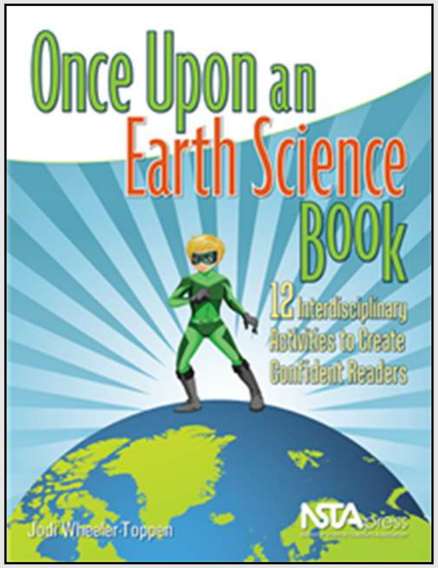
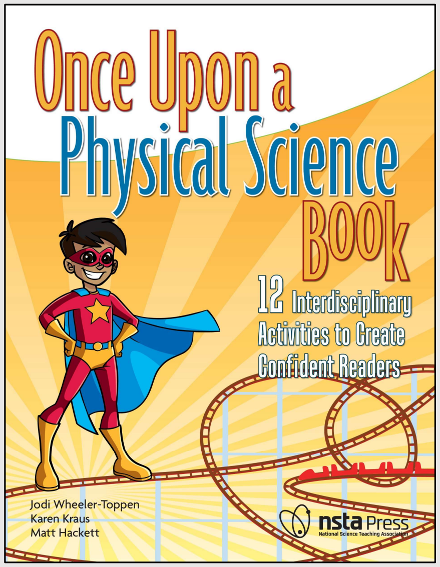
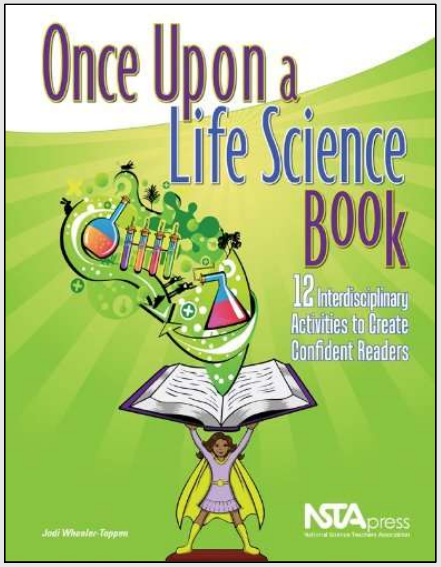
Read. Write. Science! Real Science, Real Literacy

Jodi Wheeler-Toppen, Ph.D.







Who I am and

How I ended up here

NATIONAL GEOGRAPHIC KIDS
DOG SCIENCE UNLEASHED
FUN ACTIVITIES TO DO WITH YOUR CANINE COMPANION
JODI WHEELER-TOPPEN
NATIONAL GEOGRAPHIC KIDS
HANDS-ON SCIENCE
CAT SCIENCE UNLEASHED
FUN ACTIVITIES TO DO WITH YOUR FELINE FRIEND
JODI WHEELER-TOPPEN
PHOTOGRAPHS BY MATTHEW RAKOLA
This Is a BOOK to READ with a WORM
Jodi Wheeler-Toppen
Illustrated by Margaret McCartney
NATIONAL GEOGRAPHIC KIDS
EDIBLE SCIENCE
EXPERIMENTS YOU CAN EAT
Science Experiments THAT FIZZ AND BUBBLE
Fun Projects for Curious Kids
EDGE BOOKS
Our Ears Can Hear
Our Eyes Can See
Our Mouths Can Taste
Our Noses Can Smell
Our Skin Can Touch
GROSS SCIENCE PROJECTS
GHOSTS AND ATOMS
Human Muscles
The ask Big Book of Mad Scientists' Alchemy
RECYCLED SCIENCE
AMAZING CARDBOARD TUBE SCIENCE
EDGE BOOKS
Cool Chemistry Activities for Girls
Snap
Science Experiments THAT EXPLODE AND IMPLODE
Fun Projects for Curious Kids
EDGE BOOKS
ORCHID MANTISES
AND OTHER EXTREME INSECT ADAPTATIONS

Literacy Challenges in Your Classroom

- What challenges do you see with your students?
- What expectations from others are hard to meet in your classroom?

Agenda

- Henry County Introduction
- Try a “Literacy Learning Cycle”
- Talk about how this type of lesson is structured (and why!)
- Dig in on reading challenges
- Try another Literacy Learning Cycle
- Resources

HENRY COUNTY SCHOOLS

and our COMMUNITY share

A **VISION** TO

ensure a **high-quality, world-class** education for **every student.**

and a singular

MISSION TO

empower all students with **exceptional opportunities** and **access** that lead to **success** in a global society.

A **COMPASS** FOR THE **FUTURE**

Unified Governance

An system for educating, led by the Henry County Board of Education

CORE**BELIEFS** | We believe

- Each student can learn at or above grade level and will have an equal opportunity to do so
- Family and community involvement is critical to student success
- All learning environments should be supportive, safe, and secure
- Effective teachers, leaders, and staff, produce excellent results

CORE**POLICIES** | BAB , IAB, and IB, call for

- An Aligned System of Teaching & Learning
- A System of Accountability
- A Framework for Continuous Improvement
- A Plan to Advance Opportunities, Access, and Outcomes

STRATEGIC**ACTIONS** | To advance

- And accelerate learning opportunities and experiences for students
- And support effective school leaders and teachers
- Community and stakeholder engagement so that all students, families and employees feel welcomed and valued
- Student and employee health, wellness, and support structures
- A high-performing operational culture

