

Welcome to NSTA Web Seminars!

How the OpenSciEd Instructional Model Supports a Coherent Sequence that Addresses Student Questions and Achieves Specified Outcomes

Presented by: Brian J. Resier, Michael Novak, and Sarah Delaney

May 20, 2020

12:00 pm ET / 11:00 am CT / 10:00 am MT / 9:00 am PT

Today's Presenters



Brian J. Reiser

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OpenSciEd
@SarahOpenSciEd





Agenda

- Introducing OpenSciEd
- Coherence from the students' perspective
- The Instructional Model
 - Anchoring Phenomena
 - Navigation & Investigation
 - Putting Pieces Together & Problematizing
- Q&A



Type your questions into
the chat window for
discussion in the Q&A
blocks





Introducing OpenSciEd





Introducing OpenSciEd




OpenSciEd is an innovative nonprofit organization that brings together

- world-class curriculum developers,
- state science administrators,
- teachers, and
- philanthropic organizations

to develop free, high-quality science instructional materials.



OpenSciEd

<u>OpenSciEd Staff</u>			<u>Advisory Board</u>	<u>State Steering Committee</u>
			<p>The OpenSciEd Advisory Board provides oversight and vision. The Board is made of members from the education, curriculum development, science and policy sectors.</p>	<p>As part of their participation in the OpenSciEd project, the <u>ten partner states</u> have a representative that sits on the State Steering Committee to provide guidance on how the materials can best meet the needs of their students and teachers.</p>
<p>James Ryan Executive Director</p>	<p>Matt Krehbiel Director of Outreach</p>	<p>Sarah Delaney Director of Science</p>		



The Developer's Consortium of World-Class Experts in Science Education



BSCS Science Learning is the lead institution in the OpenSciEd Developers Consortium and is jointly leading the development of the OpenSciEd instructional materials.



NextGen Science Storylines
Northwestern University

The Next Generation Science Storylines Project at Northwestern University is jointly leading the development of the OpenSciEd instructional materials with BSCS.



BOSTON COLLEGE
Lynch School of Education
and Human Development

Boston College is leading the development of professional learning materials and the implementation of field test professional learning.



The University of Texas at Austin
Charles A. Dana Center

The Dana Center is leading the field test implementation efforts and is jointly leading the field test data collection and analysis effort with Digital Promise.



Digital Promise
Accelerating Innovation in Education

Digital Promise is jointly leading the field test data collection and analysis efforts with the Dana Center at the University of Texas.



OpenSciEd Teachers & Students

228 field test teachers
and
5800 participating students
in
115 school districts
in
10 states
teach the OpenSciEd units and
provide feedback.



OpenSciEd is Generously Supported by Four Philanthropic Organizations



BILL & MELINDA
GATES *foundation*



CHARLES AND LYNN
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FAMILY FOUNDATION

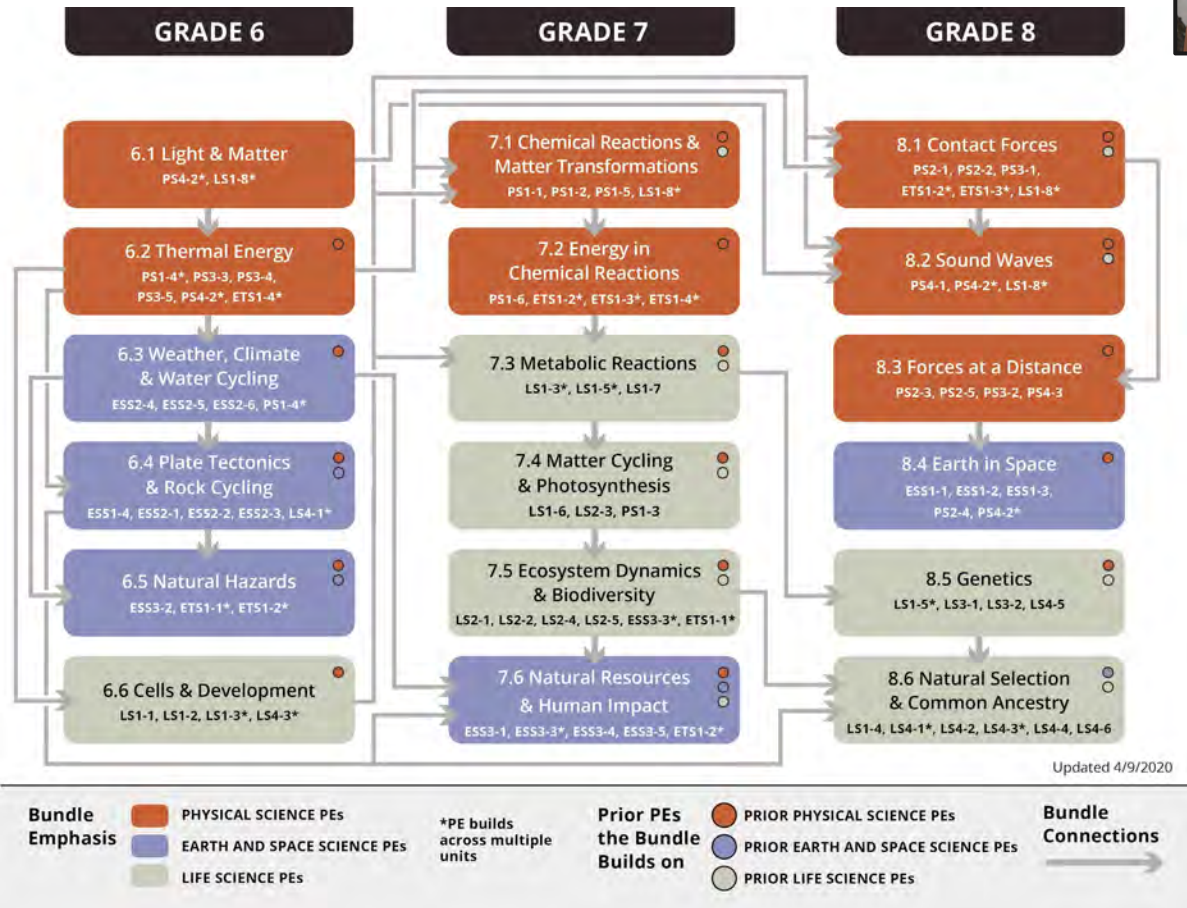


WILLIAM + FLORA

Hewlett
Foundation



Starting with Middle School and then moving to Elementary & High School





Current Units at OpenSciEd.org

Thermal Energy

How can containers keep stuff from warming up or cooling down?



