Using Phenomena to Drive Student Learning in a Unit of Instruction for Elementary School Students

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Figuring out Phenomena

How does phenomena help us support a classroom culture of figuring out for all students?
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Anchoring and Investigative Phenomena

We will show how we use an Anchoring Phenomenon to drive learning of a complex idea in an Elementary School Unit.

We will show how we use Investigative Phenomena to support a culture of “figuring out” - so all students participate in knowledge building while explaining the complex idea.

Using the Elementary School Storyline Example

We will familiarize ourselves with the Performance Expectations we are building toward in the elementary school (Grade 5) Ecosystems example unit “Why do dead things disappear over time?” (aka “Roadkill Cafe”)

We will examine the anchoring phenomenon in this unit.

We will figure out the key characteristics that make the anchor and investigative phenomena effective.

Why is the use of phenomena important to get to these performance expectations?

To explain the phenomena students will use:

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<tr>
<th>Science and Engineering Practices</th>
<th>Disciplinary Core Ideas</th>
<th>Cross Cutting Concepts</th>
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<tbody>
<tr>
<td>- Use models to describe phenomena.</td>
<td>LS1.C: Organization for Matter and Energy Flow in Organisms</td>
<td>- Energy can be transferred in various ways and between objects.</td>
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<tr>
<td>- Develop a model to describe phenomena.</td>
<td>LS2.A: Interdependent Relationships in Ecosystems</td>
<td>- Matter is transported into, out of, and within systems.</td>
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<td>Engaging in Argument from Evidence</td>
<td>LS2.B: Cycles of Matter and Energy Transfer in Ecosystems</td>
<td>Systems and System Models</td>
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<td>- Support an argument with evidence, data, or a model.</td>
<td>PS1.A: Structure and Properties of Matter</td>
<td>- A system can be described in terms of its components and their interactions</td>
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<td>Scale, Proportion, and Quantity</td>
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<td>- Natural objects exist from the very small to the immensely large</td>
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Students as partners in knowledge building

“We put the pieces of the science ideas together over time.”

“We figure out where we are going each step.”

“We figure out the science ideas.”

5th-grade Ecosystem Unit Target PEs

5-PS3-1. Use models to describe that energy in animals’ food (used for body repair, growth, and motion and to maintain body warmth) was once energy from the sun.

5-LS2-1. Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.

5-LS1-1. Support an argument that plants get the materials they need for growth chiefly from air and water.

5-PS1-1. Develop a model to describe that matter is made of particles too small to be seen.

Thinking about the 5th-grade Ecosystem Storyline and how to employ phenomena

▪ How can we use an anchoring phenomenon to motivate developing a complex model like showing how matter moves between organisms in an ecosystem.

▪ Can we use student questions to motivate investigations that look at new phenomenon that will be helpful in developing our ideas about how matter moves in ecosystems?

▪ Can students construct a model of the movement of matter and energy step by step by building up from their explanations of their investigations of phenomenon?

What key elements are necessary to ensure the anchoring phenomenon can carry the unit?

Elements of the Anchoring Phenomenon Routine

▪ Students Explore the Anchoring Phenomenon - What do we notice?

▪ Students attempt to make sense of the Phenomenon - How can we explain this? Do our explanations agree?

▪ Students Identify Related Phenomena - Where else does something like this happen?

▪ Develop Questions & Next Steps - What do we need to figure out?
Why do dead things disappear over time?

The teacher introduces unit by asking a question: Have you ever noticed something like this on the road? Does it stay there forever? What happens to it?

Students make predictions about what this raccoon will look like in the future

Students have lots of ideas for how to test their predictions...

Students’ Initial Questions
They decide to set up a video camera on a dead thing in the woods to find out what really happens.

Effective Anchoring Phenomena...

- Are immediately (or progressively) interesting to explore

Students attempt to explain the phenomenon... and have some competing ideas.

Effective Anchoring Phenomena...