PRIORITY**OUTCOMES** | Every student will be

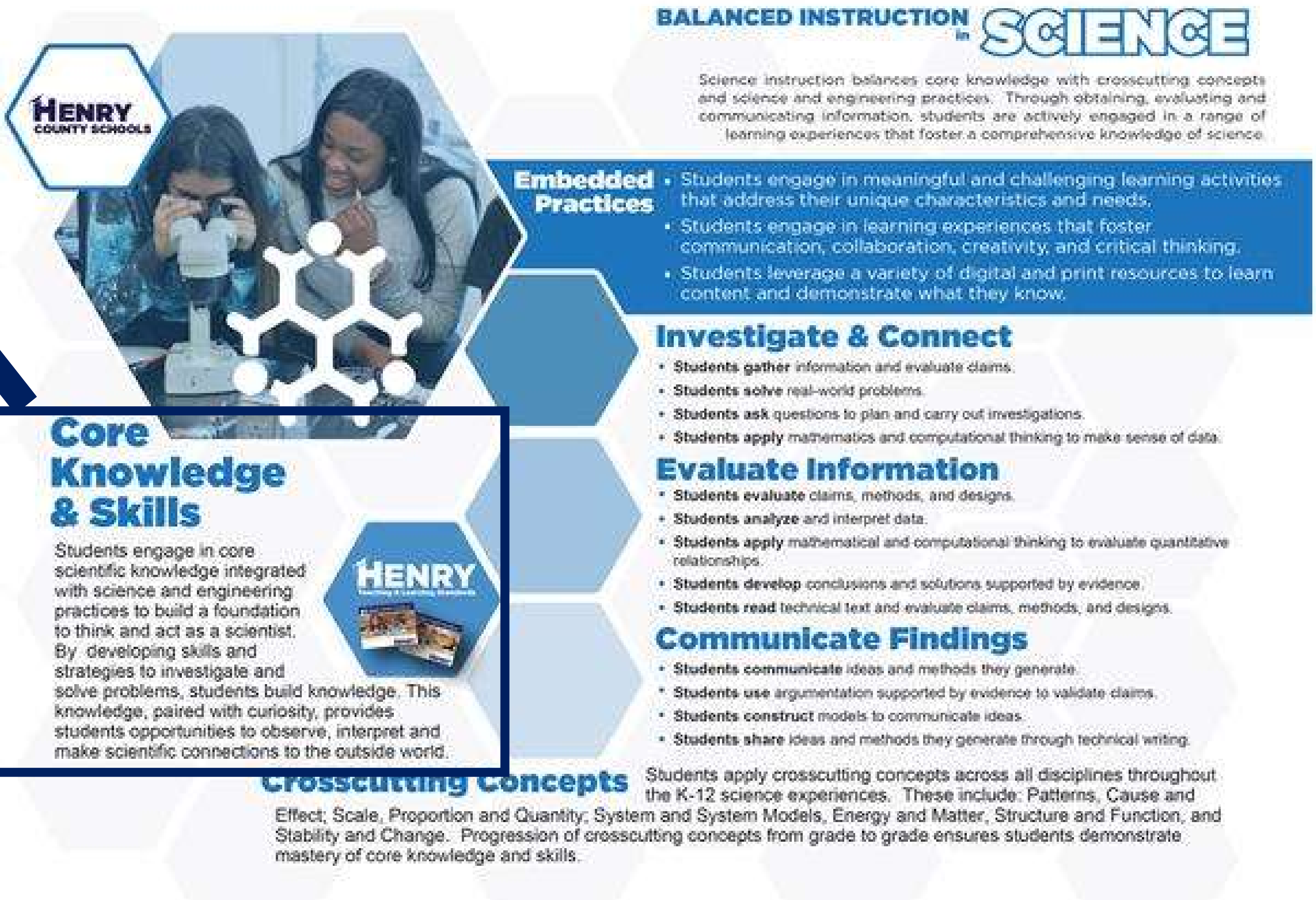
- Ready for kindergarten
- Ready to read and write at or above grade level each year with a curriculum rich literature and world languages
- Ready for success in advanced coursework at every grade level
- Ready for life with strong soft skills, personal health, and well-being
- Ready for college, career and post-secondary successes with industry certifications, competitive test scores and scholarship awards

Community-Inspired **2021-2026 Strategic Plan**
Developed by the Henry County Board of Education