OpenSciEd
MIDDLE SCHOOL SCIENCE

TEACHER EDITION

Metabolic Reactions

How do things inside our bodies work together to make us feel the way we do?



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Sound Waves

How can a sound make something move?




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Weather, Climate & Water Cycling

Why does a lot of hail, rain, or snow fall at some times and not others?



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Matter Cycling & Photosynthesis

Where does food come from and where does it go next?



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TEACHER EDITION

Forces at a Distance

How can a magnet move another object without touching it?



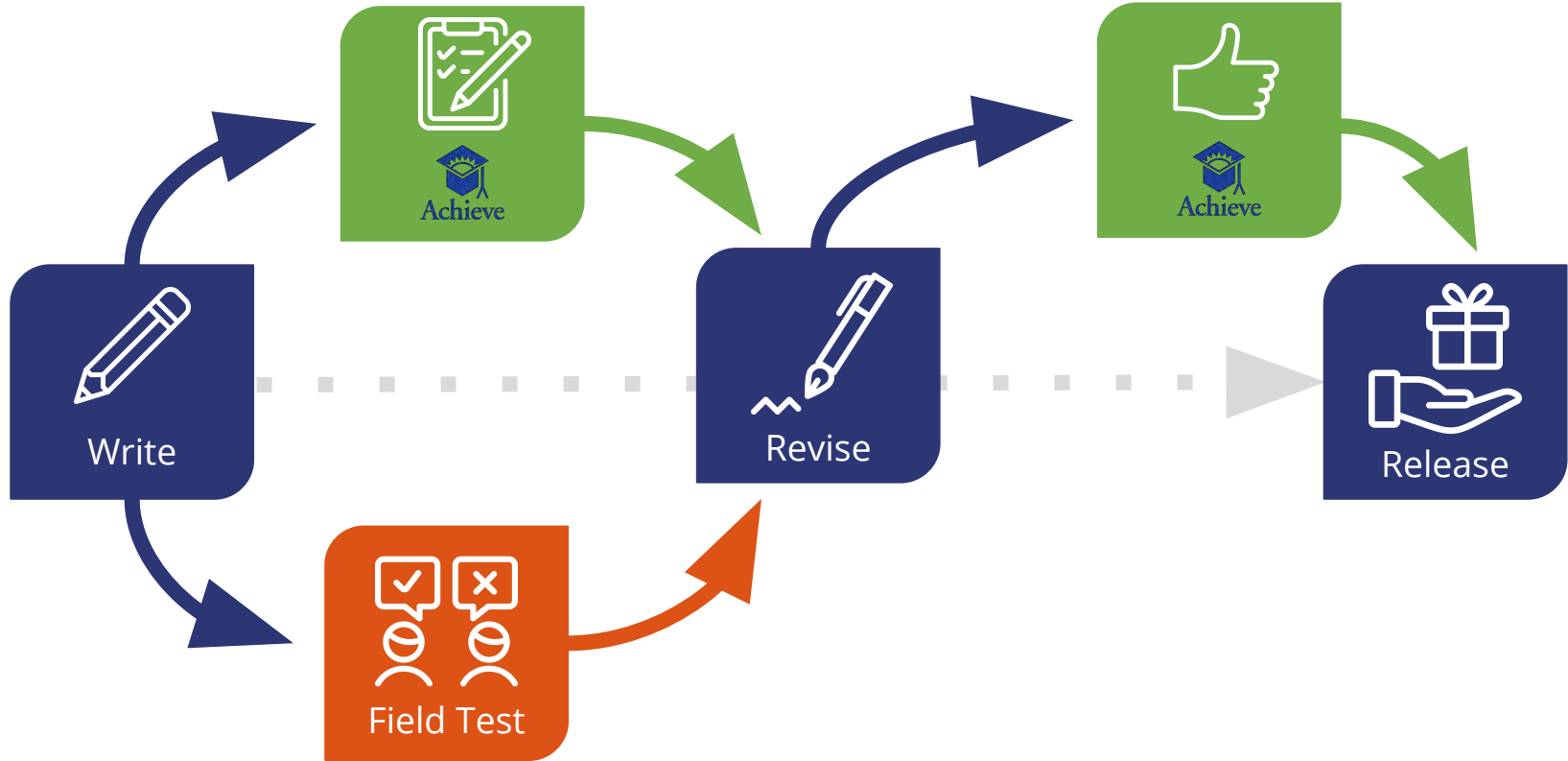
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A Nine Month Development Period

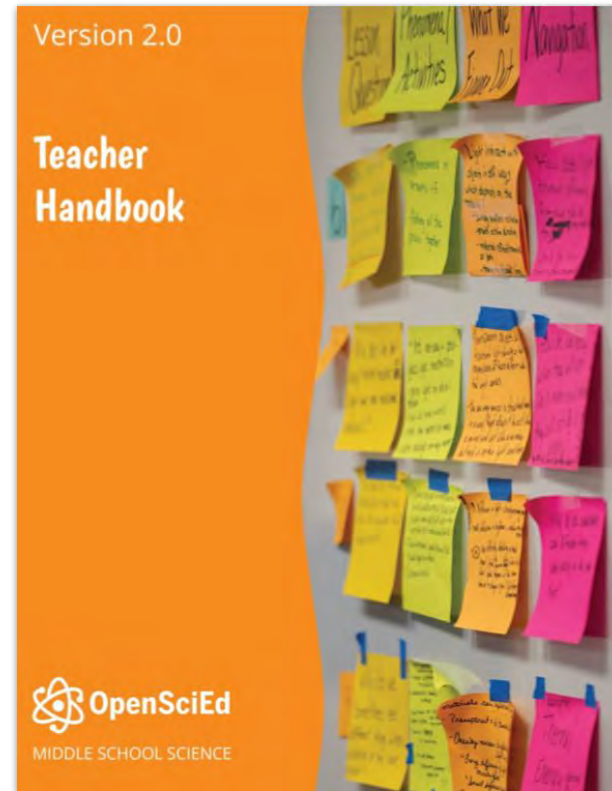




Teacher Handbook

www.openscienced.org/resources

- Instructional Model - pg. 20
- Science & Engineering Practices - pg. 22
- Crosscutting Concepts - pg. 24
- Assessment - pg. 25
- Differentiation - pg. 40
- Attending to Equity - pg. 42
- Integrating ELA - pg. 44





1. Jan/Feb OpenSciEd Instructional Model

Background Clear frame

Open on a Jamboard

Open on

Stick

1/7

1/6

Cancel Save

Share icon

Search icon

Eraser icon

Pointer icon

Text icon

Image icon

Wipe icon

Zoom in icon

Zoom out icon

Reset icon

Close icon

Share icon

Profile icon

Background color options: cyan, pink, orange, grey

Green 'G' icon

Orange callouts: A large orange callout on the left side of the screen groups several icons: a search icon, a pointer icon, a text icon, and a document icon. Two orange callouts on the right side point to navigation controls: one points to a '1/7' page indicator in the top right corner, and another points to a '1/6' page indicator inside a sticky note window.