- Are immediately (or progressively) interesting to explore
- Lead us to wonder
- Generate controversy (competing explanations)
Students explore some more information about what's going on with the dead animal and share related experiences.

Effective Anchoring Phenomena...

- Are immediately (or progressively) interesting to explore
- Lead us to wonder
- Generate controversy (competing explanations)
- Connect to other experiences that students have had with related phenomena in the world.

Students generate questions.

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- Connect to other experiences that students have had with related phenomena in the world.
- Generate questions and ideas for investigations

Students brainstorm ways to investigate their questions

What have we accomplished so far?

Students Explore the Anchoring Phenomenon
Students attempt to make sense of the Phenomenon
Students Identify Related Phenomena
Develop Questions & Next Steps

Effective Anchoring Phenomena...

- Are immediately (or progressively) interesting to explore
- Lead us to wonder
- Generate controversy (competing explanations)
- Connect to other experiences that students have had with related phenomena in the world.
- Generate questions and ideas for investigations
- Becomes our goal to try explain (by some later point in the unit).

In this role we refer to such a phenomena as an anchoring phenomena as it anchors the launch of the unit and is something we will revisit in future lessons.
What did students decide to test first?

Students have ideas for what is happening, and how to test those ideas

Why are we doing this investigation?

- We need to find out if plants also will disappear over time, and try to figure out what factors are involved because...

  **Teacher's Perspective:**
  Students need to build and use science ideas

  **Kids' Perspective:** We’re trying to see what happens to plants - is it the same or different than when the animals disappeared?

  5-LS2-1. Develop a model to **describe the movement of matter among plants, animals, decomposers, and the environment.** Systems and System Models
  A system can be described in terms of its components and their interactions.

  Because we’re trying to answer our **Driving Question** “**How do dead things disappear over time?**”

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Results of this investigation led to more questions, more ideas, and more investigations.

Investigations can center on multiple phenomena. Throughout the unit, students use multiple investigative phenomena. After the anchoring phenomenon, we use more phenomena to make progress on our questions, which often leads to more questions and more phenomena we need to explore.

In this role we refer to such a phenomenon as an investigative phenomena as it forms the basis for our investigations.
Effective Phenomena...

- Are immediately (or progressively) interesting to explore
- Lead us to wonder
- Generate controversy (competing explanations)
- Connect to other experiences that students have had with related phenomena in the world.
- Generate questions and ideas for investigations
- Advance our understanding of the key science ideas at our grade level as we work to explain it
- Become part of the puzzle we have figured out that is going to eventually help us explain other phenomena (e.g., the anchoring phenomenon).

How do students put their ideas together?

Student questions motivate each lesson

Storieslines

Students use practices to make sense of phenomena

Lessons Routine | Questions | Phenomena / Problems | What we figured out
--- | --- | --- | ---
1 | What will happen to the body of the dead moon over time? | We had different predictions about what would happen to the body of a dead animal over time based on what surface it was on or what environment it was in. | A few days after an animal died, insects started appearing on it, and then the body started "disappearing" a few days after that. |
2 | What were the things we saw on the dead animal doing? | Female fleas lay eggs on the body parts of dead things that hatch into larvae that eat the dead stuff. This helps them grow bigger and give new body structures. | We designed and built some different systems to help us investigate some of our questions.
3 | What kind of dead stuff containers can we use to help us investigate some of our questions? | | We designed and built some different systems to help us investigate some of our questions.
Summary

- The teacher and unit design work together to support students in developing questions or identifying problems to solve about the phenomenon

- **Students’** questions and problems become the motivation for each investigation or design challenge

- Students put their ideas together across lessons to make sense of phenomena and solve the problem.

Nextgenstorylines.org

The examples we showed are open source materials developed by teams of teachers and are freely available, along with supporting teacher guides and lesson plans to try out. There are other K-12 examples available at this site too, and more are coming soon.
Questions?

Download this unit and other open-source storylines: 
http://www.nextgenstorylines.org

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