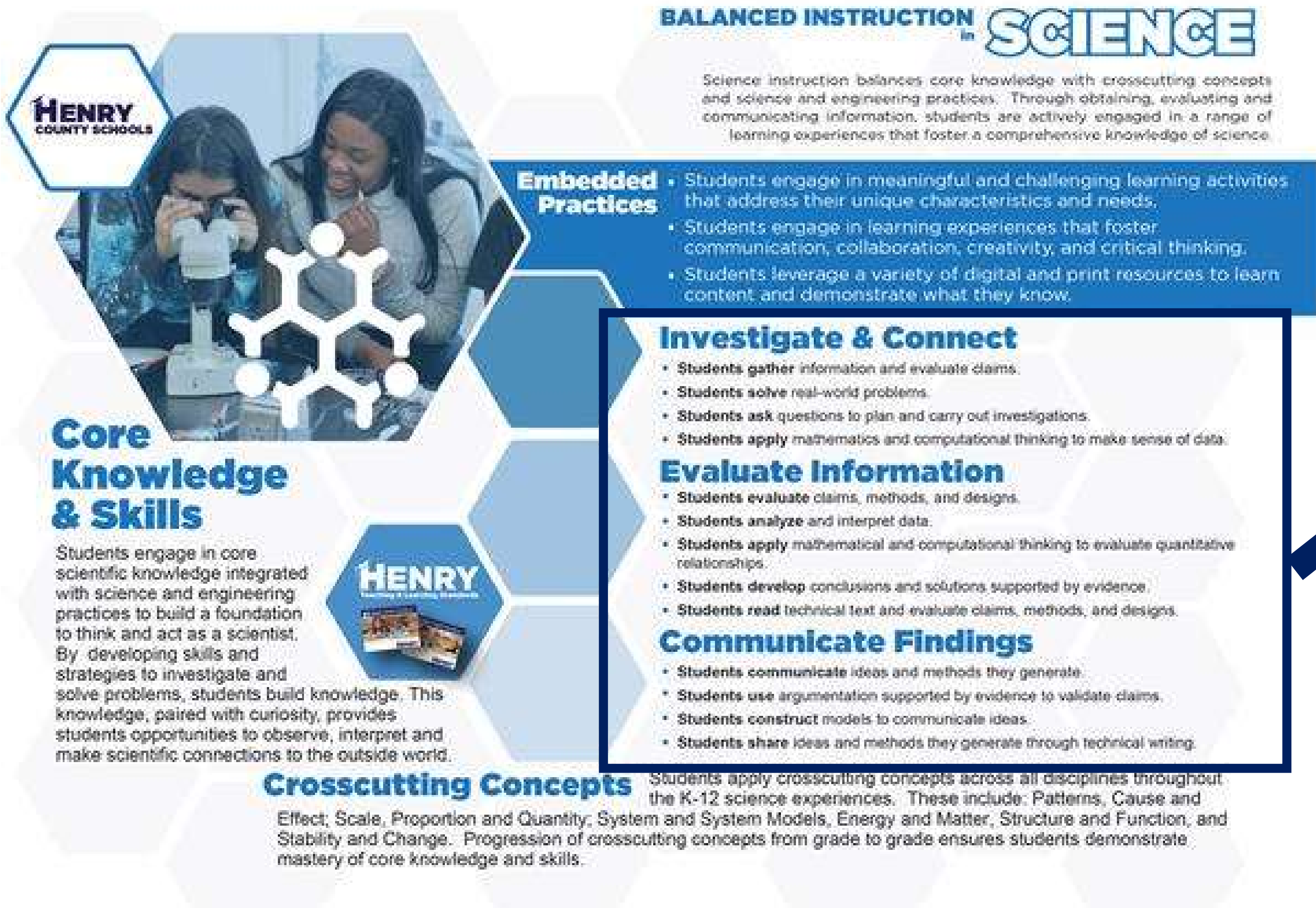
In Pursuit of *Exceptional*

In Pursuit of *Exceptional*

Disciplinary Core Ideas (Content)



