promising Instructional Strategies (Chapters 3 and 4)
Intentional Sequences of Student Interactions

Foundation for interactions

- Alone zone

**Interactions**
- One-to-one
- One-to-small group
- One-to-many
- Small group-to-many

Explicit beyond the “here” and “now”
Intentional Sequences of Student Interactions

It goes down in that one!

- One-to-one
- One-to-small group
- One-to-many
- Small group-to-many

Explicit beyond the “here” and “now”

The bubble goes down when you put the bottle in cold water
...the air...the particles are squished together...they have less space - the bubble is pushed in...

the cold air is more dense than warm air
Vocabulary is a precursor or prerequisite for doing science: Pre-teach and frontload vocabulary
– Instead, language is a product of use

Vocabulary is language
– Instead, language is more than vocabulary and includes using language to engage in disciplinary practices and learn disciplinary content

Simplify content, simplify language
– Instead, keep content, amplify language (both support and challenge MLs)
Multiple Modalities (Means of Communication)

Students communicate their thinking through multiple modalities.

Students need to receive information through multiple modalities.
# Language Instructional Shifts

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<tr>
<th>Modalities</th>
<th>Registers</th>
<th>Interactions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Linguistic</strong></td>
<td>Everyday Language</td>
<td><strong>Specialized Language</strong></td>
</tr>
<tr>
<td>◯ Talk</td>
<td></td>
<td></td>
</tr>
<tr>
<td>◯ Text</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Visual</strong></td>
<td></td>
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</tr>
<tr>
<td>◯ Drawing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>◯ Symbol</td>
<td></td>
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<tr>
<td>◯ Table</td>
<td></td>
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<tr>
<td>◯ Gesture</td>
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</tr>
<tr>
<td><strong>Multimodality</strong></td>
<td><strong>Precise Ideas and</strong></td>
<td><strong>Explicit beyond the “here” and “now”</strong></td>
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<td></td>
<td>Precise Language</td>
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Lee, Quinn, & Valdés (2013)
Science/STEM and language integration is achieved through “doing science, using language”

1) Identify Compelling Phenomena or Problems
2) Engage Students in Disciplinary Practices
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**Continuum of Science Instruction**

**Information Frame**
- Teacher is focused on disseminating information.
- Students are focused on knowing information.
- Science is portrayed as a body of established facts.
- Assessments are focused on “right” answers.

**Sensemaking Frame**
- Teacher is focused on developing conceptual understanding.
- Students are focused on understanding something.
- Science is portrayed as a way to make sense of something.
- Assessments are focused on use of evidence to support conclusions/generalizations.

From: Cynthia Passmore, NSTA Virtual PD, Nov. 15, 2014
Continuum of Science Instruction

Information Frame
• Teacher is focused on disseminating

Sensemaking Frame
• Teacher is focused on developing conceptual

Less Like
• Science is portrayed as a body of established facts.
• Assessments are focused on “right” answers.

Knowing about...

More Like
• Science is portrayed as a way to make sense of something.
• Assessments are focused on use of evidence to support conclusions/generalizations.

Figuring out...
What are phenomena?

Natural phenomena are *observable events* that *occur in the universe* and that we can use our *science knowledge to explain or predict*.

The goal of building knowledge in science is to develop general ideas, based on evidence, that can explain and predict phenomena.
Shifting Toward Sensemaking

Students sensemaking in a 4th-grade classroom.
Shifting Toward the Sensemaking

Information Frame  Sensemaking Frame

Less Like  More Like
Shifting Toward the Sensemaking

Information Frame

Sensemaking Frame

Less Like

More Like

Soils, Rocks, and Landforms
INVESTIGATIONS GUIDE
Choosing Phenomena

What phenomenon can I put in front of students that will get them to ask questions that require the targeted science ideas to answer?

That is, what phenomenon requires the targeted science ideas to explain *how* or *why* the phenomenon occurs?
Phenomenon: Channeled Scablands

Video clip 02:56 – 04:52

https://vimeo.com/331335155
Phenomenon: Channeled Scablands
Phenomenon: Channeled Scablands

Alone Zone
What experiences do you have that might help you think about the Channeled Scablands phenomenon?
Where have you experienced something that reminds you of this phenomenon (the experience is similar but not quite the same)?

Partner Talk
Please share your experience(s) with related phenomena with your partner and tell them how it connects with the Channeled Scablands.
Wonderings

• Review your own observations and the observations shared by the class.
• Think about your own and shared related phenomena.
• Review the questions you recorded in the “I wonder” column of your table.
• Add new questions and/or revise questions you recorded while watching the video of the Channeled Scablands.
• Choose one or two questions to share.
Phenomenon: Channeled Scablands

Our wonderings about the Channeled Scablands

- Why is it so flat?!
- Why was the geologist trying to split the rocks?
- Was there water there? Where did it go?
- Is there different matter in the different layers?
- How did they know the water fall was there?
- Why did the waterfall dry up?
- Where did the boulders come from?
- Are there fossils in the rock?
- How did the ash get there? Was there a volcanic eruption?
- How long did it take to the form the Scablands?
ESS1: Earth’s Place in the Universe
ESS1.C: The History of Planet Earth
- Local, regional, and global patterns of rock formations reveal changes over time due to Earth forces, such as earthquakes. The presence and location of certain fossil types indicate the order in which rock layers were formed.