Share on Jamboard

- **Why were you interested in attending this webinar?**
- **Your Name & Role**

To add a sticky note:

- Click on the  icon and type your response
- Click save
- Move your sticky note somewhere on the Jamboard

Birth Month	Jamboard Link
Jan & Feb	bit.ly/JanFebJamboard
March & April	bit.ly/MarchAprilJamboard
May & June	bit.ly/MayJuneJamboard
July & Aug	bit.ly/JulyAugJamboard
Sept & Oct	bit.ly/SeptOctJamboard
Nov & Dec	bit.ly/NovDecJamboard



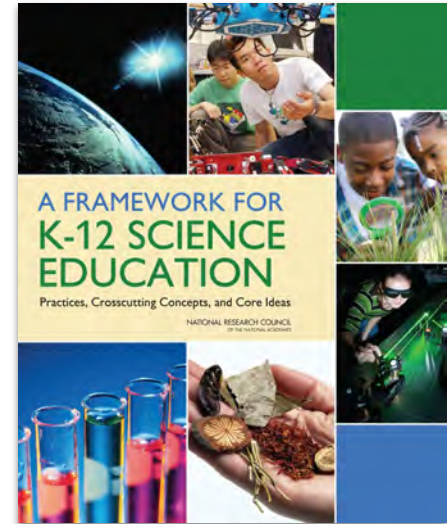
Coherence from the students' perspective



The Problem

“The framework is motivated in part by a growing national consensus around the **need for greater coherence**. Too often, standards are **long lists of detailed and disconnected facts**, reinforcing the criticism that science curricula in the United States tend to be **‘a mile wide and an inch deep’** (Schmidt et al., 1997).”

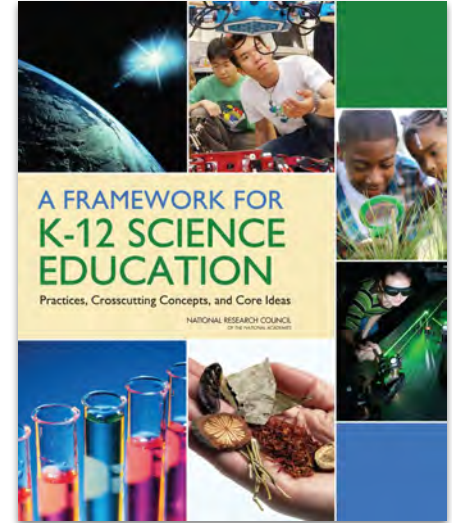
(National Research Council, 2012, p. 10)





Guidelines for the NGSS

Organize standards and curriculum in:
“developmental progression ... 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.”



Start with Student Questions

Build on Prior Knowledge

Make Connections





How can we support students as partners in the science work?

The Storyline Approach

1. How do we kick off investigations in a unit?

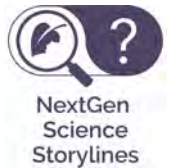
2. How do we work with students to motivate the next steps?

3. How do we help students use practices to build science ideas?

4. How do we help students put science ideas together?

5. How do we push students to go deeper?

Adapted from Reiser, Novak, & McGill (2018)
bit.ly/reiserbose2017





Storylines Instructional Model

Question	Routine	Purpose
1. How do we kick off investigations in a unit?	Anchoring Phenomenon Routine	Common experience of phenomenon; develop curiosity; connect to students' lives
2. How do we work with students to motivate the next steps?	Navigation Routine	Motivate next lesson from gaps in what the class figured out so far
3. How do we help students use practices to build science ideas?	Investigation Routine	Students use science and engineering practices to make progress on our questions and problems
4. How do we help students put science ideas together?	Putting Pieces Together Routine	Help students assemble ideas from multiple lessons and apply them to the class' questions
5. How do we push students to go deeper?	Problematizing Routine	Help students uncover limitations and unanswered questions in the explanations, solutions, and models so far



Videos and Artifacts from OpenSciEd Units



Plate Tectonics & Rock Cycling
(in field test)



Metabolic Reactions
(released)





The Anchoring Phenomenon Routine





1. How do we kick off investigations in a unit?

Anchoring Phenomenon Routine

Common experience of phenomenon; develop curiosity; connect to students' lives

*Element #1:
Explore the
phenomenon*

*Element #2:
Attempt to
make sense*

*Element #3:
Identify related
phenomenon*

*Element #4:
Questions and
next steps*



Plate Tectonics
& Rock Cycling

How and why
does Earth's
surface change?

OpenSciEd
MIDDLE SCHOOL SCIENCE

FIELD TEST
VERSION
DO NOT
DISTRIBUTE
TEACHER EDITION





Explore the Phenomena

Slide A

Explore an Interesting Phenomenon



Make a chart on a blank page on the left side of your science notebook and record what you notice and wonder about.

Mt. Everest Phenomena

Notice	Wonder



Watch these videos closely and record things you notice and wonder about.

- [Scary Day on Mt. Everest](#)
- [News Report: What Happened on Mt. Everest](#)