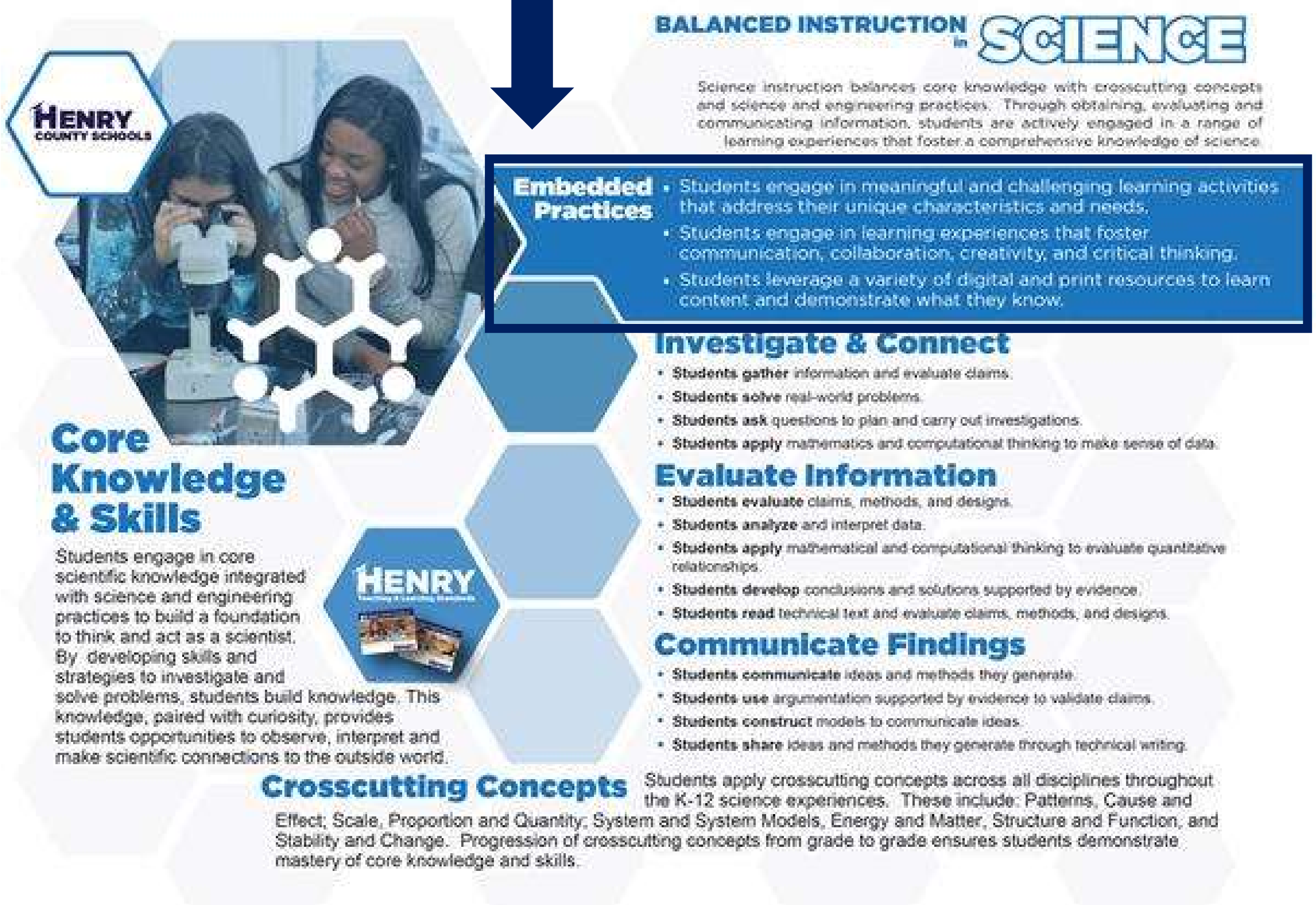
In Pursuit of *Exceptional*



Science & Engineering Practices

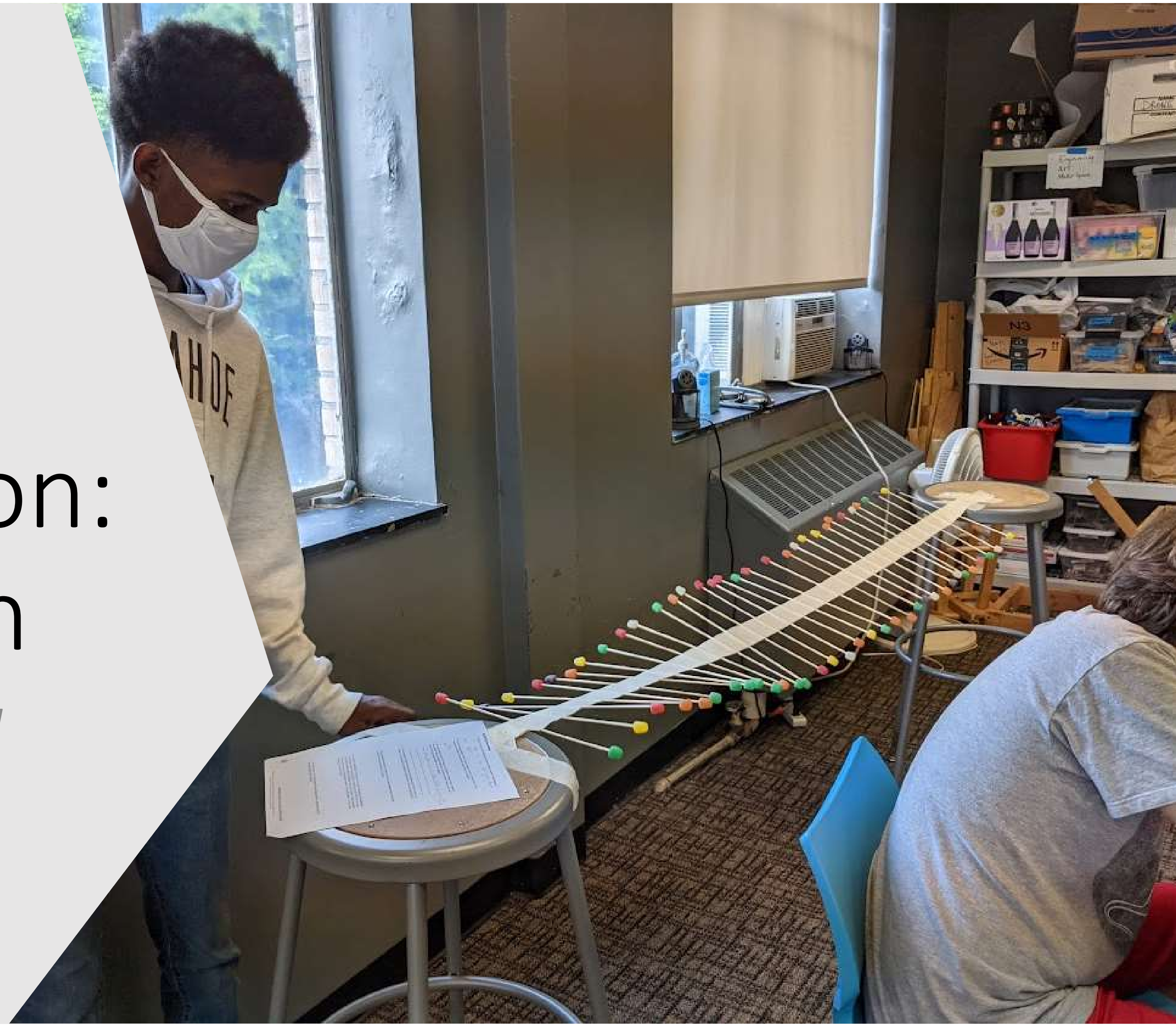
In Pursuit of *Exceptional*

In Pursuit of *Exceptional*



Sample Lesson: Wave Motion

Chapter 13 of *Once Upon a Physical Science Book*



Part 1a: Explore the wave machine

(p. 187-189)

1. Walk to one end of the machine and tap the side of a skewer. What happens?

2. Let the machine settle so that it stops moving. Are any of the parts of the machine in a different place than they were when you started?

3. The motion that you saw move along the machine is called a wave. Spend a few moments tapping different skewers to see what kinds of waves you can make. Write three observations from your tapping.

4. Use your hands to steady the skewers so the machine is still. Tap the side of a skewer at the far end of the machine. In which direction did your wave travel?

5. Watch the candies carefully. In which direction do the candies move? Are they moving in the same direction as the wave?

Part 1b: Explore the wave machine

(p. 187-189)

6. The individual candies don't move very far, at least compared to the distance that the wave travels. The tape doesn't move much at all. And all the parts of your wave machine return to the place where they started. That's because the wave carries energy, not particles.