ESS2: Earth’s Systems
ESS2.A: Earth Materials and Systems
- Rainfall helps to shape the land and affects the types of living things found in a region. Water, ice, wind, living organisms, and gravity breaks rocks, soils, and sediments into smaller particles and move them around.
Phenomena

Using Phenomena in NGSS-Designed Lessons and Units

WHAT ARE PHENOMENA IN SCIENCE AND ENGINEERING?
- Natural phenomena are observable events that occur in the universe and that we can use our science knowledge to explain or predict. The goal of building knowledge in science is to develop general ideas, based on evidence, that can explain and predict phenomena.
- Engineering involves designing solutions to problems that arise from phenomena, and using explorations of phenomena to design solutions.
- In this way, phenomena are the context for the work of both the scientist and the engineer.

WHY ARE PHENOMENA SUCH A BIG DEAL?
- Despite their centrality in science and engineering, phenomena have traditionally been a missing piece in science education, which too often has focused on teaching general knowledge that students can have difficulty applying to real-world contexts.
- Anchoring learning in explaining phenomena supports student agency for wanting to build science and engineering knowledge. Students are able to identify an answer to "why do I need to learn this?" before they even know what the "this" is. In contrast, students might not understand the importance of learning science ideas that teachers and curriculum designers know are important but that are disconnected from phenomena.
- By centering science education on phenomena, students are motivated to explain the focus of learning shifts from learning about a topic to figuring out why or how something happens. For example, instead of simply learning about the topics of photosynthesis and mitosis, students are engaged in building evidence-based explanatory ideas that help them figure out how a tree grows.
- Explaining phenomena and designing solutions to problems allow students to build general science ideas in the context of their application to understanding phenomena in the real world, leading to deeper and more transferable knowledge.
- Students who come to see how science ideas can help explain and model phenomena related to competing real-world situations seem to appreciate the social relevance of science. They get interested in science as a way of understanding and improving real-world contexts.
- Focusing investigations on competitive phenomena can help sustain students’ science learning.

HOW ARE PHENOMENA RELATED TO THE NGSS AND THREE-DIMENSIONAL LEARNING?
- The Next Generation Science Standards (NGSS) focus on helping students use science to make sense of phenomena in the natural and designed world, and use engineering to solve problems.
- Learning to explain phenomena and solve problems is the central mission students engage in the three dimensions of the NGSS. Students explain phenomena by developing and applying the Disciplinary Core Ideas (DCIs) and Crosscutting Concepts (CCCs) through use of the Science and Engineering Practices (SEPs).
- Phenomena-centered classrooms also give students and teachers a context in which to monitor ongoing progress toward understanding all three dimensions. As students are working toward being

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Understanding of DCI ESS1.A, which at the 5th grade level, focuses on the relationship between star brightness and distance from Earth.

- The process of developing an explanation for a phenomenon should advance students’ understandings. If students already need to know the target knowledge before they can inquire about the phenomenon, then the phenomenon is not appropriate for initial instruction (although it might be useful for assessment).
- Students should be able to make sense of anchoring or investigative phenomena, but not immediately, and not without investigating it using examples of the science and engineering practices. With instruction and guidance, students should be able to figure out, step by step, how and why the phenomenon works.
- An effective phenomenon does not always have to be flashy or unexpected. Students might not be intrigued by an everyday phenomenon right away because they believe they already know how or why it happens. It takes careful teacher facilitation to help students become dissatisfied with what they can explain, helping them discover that they really can’t explain it beyond a simple statement

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Table:

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<th>THINKING ABOUT PHENOMENA THROUGH THE NGSS</th>
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<td>Authentic engagement does not have to be fun or flashy; instead, engagement is determined more by how the students generate compelling lines of inquiry that create real opportunities for learning.</td>
<td>Students need to be able to engage deeply with the material in order to generate an explanation of the phenomenon using target DCIs, CCCs, and SEPs.</td>
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<td>Explanations (e.g., &quot;electromagnetic radiation can damage cells&quot;) are examples of phenomena.</td>
<td>Phenomena (e.g., a sunburn, vision loss) are specific examples of something in the world that is happening—a complete or partial example of a general process. Phenomena are NOT the explanations or scientific terminology behind what is happening. They are what can be experienced or documented.</td>
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<td>Phenomena are just for the initial hook.</td>
<td>Phenomena can drive the lesson, learning, and reflection/monitoring throughout. Using phenomena in these ways leads to deeper learning.</td>
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<td>Phenomena are good to bring in after students develop the science ideas so they can apply what they learned.</td>
<td>Teaching science ideas in general (e.g., teaching about the process of photosynthesis) may work for some students, but often leads to decontextualized knowledge that students are unable to apply when relevant. Anchoring the development of general science ideas in investigations of phenomena helps students build more credible and generative knowledge.</td>
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<td>Engaging phenomena need to be questions.</td>
<td>Phenomena are observable occurrences. Students need to use the occurrence to help generate the science questions or design problems that drive learning.</td>
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<td>Engaging phenomena need to be questions.</td>
<td>Engagement is a crucial access and equity issue. Students who do not have access to the material in a way that makes sense and is relevant to them are disadvantaged. Selecting phenomena that students find interesting, relevant, and consequential helps support their engagement. A good phenomenon builds on everyday or family experiences: who students are, what they do, where they came from.</td>
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Published September 2013

