Phenomena, Not Just for the Classroom

What is the issue?

Phenomena are defined as natural 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. The good news is that phenomena aren't just located in our classrooms, they can be found all around us. **How can we ensure the continuation and inclusion of phenomena for home-based continued learning?**

Equity Connection

Send thumb drives home to students with all virtual/Internet resources needed for science to accommodate for limited or no internet access.

Audience:

For educators to share with families or to use as a tool in remote learning.

Strategy:

A guide for users on how to interact with phenomena.

This effort represents the collective work of a group of individuals including, but not limited to science education leaders representing the Council of State Science Supervisors and NSELA. Resource Contributors (listed in alphabetical order): Lizette Burks, Linda Cook, Maya Garcia, Mike Heinz, K. Hillary Paul Metcalf, Renae Pullen, Kathy Renfrew, Meg Richard,and Tricia Shelton. Special thanks to Kathy Renfrew, Hillary Paul Metcalf, and Meg Richard for their work on "Phenomena Protocol, Not Just for the Classroom".

Implementation

Start with simple questions that help to stimulate curiosity and set the stage for inquiry. Try this **"See, Think, Wonder"** routine developed by Harvard Project Zero's Visible Thinking Project. Parents, family members, and siblings can engage in this activity while doing things around the house, or as a **"Notice and Wonder Walk"** around the community while practicing social distancing. Students can develop their own list of phenomena that are relevant to their lives. Get started with these questions and see where it goes!

- What do you see?
- What do you think about what you are seeing?
- What does it make you wonder?

Use Graphic Organizers as a Tool to Deepen Engagement with Phenomena at Home Consider introducing a **graphic organizer** that provides scaffolding for use by parents and families. You could also introduce science notebooks as a way to engage learners over an extended period of time.

Home and School Connections
Without the constraints of the formal learning space teachers have the opportunity to cultivate a more inclusive science community. Here is a model you might use to support at-home learning, that invites the use of the science and engineering practices, crosscutting concepts, and disciplinary core ideas in the process. Try this sample **phenomenon protocol** with the examples below. All of the examples provided were chosen with close attention paid to student interest and identity, Some that can be done indoors while others are community-based. Access the protocol and example Elementary and Secondary phenomenon.

Engage with Citizen Science Projects
"Science needs more eyes, ears and perspectives than one scientist possesses, to develop solutions to some of our planet's most challenging questions. Citizen science is a collaboration between scientists and those of us who are just curious or concerned and motivated to make a difference" (SciStarter, 2020). Students and families can collect data by taking photos of clouds or streams, documenting changes in nature, using smartphone sensors to help scientists monitor water and air quality, or playing games to help advance health and medical research. A citizen science project can involve one person or millions of people collaborating towards a common goal. Typically, public involvement is in data collection, analysis, or reporting. Citizen Science projects can be done from virtually anywhere making these fun activities easy to join while maintaining safe social distancing. April is the launch of Citizen Science Month, here are a few projects to get started with:

- Cornell Bird Project
- NASA Citizen Science
- Inaturalist
- National Geographic
- Zooniverse
- Mass Audubon

Strategic Tips

- **ELA Connections**
  Students are explicitly asked to develop and write questions. They also use language as they develop and revise models.
  In the elementary examples provided below, there is an explicit connection to a reading selection that could be used for addressing literacy standards.
- **Math Connections**
  Invite mathematical sensemaking about phenomena. How does it compare in size to similar phenomena? What can learn from collecting, recording and analyzing data about the phenomena? How can we best represent this information?