Based on this information, try to write a definition for the word wave:

7. Start a new wave. Then make a second wave chase the first. Does the second wave ever catch the first wave?

8. Experiment until you figure out how to make bigger and smaller waves. How do you do it?

9. Each time you send a wave down the machine, you are moving energy from one end to another. Which sends more energy, a big wave or a small wave?

10. An individual wave can only get so big. Given that each wave is limited in size, how can you send more energy across the machine?

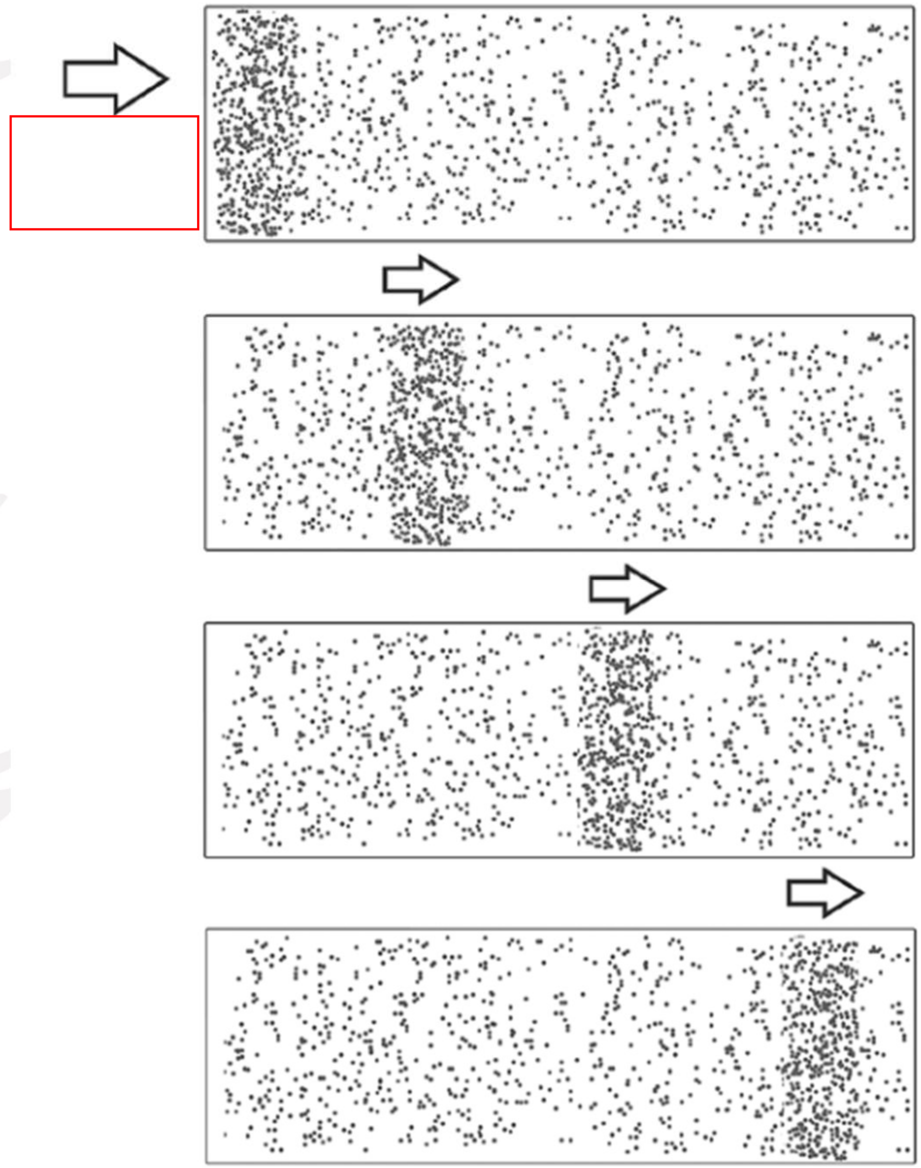
Part 2: Read!

- We are going to read an article that will talk about how bats use waves.
- Before we read, let's preview some of the diagrams from this text. (reading strategy)
- Grab a partner. Decide who is going to be Partner 1 and who will be Partner 2.

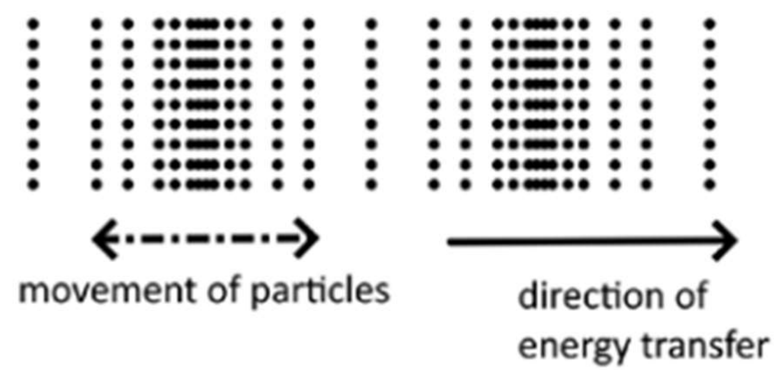
- Partner 1: Describe what you see.

