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?
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 and 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.

Additionally we will highlight the relationship we have developed to support the introduction of NGSS storyline units in two 5th-grade classes in our district.
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.

Systems and System Models

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.
Students as partners in knowledge building

“We figure out the science ideas.”

Phenomena

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

“We put the pieces of the science ideas together over time.”
Why is the use of phenomena important to get to these performance expectations?

To explain the phenomena students will use:

<table>
<thead>
<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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<tr>
<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>
</tr>
<tr>
<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></td>
<td></td>
<td>● Natural objects exist from the very small to the immensely large</td>
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</table>
Thinking about the 5th-grade Ecosystems 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?
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...

Take a picture each day
Put a GOPRO out side were the animal is and then check it was in a wire

- Find out how it died
- Go back in time
- Look it up
- See if there are bite marks
- Look it up on a computer
- You can put a GOPRO in your backyard
- Come back each day
- You can check on it every day
- Research what happens to it when it dies
- Find a GOPRO there
- Take it to the vet so it can get an X-Ray
- Take pictures of it each day
- You could get a drone so you can look at it from the inside the house instead of going up close to it

Put another Cammer closer.

- Look closer to it.
- Look up at what insect eat dead animals
- Looks to see any thing that was inside the body there
- We could watch The video over again
- You could put aten and study it.

How many hours was it recording

We could look for more videos to watch
We could get 360 canvas to put around it
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
Students’ Initial Questions
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.

Patterns we noticed in a dead animal body over time:

- Similar phenomena
- Think about it

When me and my mom were going to the store we saw a man on the side of the road and it looked like it was there for days and blood was everywhere.

A dead bird
- It looked like it been there for two days
- It was there because it was under a tree
- It was dead

Mervin

There was a dead animal.

It was a dead animal.

So we went back.
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

- Why do dead things disappear over time?
- Patterns
- Wonderi...
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
Students brainstorm ways to investigate their questions

Investigate weight

- Capture a fly
- Different bug
- Plant
- Fruit veggie

Ideas for investigation:

* Dead plants in a jar with soil & earthworms
* Pictures & videos of dead animals to compare to plants
* Put tree parts & mushrooms in a jar and observe
* Potato in a bowl some w/ water some without none w/ soil
* Insect in a jar (with soil without)
  at MS. MC Greal's house
* Fruit in a jar sealed up
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
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?
How can we know for sure what is making our plants change over time?
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

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.

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

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

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Results of this investigation led to discovering some key ideas and also led to more questions.

Lesson 4: What are those things doing that were crawling all over the body of the animal?

Part 1: Launch

Q1—Predict: If we could watch what was happening to the inside parts of the body of the dead animal, what do you think we would see happening to those parts over many weeks?

I think you would see decomposers eating it and flies laying eggs so there is more decomposers. And the decomposers will be eating organs, lungs, blood that the badger was eating or already ate. And the decomposers are turning all the fur and bones into fertilizer.

Q2—Plan: If we recorded a video of what happens to an inside part of the body of a dead animal (such as muscle) and left it out in the open air for a few days, how could that help us investigate our predictions?
Results of this investigation led to discovering some key ideas and also led to more questions....
What do plants need to grow?
What do plants need to grow?
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 phenomena 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

Lesson Routine

L1
Anchoring phenomena

L2
Investigation

L3a
Investigation

L4
Investigation

Questions

 Phenomena / Problems

What will happen to the body of this dead raccoon over time?

What were those things we saw on the dead animal doing?

What kind of dead stuff containers can we make to help us investigate some of our questions?

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.

Female flies lay eggs on the body parts of dead things that hatch into larvae that eat the dead stuff. This helps them grow bigger and grow new body structures.

We designed and built some different systems to simulate different environments to see what would happen to parts of plants left in them over time.
Storylines

Student questions motivate each lesson

Students use practices to make sense of phenomena

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Lesson Routine

**L1**
Anchoring phenomena

**L2**
Investigation

**L3a**
Investigation

**L4**
Investigation

Questions

Phenomena / Problems

What we figured out

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.

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Students use practices to make sense of phenomena

Questions arise from what students figured out so far

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### Storylines

**Student questions motivate each lesson**

**Students use practices to make sense of phenomena**

**Questions arise from what students figured out so far**

**Students build ideas incrementally over time**

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<th>Questions</th>
<th>Phenomena / Problems</th>
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<td>What will happen to the body of this dead raccoon over time?</td>
<td>and students' prior experiences</td>
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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.
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.
Talk about continued support and having teacher teams HS/Elementary partners.
Questions?

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

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