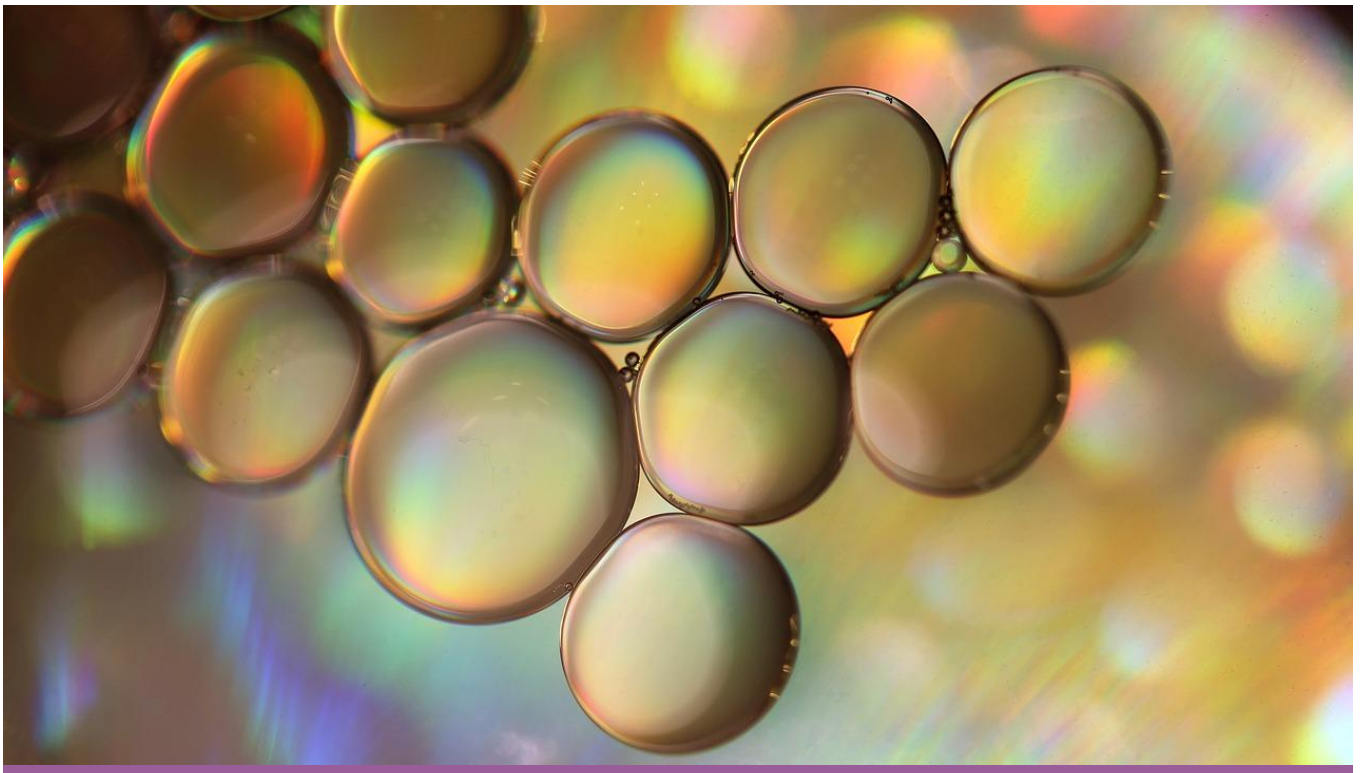
Tech to Try

- **Padlet** is one method of leaving virtual posts
- **Epic Read Aloud** (Free to teachers)

Resources:

Here are some additional resources to support at home learning. Each feature accessible activities to support phenomena based learning that will foster curiosity and support meaningful science instruction

★ **Phenomena for NGSS**
★ **PBS Kids**
★ **Science Friday Educate**
★ **Exploratorium Science Snacks**
★ **Mystery Science lessons**
★ **Science at Home**



Phenomena Protocol for Home/School Connection

This protocol focuses on the science and engineering practices of **modeling** and **asking questions**, two critical practices in science learning. This document is structured around two activities, that educators can adapt to support home school learning connections. Activities have distinctive opportunities for students to share their sensemaking with their families, teachers, and peers. Start with the sample phenomena included in this document. Feel free to substitute your own aligned investigations and literacy connections.

> " Science begins with a question about a phenomenon."
>
> *-A Framework for K-12 Science Education, p. 50*

Activity 1: Make Observations and Develop a Model

Identify and Observe - Assign a local or easily accessible phenomenon, or have children/ students and families identify, a local phenomenon to observe. (see a list of sample elementary and secondary phenomena to get started with below). This can be done with pen and paper, with their phones, or some other medium. Get creative!

Draw and Discuss - Models use words and pictures to show thinking, helping us all learn and make sense of the world together. Encourage students and other family members to draw models to represent their understanding of the phenomena, and then discuss the similarities and differences between models. Here are some tips to get started:

- If students are stuck, ask guiding questions such as "Are you seeing any patterns?," "Why do you think [x]?," "What do you think caused [X]?"
- Help students add meaning to their models by suggesting the use of arrows or substitute difficult to draw objects with a labeled box.

Share - Have children/students submit their models (e.g., pictures sent through your learning management system, school drop off, or texted via phone to teacher's email address or class email):

1. Do a virtual gallery walk where children/students can ask questions, leave thoughts, etc
2. Ask students to compare the similarities and differences in their models, allowing students to tell the "story" of their model.

Extend: Here are two ways for students to continue to develop their models at home.

1. If appropriate, ask children/students to work together with someone else to come up with a consensus model (one model representing the combined thinking).
2. Invite children/students to think about things that come to mind when thinking about the phenomenon. Sometimes children won't have another example of the phenomena and that's okay too. Possible prompts:
    a. Have you seen anything like this phenomenon before?
    b. What does the phenomenon remind you of?