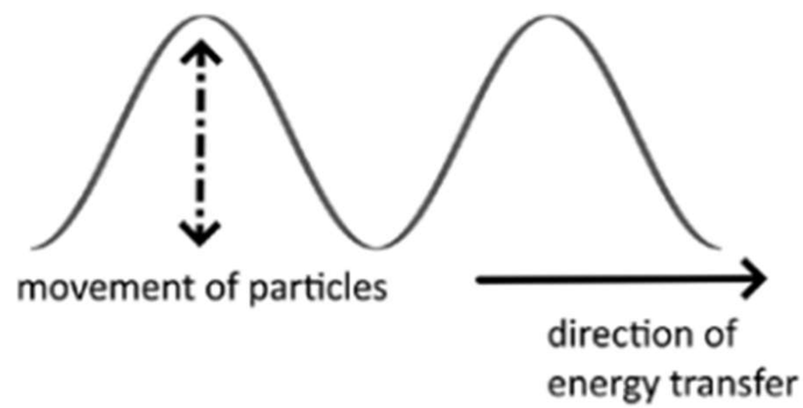
- Partner 2: Make a prediction—what do you think this diagram could possibly be showing?

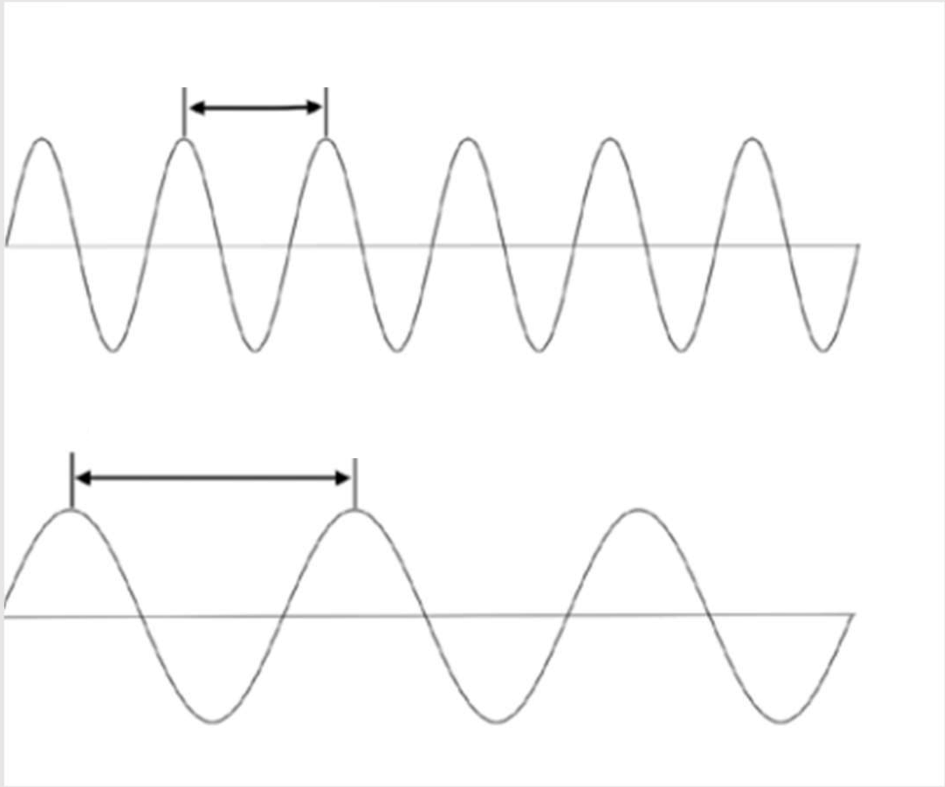
- Partner 1: There is text hidden under the red box. Take a guess. What do you think it might say?



- Partner 2: Describe what you see on the top section.
- Partner 1: Describe what you see in the bottom section.
- Partner 2: Make a prediction. What do you think this diagram is trying to show about these two types of waves?