INDIVIDUAL ➡ WHOLE GROUP



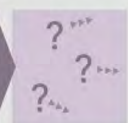
<https://youtu.be/gE33lkBc7jo>

Element #1:
Explore the
phenomenon

Element #2:
Attempt to
make sense

Element #3:
Identify related
phenomenon

Element #4:
Questions and
next steps





Explore the Phenomena



https://youtu.be/W_1aQDLTGjg

*Element #1:
Explore the
phenomenon*



*Element #2:
Attempt to
make sense*



*Element #3:
Identify related
phenomenon*



*Element #4:
Questions and
next steps*

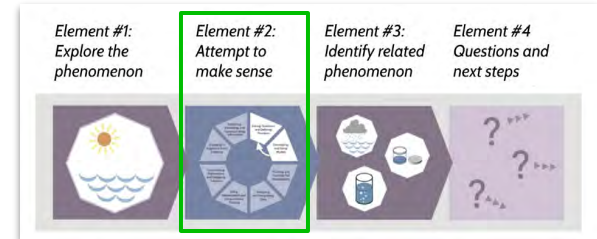




Attempt to make sense of the phenomena



<https://youtu.be/scwscFtDaIM>

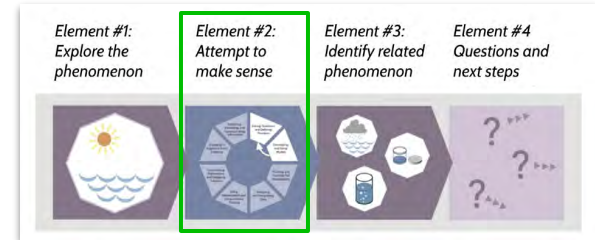




Attempt to make sense of the phenomena

Initial Consensus Model

- Tectonic plates?
 - ↳ moving parts under Earth's crust as Earth moves?
- Tension between fault lines?
- Mtn moving up a hill?
- Earthquake itself (shrink/growth)?
- Snow falls/freezes & pushes mtn up.
- Layers underground moving up. → thinner vs taller?
- Erosion possibly? (slow vs. fast?)
- Avalanche causing sudden shrinkage?





Identify related phenomena

Slide P

Related Phenomena



Turn and Talk

- What other experiences might help us explain what happened at Mt. Everest?
- Where else in the world does the land seem to change slowly or suddenly?

→ Be prepared to share these with the whole class.

Related Phenomena

- Other earthquakes around world (Maia - Pakistan, Ali's bro - California)
- other earthquakes around mtns
- volcanoes (?)
- Pieces of land moving/changing
- Erosion - Easter Island - tiny pieces coming off in natural ways
- Roanoke Island - part is gone!

Element #1:
Explore the phenomenon



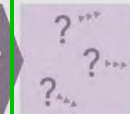
Element #2:
Attempt to make sense



Element #3:
Identify related phenomenon

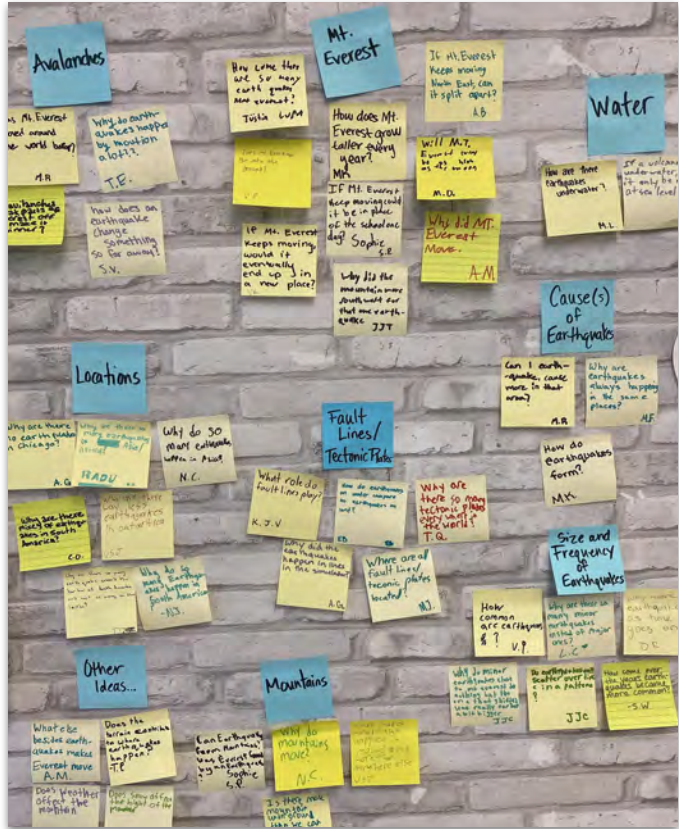


Element #4:
Questions and next steps





Generating questions



Will Mt. Everest ever stop growing?

Why do mountains move?

How can you figure out when earthquakes will happen?

Is there anywhere in the world where there's no earthquakes?

Can Chicago have earthquakes? Why or why not?

Why do so many earthquakes happen near mountains?

Why doesn't Mt. Everest ever move to NW or SE?

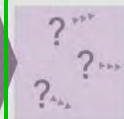
How can earthquakes form in oceans but not in lakes?

Element #1:
Explore the
phenomenon

Element #2:
Attempt to
make sense

Element #3:
Identify related
phenomenon

Element #4:
Questions and
next steps





Generating ideas for next steps

Slide 8

Information and Data Needed

What additional sources of data might we need to figure out the answers to our questions? What information do we still need?



Add your ideas to a new notebook page titled:

**Information and
Data We Need**

Information and Data We Need	
Category of Questions	Helpful Data/Info

→ Be prepared to share these with the whole class.

Investigation Ideas
(How we'll get the info/data we need)

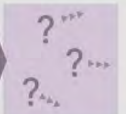
- Make earthquake model mountain (tests on it)
- Where tectonic plates are (map)
- Maps showing country lines & physical characteristics
- Fault line data
- Earthquake data
- Water-based test for underwater quakes!

Element #1:
Explore the
phenomenon

Element #2:
Attempt to
make sense

Element #3:
Identify related
phenomenon

Element #4
Questions and
next steps





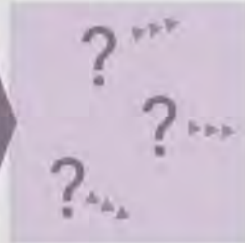
Summary: Anchoring Phenomenon Routine

Element #1:
Explore the
phenomenon

Element #2:
Attempt to
make sense

Element #3:
Identify related
phenomenon

Element #4
Questions and
next steps



Initial Consensus Model

Before $\begin{matrix} W & \leftarrow & N \\ & & \downarrow E \\ & & S \end{matrix}$ After

20km
30m
50m
100m

After Earthquake

- Tectonic plates?
 - ↳ moved parts under
 - ↳ Earths crust as Earth moves
- Tension between fault lines?
- Mtn moving up a hill?
- Earthquake itself (shrink/expand)?
- Snow falls / freezes at peaks with up?
- Layers underground moving up? - primer hill?
- Erosion possible? (slow vs fast?)
- Avalanches causing sudden shrink?

Related Phenomena

- Other earthquakes around world (Maia - Pakistan, Alaska - California)
- other earthquakes around mtns
- volcanoes(?)
- Pieces of land moving/changing
- Erosion - Eastern Island tiny pieces coming off in natural ways
- Roanoke Island - part is gone!