Activity 2: Asking and Categorizing Questions

Wonder: Have students think about a chosen phenomenon and spend five minutes writing questions (remind them these should be questions and not statements). Consider encouraging students and their families to develop a "wonder wall". Help students get started with a few of the following prompts:

- Does _____ always look like that?
- What might happen if...?
- What is the reason for this...
- If _____ changes, what might happen to ...
- How might ……
- Why……..

Sort: Students and families can sort questions into "Observable" questions and "Investigable" questions.

- Observational questions- can be answered using your five senses. Add a ✔️ next to all the observation questions.
    - Ex. How does the bark on the tree feel?
    - Ex. What sound do the branches in the tree make when the wind blows?
- Investigable questions are questions you must test to find an answer. These are questions where you may need to collect data or change a variable. Add a **$** next to all your investigable questions.
    - Ex. How far will the car travel on the rug when pushed using a small amount of force?
    - Ex. How much will the plant grow over the next three months?

Choose: Invite students to choose one question they would like to figure out and put a **#** next to it and start a plan to investigate their "interest" question! Students can send their questions to their teacher to post and share with the class.

Sample Phenomena with Literacy Connections

Elementary K-5 Examples

Cloud formations in the sky K-ESS2-1

- Possible Investigation: Go for a short cloud walk every day for a week. Record the number and shapes of clouds. Describe patterns between clouds and weather.
- ELA Connection: Next Time You See A Cloud, Clouds Readworks

Sunsets 1-ESS1-1

- Possible Investigations: Keep track of the time of sunsets. Make a chart. Make statements about the patterns you notice.
- ELA Connection: Next Time You See a Sunset

Potential Properties- Select objects from around the house that are made of different materials. 2-PS1-1

- Possible Investigation: Properties Scavenger Hunt
- ELA Connection :, States of Matter Readworks

Funny friction: Observing that toy cars move differently on different surfaces in a house**.** 3-PS2-2

- Possible Investigation: Use a marble and roll across a carpet, a wood, tile, or linoleum floor. Consider what forces are acting on the object.
- ELA Connection: Newton and Me (Epic Read-aloud)

Sending messages

- Possible Investigations Using objects found at home design way to send a message 4-PS4-3
- ELA Connection: The Secret of Cell Phones Readworks

Ducks Float, Boats Float 5-PS1-3

- Possible investigation: Use the following items to figure out what properties allow the big boats to float:
  - container of water
  - aluminum foil
  - pennies
- ELA Connections Why do Boats Float and Rocks Sink? Readworks

Sample Phenomena with Literacy Connections

Middle and High School Examples

Physical Science:

Rainbows in the House

- *Possible Investigation:* Use a transparent glass of water and allow light to pass through it at various angles. MS-PS4-2
- *ELA Connection:* How Droplets of Oil and Water Can Glow Different Colors, *Science News*

Why Don't Woodpeckers Get Concussions?

- *Possible Investigation*: Have students engineer a vessel that minimizes impact damage to its contents. Extension, add something breakable into another object and try to protect them both (simulating the brain inside the skull inside a helmet). HS-PS2-3
- *ELA Connection:* Woodpecker Bodies Cushion Collision Impact on Bird Brains

Earth and Space Science:

The Weather is Changing

- *Possible Investigation:* Watch or research the weather over the course of a week. Why does the weather change? What factors does a meteorologist mention? Track the movement of high and low-pressure fronts. MS-ESS2-5
- *ELA Connection*: Why Does Wind Blow?

Cave Formation

- *Possible Investigation:* Use materials and water in a tub to attempt to make a cave formation. Observe how water dissolves various materials and how the materials behave when the water evaporates. Extension: consider the earth's composition when constructing your model and layer multiple components. An extension could include additional items and examining their solubility. HS-ESS2-5
- *ELA Connection:* Speleothems (Cave Formations)

Life Science:

Different Seeds for Different Folks

- *Possible Investigation:* Gather seeds from local plants and trees and examine how they move or are moved by factors in their environment to make them successfully grow and reproduce. MS-LS1-4.
- *ELA Connection:* SeedFolks or Why Tumbleweeds May Be More Science Fiction Than Old West

Finding Fireflies (Lightning Bugs)

- *Possible Investigation*: Catching fireflies is a pastime. Go outside and collect data on how many you see and the human factors that may be impacting the numbers. Consider adding your findings to the Mass Audubon Citizen Science Project. HS-LS2-7
- *ELA Connection:* Silent Sparks: The Wondrous World of Fireflies or Are Firefly Populations Blinking Out?