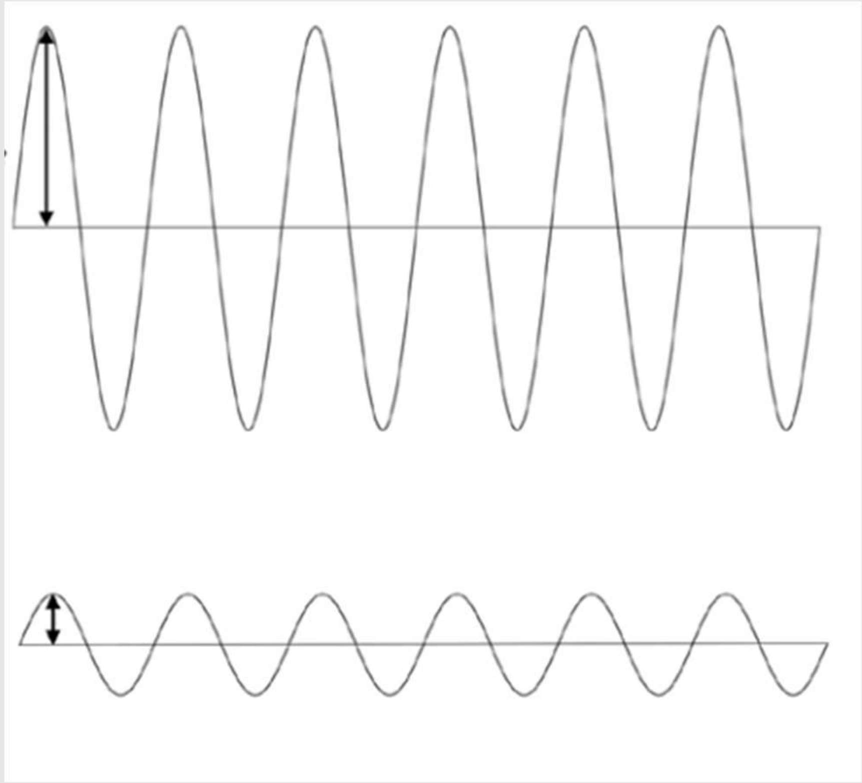


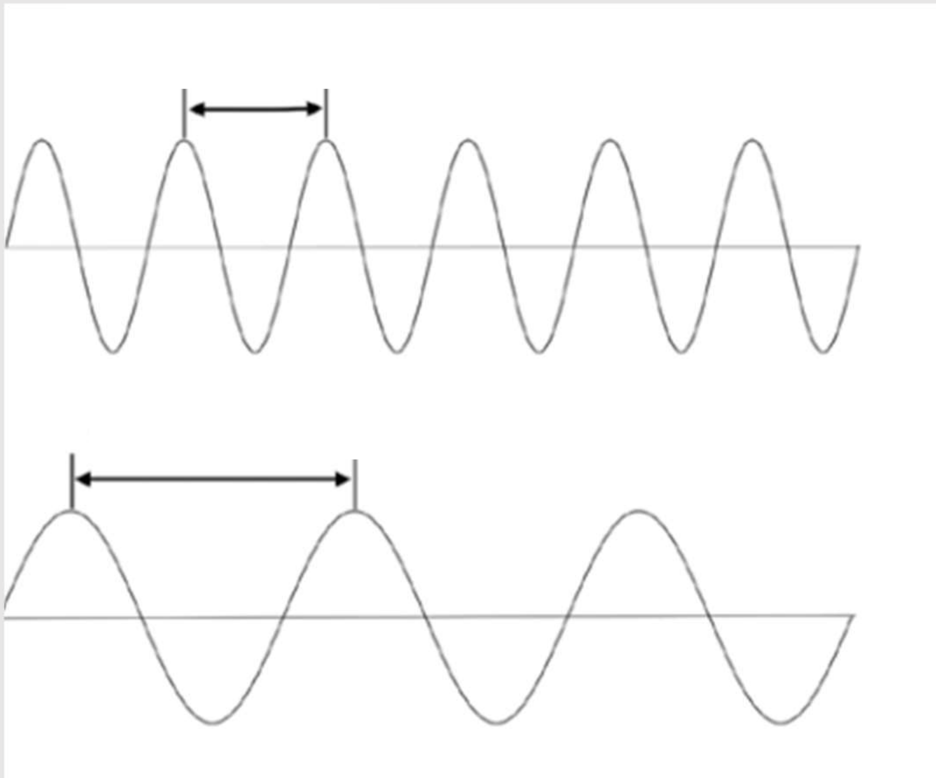


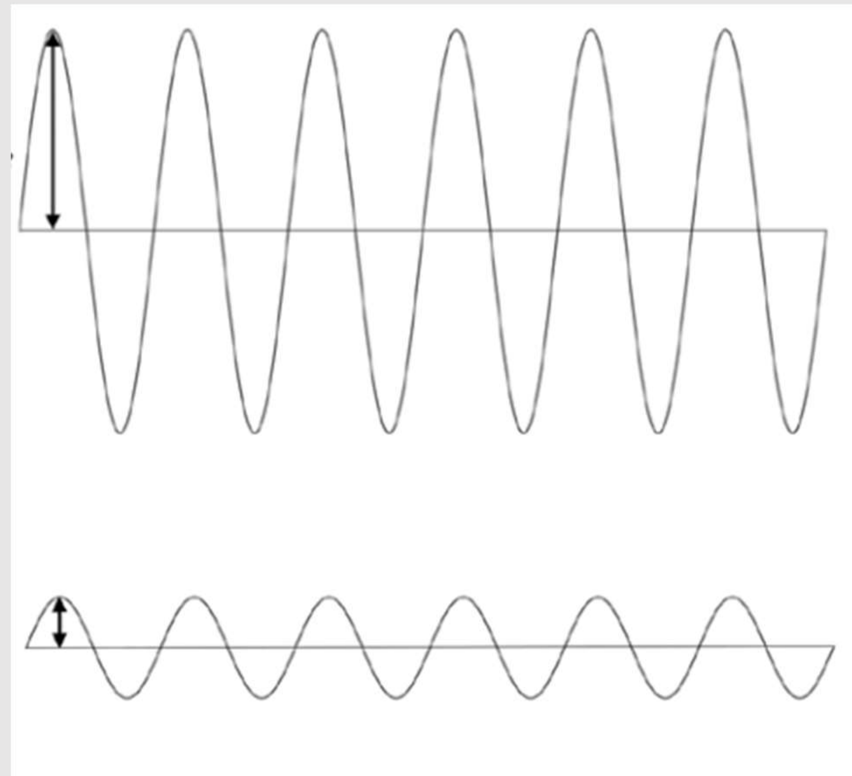


Partner 1: What difference do you see between these two waves?

- Partner 2: What difference do you see between these two waves?







Partner 1: These two diagrams (left and right) are each showing us something about how waves can be different. Compare the two. What do they show us?