Information + Data We Need

Category of ?s	Helpful Data/Info
Avalanches	Model w/ tracks + ice
Mt Everest	Mountain simulator
Earthquake Causes	Plate Tectonic Model (puzzle - ?)
	Consensus Earthquake Info page.com
	Wikipedia





1. How do we kick off investigations in a unit?

Anchoring Phenomenon Routine

Common experience of phenomenon; develop curiosity; connect to students' lives

*Element #1:
Explore the
phenomenon*

*Element #2:
Attempt to
make sense*

*Element #3:
Identify related
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*Element #4:
Questions and
next steps*



Metabolic Reactions

How do things
inside our bodies
work together to
make us feel
the way we do?

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Explore the Phenomenon

Symptoms that started first

- Nausea
- Vomiting
- Abdominal cramps
- Diarrhea
- Constipation

Symptoms that started later

- Fever
- Fatigue
- Weight loss
- Fainting
- Weight gain
- Back pain
- Leg pain
- Muscle cramps
- Rapid heartbeat with exercise
- Swollen joints
- Difficulty walking or moving
- Confusion
- Dizziness
- Brain fog or difficulty concentrating
- Headaches
- Numbness
- Slow heartbeat
- Cold feet or hands
- Chest pain
- High blood pressure
- Difficulty breathing with exercise
- Difficulty breathing all the time
- Chest pain
- Wheezing
- Asthma

Notes

The patient complains that her stomach hurts after she eats and that she feels nauseated. Her parents say she eats regular meals but has suddenly started losing a lot of weight. The patient says she often has diarrhea and stomach cramping. She has a hard time breathing when she tries to play basketball and gets out of breath quickly. The patient complains of feeling tired and weak all the time.

Girl Who Gets Sick

M'Kenna, who has recently started complaints are that her stomach hurts and stomach cramping.

Element #1:
Explore the
phenomenon



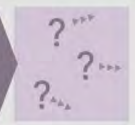
Element #2:
Attempt to
make sense



Element #3:
Identify related
phenomenon



Element #4:
Questions and
next steps





Attempt to make sense of the phenomenon

Developing Initial Models

Develop an initial model. Use *pictures, symbols, and words* in your model to further explain:

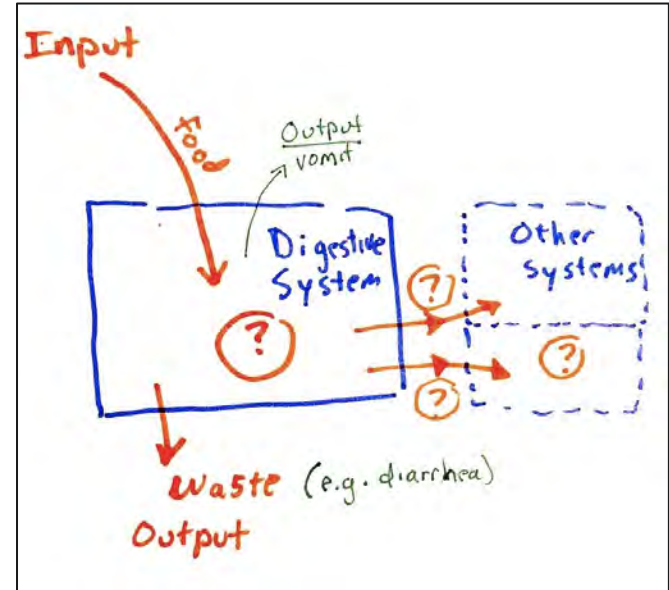
“How can M’Kenna be having symptoms in all of these different parts of her body?”

Areas in our model we agree

- Digestive system
- Other systems
- connections between systems
- “It” moves from one system to another
- We have inputs, outputs in system

Areas in our models we have differences

- what causes all her symptoms
- components of the digestive system
- what are the inputs and outputs in her system
i.e. food
nutrients
bacteria
energy



Element #1:
Explore the
phenomenon



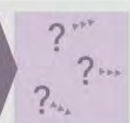
Element #2:
Attempt to
make sense



Element #3:
Identify related
phenomenon



Element #4:
Questions and
next steps





Identify related phenomena

Slide 1

Sharing Related Phenomena



Stop and Jot then Turn and Talk



1. When have you or someone you know experienced more than one of these symptoms happening at the same time like M'Kenna?
2. If you knew the cause of the symptoms, was the cause occurring in the same body part as the symptom or a different part of the body?

For example, I had a headache and started to get tired, but what was actually causing it was that I didn't drink enough water (not actually something going on with my head).

→ Be ready to share these ideas with the whole class.

Element #1:
Explore the
phenomenon



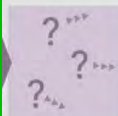
Element #2:
Attempt to
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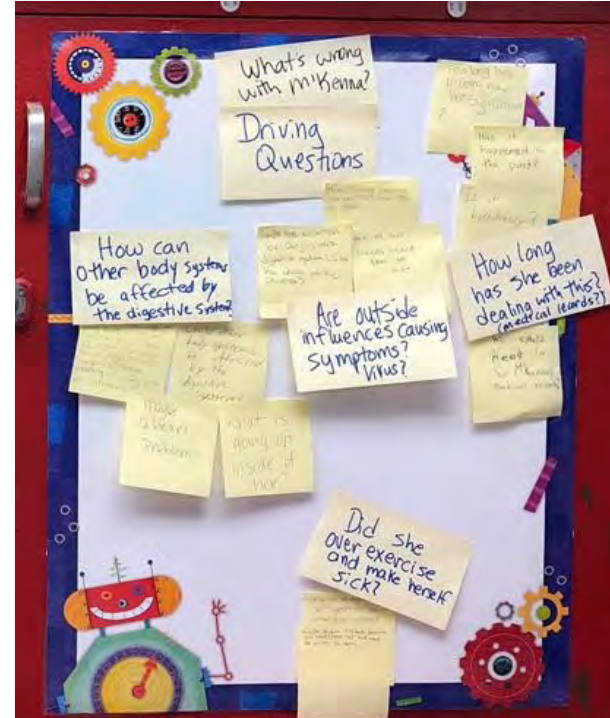
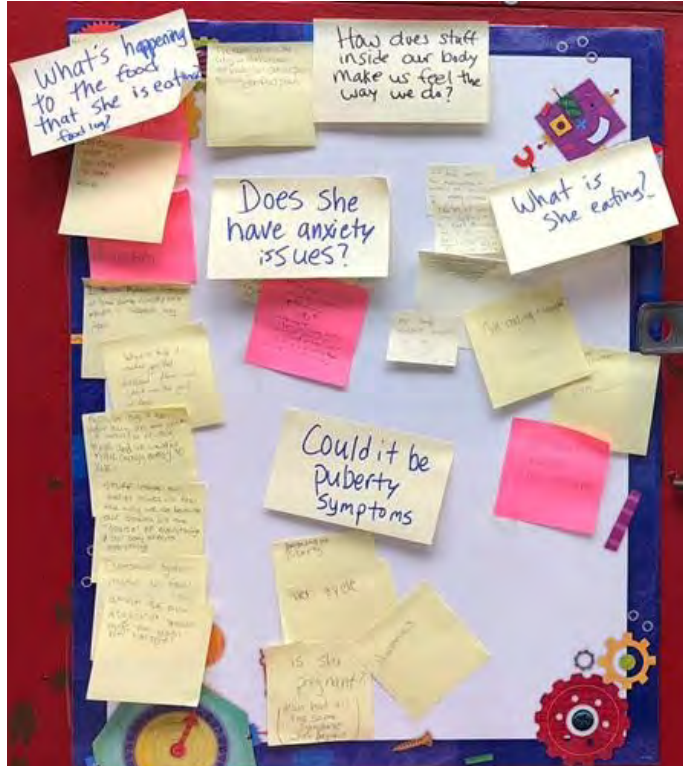
Element #3:
Identify related
phenomenon