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<th>Thinking About Phenomena Through the NGSS</th>
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<td>Authentic engagement does not have to be fun or flashy; instead, engagement is determined more by how the students generate compelling lines of inquiry that create real opportunities for learning.</td>
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<td>Anything students are interested in would make a good “engaging phenomenon”</td>
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<td>Student engagement is a nice optional feature of instruction, but is not required</td>
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Choose one characteristic/description of thinking about phenomena that resonates with you.

How does the Channeled Scablands phenomenon exemplify this characteristic/description?

Be ready to share the connection you made between the description (#) and your experience with Channeled Scablands phenomenon.

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<td>Engagement is a crucial access and equity issue. Students who do not have access to the material in a way that makes sense and is relevant to them are disadvantaged. Selecting phenomena that students find interesting, relevant, and consequential helps support their engagement. A good phenomenon builds on everyday or family experiences: who students are, what they do, where they came from.</td>
</tr>
</tbody>
</table>
Choose one characteristic/description of thinking about phenomena that resonates with you.

How does the Channeled Scablands phenomenon exemplify this characteristic/description?

Be ready to share the connection you made between the description (#) and your experience with Channeled Scablands phenomenon.

**Phenomenon: Channeled Scablands**

<table>
<thead>
<tr>
<th>THINKING ABOUT PHENOMENA THROUGH THE NGSS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1</strong> Authentic engagement does not have to be fun or flashy; instead, engagement is determined more by how the students generate compelling lines of inquiry that create real opportunities for learning.</td>
</tr>
<tr>
<td><strong>2</strong> Students need to be able to engage deeply with the material in order to generate an explanation of the phenomenon using target DCIs, CCCs, and SEPs.</td>
</tr>
<tr>
<td><strong>3</strong> Phenomena (e.g., a sunburn, vision loss) are specific examples of something in the world that is happening—an event or a specific example of a general process. Phenomena are NOT the explanations or scientific terminology behind what is happening. They are what can be experienced or documented.</td>
</tr>
<tr>
<td><strong>4</strong> Phenomena can drive the lesson, learning, and reflection/monitoring throughout. Using phenomena in these ways leads to deeper learning.</td>
</tr>
<tr>
<td><strong>5</strong> Teaching science ideas in general (e.g., teaching about the process of photosynthesis) may work for some students, but often leads to decontextualized knowledge that students are unable to apply when relevant. Anchoring the development of general science ideas in investigations of phenomena helps students build more usable and generative knowledge.</td>
</tr>
<tr>
<td><strong>6</strong> Phenomena are observable occurrences. Students need to use the occurrence to help generate the science questions or design problems that drive learning.</td>
</tr>
<tr>
<td><strong>7</strong> Engagement is a crucial access and equity issue. Students who do not have access to the material in a way that makes sense and is relevant to them are disadvantaged. Selecting phenomena that students find interesting, relevant, and consequential helps support their engagement. A good phenomenon builds on everyday or family experiences: who students are, what they do, where they came from.</td>
</tr>
</tbody>
</table>
Phenomena: Equity

- Students have a common experience with the phenomenon (no one student is at an advantage or disadvantage).
- Students connect to the phenomenon through their experience with related phenomena.
- Students’ experience with related phenomena valued by learning community.
- In trying to explain the phenomenon, students recognize gaps in their knowledge which leads to questions they want to answer.
Phenomena

The point of using phenomena to drive instruction is to help students engage in practices to develop the knowledge necessary to explain or predict the phenomena.

It is the **phenomenon plus the student-generated questions** about the phenomenon **that guides the learning and teaching**.

STEM Teaching Tool 42
Alone Zone

Look and listen for evidence that students have been/are currently focused on explaining the phenomenon of the Channeled Scablands.

How is the teacher supporting students in tracking their own progress in explaining the phenomenon over time?
Sensemaking: Putting the Pieces Together
Students Build Understanding Piece by Piece
What is Sensemaking?

Small Group

Revisit your initial ideas about sensemaking.
- What ideas are supported?
- What ideas might you want to add to or change?
- What questions can you now answer?

Post any new questions you have about sensemaking.
What is Sensemaking?

Whole Group

Share one thing your group added to or changed and tell why.
Thank you
END DAY 1