Element #4:
Questions and
next steps



Generating questions

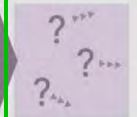


Element #1:
Explore the
phenomenon

Element #2:
Attempt to
make sense

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phenomenon

Element #4
Questions and
next steps



Generating Ideas for Investigations

Ideas for Investigations

What investigations could we do to help us figure out what is going on inside M'Kenna and to help us answer our DQB questions?

Possible Future Investigations

- Eat foods + see what they do
- Test to see what is in food
- Mash up food + put stomach acid on it
- Camera inside of M'Kenna
- Research what the digestive system is

Element #1:
Explore the
phenomenon



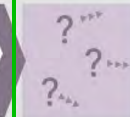
Element #2:
Attempt to
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Element #3:
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Element #4:
Questions and
next steps





Summary: Anchoring Phenomenon Routine

Element #1:
Explore the phenomenon

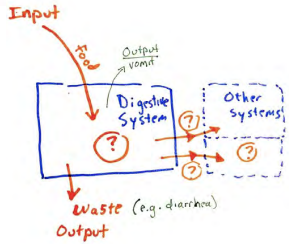
Element #2:
Attempt to make sense

Element #3:
Identify related phenomenon

Element #4:
Questions and next steps



<p>Symptoms that started first</p> <ul style="list-style-type: none"> ✓ Nausea ✓ Bloating ✓ Abdominal cramps ✓ Diarrhea ✓ Constipation <p>Symptoms that started later</p> <ul style="list-style-type: none"> ✓ Fever ✓ Fatigue ✓ Weight loss ✓ Fainting ✓ Night sweats ✓ Back pain ✓ Leg pain ✓ Muscle cramps ✓ Rapid heartbeat with exercise ✓ Swollen joints ✓ Difficulty walking or moving ✓ Confusion ✓ Dizziness ✓ Slurred or difficulty concentrating ✓ Headaches ✓ Numbness ✓ Slow heartbeat ✓ Cold feet or hands ✓ Chest pain ✓ High blood pressure ✓ Difficulty breathing with exercise ✓ Difficulty breathing all the time ✓ Chest pain ✓ Wheezing ✓ Anemia 	<p>Notes</p> <p>The patient complains that her stomach hurts after she eats and that she feels nauseated. Her parents say she eats regular meals but has suddenly started losing a lot of weight. The patient says she often has diarrhea and stomach cramping. She has a fever (one smothering when she lies in bed, horizontal) and gets out of breath quickly. The parent complains of feeling tired and weak all the time.</p>
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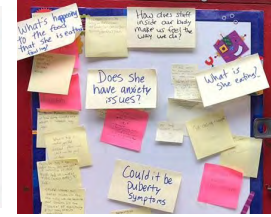


Slide 1: Sharing Related Phenomena

Stop and Jot then Turn and Talk

- When have you or someone you know experienced more than one of these symptoms happening at the same time like McKenna?
- If you knew the cause of the symptoms, was the cause occurring in the same body part as the symptom or a different part of the body? For example, I had a headache and started to get tired, but what was actually causing it was that I didn't drink enough water (not actually something going on with my head).

Be ready to share these ideas with the whole class.



Possible Future Investigations

- Eat foods + see what they do
- Test to see what is in food





1. How do we kick off investigations in a unit?

How does the
**ANCHORING
PHENOMENON
ROUTINE**
support students as
partners in the science
work?

Birth Month	Jamboard Link <i>On Jamboard, Go to Frame 2</i>
Jan & Feb	bit.ly/JanFebJamboard
March & April	bit.ly/MarchAprilJamboard
May & June	bit.ly/MayJuneJamboard
July & Aug	bit.ly/JulyAugJamboard
Sept & Oct	bit.ly/SeptOctJamboard
Nov & Dec	bit.ly/NovDecJamboard



The Navigation & Investigation Routines





Question	Routine	Purpose
1. How do we kick off investigations in a unit?	Anchoring Phenomenon Routine	Common experience of phenomenon; develop curiosity; connect to students' lives
2. How do we work with students to motivate the next steps?	Navigation Routine	Motivate next lesson from gaps in what the class figured out so far
3. How do we help students use practices to build science ideas?	Investigation Routine	Students use science and engineering practices to make progress on our questions and problems

Metabolic Reactions

How do things inside our bodies work together to make us feel the way we do?



 OpenSciEd
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What happened in the previous lessons

- We figured out that burning food is a chemical reaction resulting in new products.
- We figured out that fuel and oxygen react when they burn to release energy, carbon dioxide gas, and water vapor.





This lesson: Navigation Routine

Navigation



Discuss with a partner:

- What did we figure out last class?
- What questions did this raise for us?



<https://youtu.be/mLUfjeyLM1Q>

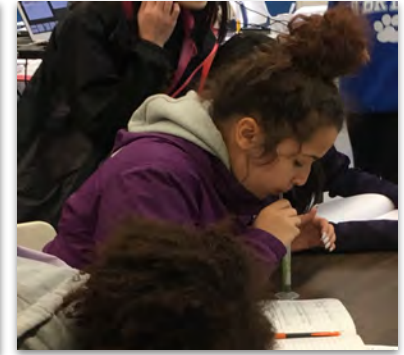
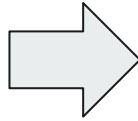




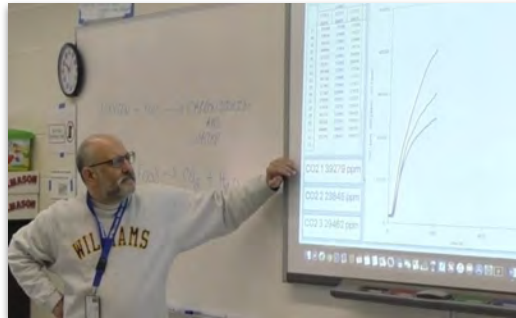
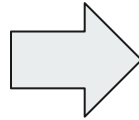
This lesson: Investigation Routine

Is there carbon dioxide in the air coming out of our lungs?

**Investigation #1:
Bromothymol blue**



**Investigation #2:
Carbon Dioxide
Sensors**





This lesson: Investigation Routine

Does this chemical reaction between food and oxygen happen in our bodies?


indicator: Bromothymol blue (BTB)

BTB mixed with	color before mixing	color after mixing
water only	Dark green	light green
water + carbon dioxide (seltzer water)	Dark green	yellow/orange
Air from our lungs	Dark green	yellow/orange

	Carbon Dioxide level (ppm)
Air from room	

Sample student data from the two investigations


Building Understandings Discussion



Jot the answers to the following questions in your science notebook to prepare for the whole class discussion.

- What does the color change from blowing into the BTB tell you about the air coming out of our lungs?
- How does this color change provide evidence about a chemical reaction that might be occurring in our bodies?
- Where does the air go when we breathe it in, and where is carbon dioxide coming from when we breathe out?

→ Be ready to share these ideas in the discussion.



Small group sensemaking to prepare for whole-class discussion





This lesson: Investigation Routine



Jot the answers to the following questions in your science notebook to prepare for the whole class discussion.

- What does the color change from blowing into the BTB tell you about the air coming out of our lungs?
- How does this color change provide evidence about a chemical reaction that might be occurring in our bodies?
- Where does the air go when we breathe it in, and where is carbon dioxide coming from when we breathe out?





Storylines Instructional Model

Question	Routine	Purpose
1. How do we kick off investigations in a unit?	Anchoring Phenomenon Routine	Common experience of phenomenon; develop curiosity; connect to students' lives
2. How do we work with students to motivate the next steps?	Navigation Routine	Motivate next lesson from gaps in what the class figured out so far
3. How do we help students use practices to build science ideas?	Investigation Routine	Students use science and engineering practices to make progress on our questions and problems





The Putting Pieces Together Routine





Question	Routine	Purpose
1. How do we kick off investigations in a unit?	Anchoring Phenomenon Routine	Common experience of phenomenon; develop curiosity; connect to students' lives
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Putting Pieces Together: Taking Stock

Slide A

Taking Stock: What have we been up to?



Whole group

What patterns did we notice with where Earthquakes happen?

What did we find out about how plates move?

What did we learn that causes plate movement?



**From
Lesson 2
through
Lesson 7**





Putting Pieces Together: Modeling

Slide D

Develop a Model: Plate movement and Mt. Everest



Develop a model to show your thinking:

- How does plate movement explain movement at Mt. Everest? Three types of movement:

- getting taller
- moving to the northeast each year
- moving backward during the earthquake

Gotta-Have-It Checklist

Gotta-Have-It Checklist	
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	

Mt. Everest Model

question	evidence
What we figured out in words/pictures	



Include words, pictures, and anything else to capture your thinking.





Putting Pieces Together: Group models

MT. EVEREST MODEL

Question: How does plate movement explain the movement of Mt. Everest?

EVIDENCE
GPS DATA, Earthquake data, recording & simulator, convection demonstration

By: Maia K, Tien T, Tiffany E.

How is the mountain getting taller? Table 6

Should you explain how about the mantle or how the mantle will move in a hot? Table 7

Where is the Eurasian Plate? Table 8

KEY
- slow movement
- Fast Movement

When these two plates move together, it exposes mantle and mantle comes out to make new crust.

Evolution

EQ HAPPENS WHEN PLATES COLLIDE!

The crust is all bedrock

crust

mantle

core

Under The Plates

Mt. Everest

Would the plates go under each other when they move? Table 6

How can a mountain form? Is there a gap below? - Table 5

heat up = moving

heat = hotter

slower

faster

= Convection (heat moving through mantle and plates)

= earthquake

Indian

Eurasian

North

South

plate boundary

bedrock

crust

How do plates in the world grow to... Table 5





Applying Our Model to A Different Phenomenon

Slide 1

Revise your Gotta-Have-It Checklist

Our question: How does plate movement explain what we observed in locations where plates spread apart?

Use a different colored pencil.

Place a checkmark (✓) by ideas you still need.

Write down new ideas that you didn't need before, but you need now.

Iceland



Lake Baikal, Baikal Rift Valley

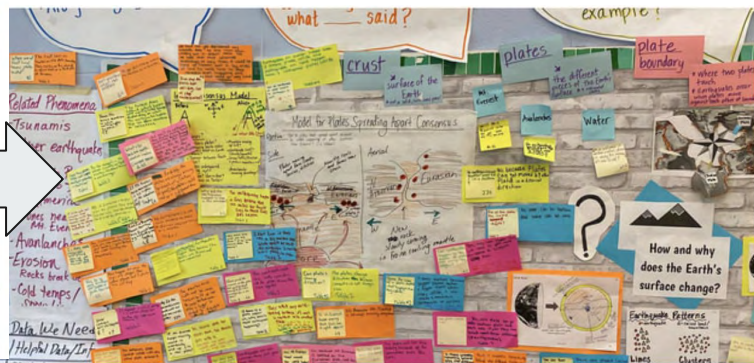


Mid-Atlantic Ridge





Revisiting Our Driving Question Board





Question	Routine	Purpose
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3. How do we help students use practices to build science ideas?	Investigation Routine	Students use science and engineering practices to make progress on our questions and problems
4. How do we help students put science ideas together?	Putting Pieces Together Routine	Help students assemble ideas from multiple lessons and apply them to the class' questions

Metabolic Reactions

How do things inside our bodies work together to make us feel the way we do?

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Taking Stock

Slide B

What Can We Explain Now?



Look at the initial model that you developed to explain M'Kenna's symptoms. Then think about the investigations that we have done and what we have figured out.

*Review all of the models that you developed in your Progress Tracker. If we think of the models from our Progress Trackers as smaller pieces of a larger model, our goal now is to compile the pieces into a larger model to answer: **What have we figured out so far?***

- Individually, compile all of the models from your Progress Tracker into one model.
- Don't worry about depicting anything about the organs in the digestive system at this point. **Just focus on the breakdown and absorption of large food molecules.**

→ Record questions that come to mind as you are reviewing your model.





Putting Pieces Together

Slide D

Develop Models in Small Groups

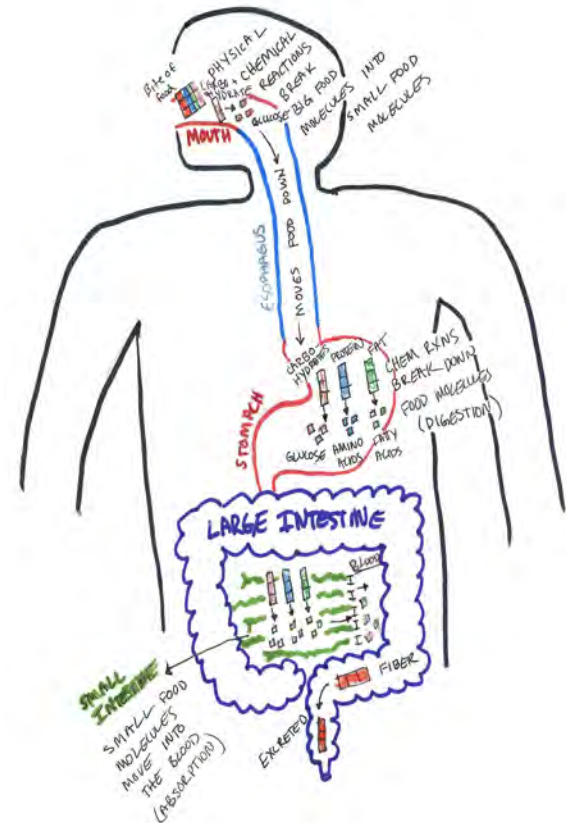


Develop a model to explain, "How does a healthy digestive system work?" Use your Gotta-Have-It Checklist to help you. Check off ideas on your list that you used or did not use to develop your model.

Use pictures, symbols, and words in your model to help represent and further explain the following:

- What are the different structures in the digestive system? How do the functions of each structure distinguish it from other structures in the digestive system?
- What happens to food when it enters the digestive system? What kinds of food molecules are broken down? Where are they broken down?
- What kinds of food molecules are absorbed? Where are they absorbed? What kinds of food molecules are excreted?

→ Record questions that come to mind as you are constructing your model.





The Problematizing Routine





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3. How do we help students use practices to build science ideas?	Investigation Routine	Students use science and engineering practices to answer our questions and problems
4. How do we help students put science ideas together?	Putting Pieces Together Routine	Help students assemble ideas from multiple sources and connect them to the class' questions
5. How do we push students to go deeper?	Problematizing Routine	Help students uncover limitations and unanswered questions in the explanations, solutions, and models so far





Foreground a new question or phenomenon

Slide E

Problematize M'Kenna's Symptoms in Other Systems



Look at your *Lesson 9 - Symptoms and Systems* handout.

- What do we notice about M'Kenna's other symptoms and systems?
- What else are we wondering about?
- How could something so small in one subsystem (the digestive system) have that much impact on other parts of the body?

Symptoms

Symptoms that started first

- Nausea
- Vomiting
- Abdominal cramps
- Diarrhea
- Constipation

Symptoms that started later

- Fever
- Fatigue
- Weight loss
- Fainting
- Weight gain
- Back pain
- Leg pain
- Muscle cramps
- Rapid heartbeat with exercise
- Swollen joints
- Difficulty walking or moving
- Confusion
- Dizziness
- Brain fog or difficulty concentrating
- Headaches
- Numbness
- Slow heartbeat
- Cold feet or hands
- Chest pain
- High blood pressure
- Difficulty breathing with exercise
- Difficulty breathing all the time
- Chest pain
- Wheezing
- Asthma

Notes

The patient complains that her stomach hurts after she eats and that she feels nauseated. Her parents say she eats regular meals but has suddenly started losing a lot of weight. The patient says she often has diarrhea and stomach cramping. She has a hard time breathing when she tries to play basketball and gets out of breath quickly. The patient complains of feeling tired and weak all the time.





Argue for competing ideas

Slide D

Revisit M'Kenna's Doctor's Note



With a partner, look back at our symptoms/systems mapping and think about which symptoms are connected to what we have figured out and which ones we still can't explain. Record your thinking on your Lesson 9 handout.

- Part 1: Which of M'Kenna's symptoms could be connected to what we've figured out?
- Part 2: Which of M'Kenna's symptoms have we not found a connection to yet?

→ Be prepared to share out your ideas with the class.





Determine a way to resolve this question

Slide B

Navigation: M'Kenna's other symptoms



Turn and Talk

What are your initial ideas about why M'Kenna is losing so much weight?

What sort of data could help us investigate this question?

Patient's Name: M'Kenna

Age: 13

Symptoms

Symptoms that started first

- Nausea
- Vomiting
- Abdominal cramps
- Diarrhea
- Constipation

Notes

The patient complains that her stomach hurts after she eats and that she feels nauseated. Her parents say she eats regular meals but has suddenly started losing a lot of weight. The patient says she often has diarrhea and stomach cramping. She has a hard time breathing when she tries to play basketball and gets out of breath quickly. The patient complains of feeling tired and weak all the time.

Symptoms that started later

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How do storyline routines support students as partners in science work?

Question	Routine
1. How do we kick off investigations in a unit?	Anchoring Phenomenon
2. How do we work with students to motivate the next steps?	Navigation
3. How do we help students use practices to build science ideas?	Investigation
4. How do we help students put science ideas together?	Putting Pieces Together
5. How do we push students to go deeper?	Problematizing

Birth Month	<i>Jamboard:</i> Go to <u>Frames 3-6</u> and pick the routine that stands out to you.
Jan & Feb	bit.ly/JanFebJamboard
March & April	bit.ly/MarchAprillamboard
May & June	bit.ly/MayJunelamboard
July & Aug	bit.ly/JulyAuglamboard
Sept & Oct	bit.ly/SeptOctlamboard
Nov & Dec	bit.ly/NovDeclamboard



“But like in this, we were the ones who came up with it. So we were able to understand... We had similar ideas or different ideas. So we were able to come up with this one model that we could ALL understand. Because WE came up with it.”

[OpenSciEd Middle School Student](#)





“I’m really excited for this unit because I feel like last time we had a whole bunch of crazy ideas, and then at the end we pretty much made all of them happen. So I am excited to see what we do for this unit.”

OpenSciEd Middle School Student





Q&A



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Thanks to Today's Presenters



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