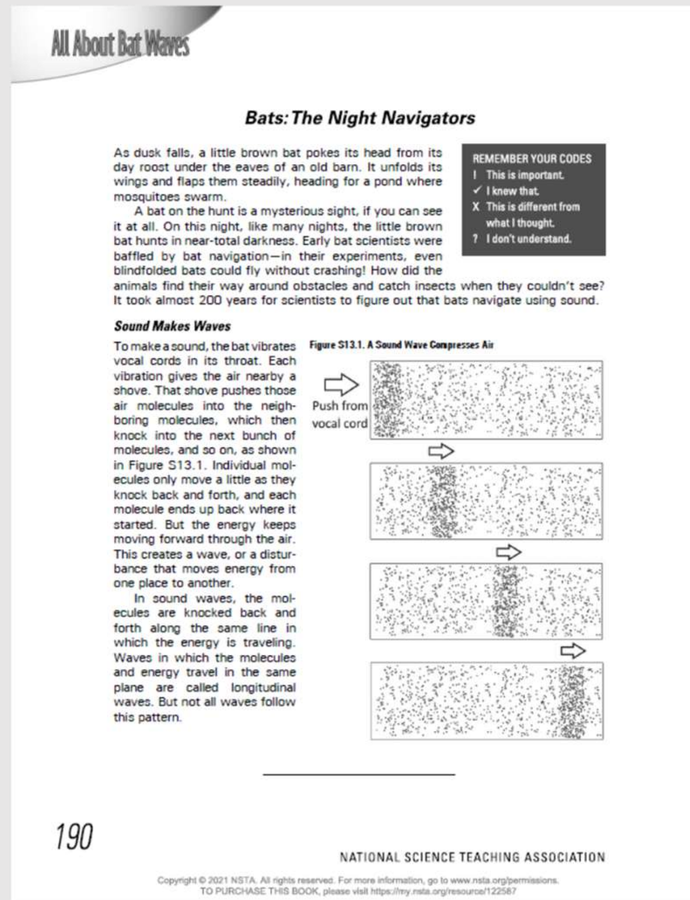
Partner 2: Make a prediction. How do you think the height of a wave “means”? What about the width of a wave?

Instructions to build wave machines

- https://wheelertoppen.files.wordpress.com/2023/10/wave-machine-instructions.pdf

Part 2: Learn About Waves

- Article on pages 190-192 (Chapter 13)
- Or at this link: https://wheelertoppen.files.wordpress.com/2023/10/bats-the-night-navigator.pdf



All About Bat Waves

Bats: The Night Navigators

As dusk falls, a little brown bat pokes its head from its day roost under the eaves of an old barn. It unfolds its wings and flaps them steadily, heading for a pond where mosquitoes swarm.

A bat on the hunt is a mysterious sight, if you can see it at all. On this night, like many nights, the little brown bat hunts in near-total darkness. Early bat scientists were baffled by bat navigation—in their experiments, even blindfolded bats could fly without crashing! How did the animals find their way around obstacles and catch insects when they couldn't see? It took almost 200 years for scientists to figure out that bats navigate using sound.

REMEMBER YOUR CODES
- I This is important.
- ✓ I knew that.
- X This is different from what I thought.
- ? I don't understand.

Sound Makes Waves

To make a sound, the bat vibrates vocal cords in its throat. Each vibration gives the air nearby a shove. That shove pushes those air molecules into the neighboring molecules, which then knock into the next bunch of molecules, and so on, as shown in Figure S13.1. Individual molecules only move a little as they knock back and forth, and each molecule ends up back where it started. But the energy keeps moving forward through the air. This creates a wave, or a disturbance that moves energy from one place to another.

In sound waves, the molecules are knocked back and forth along the same line in which the energy is traveling. Waves in which the molecules and energy travel in the same plane are called longitudinal waves. But not all waves follow this pattern.

Figure S13.1. A Sound Wave Compresses Air

Push from vocal cord

190

NATIONAL SCIENCE TEACHING ASSOCIATION

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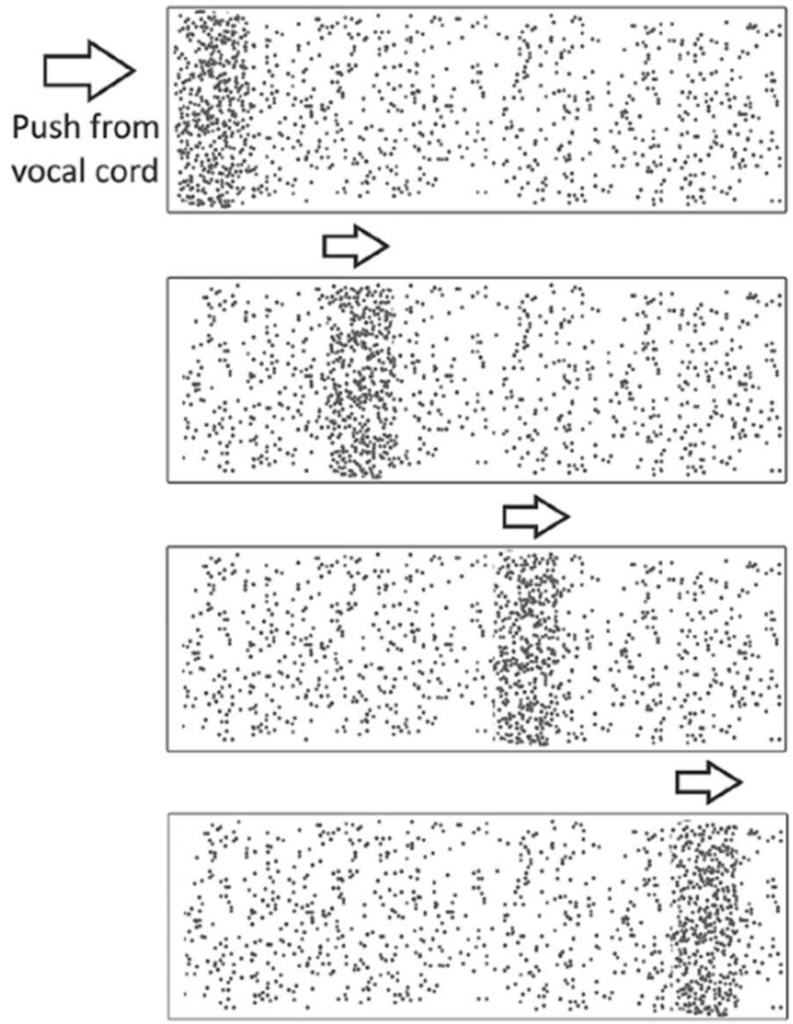
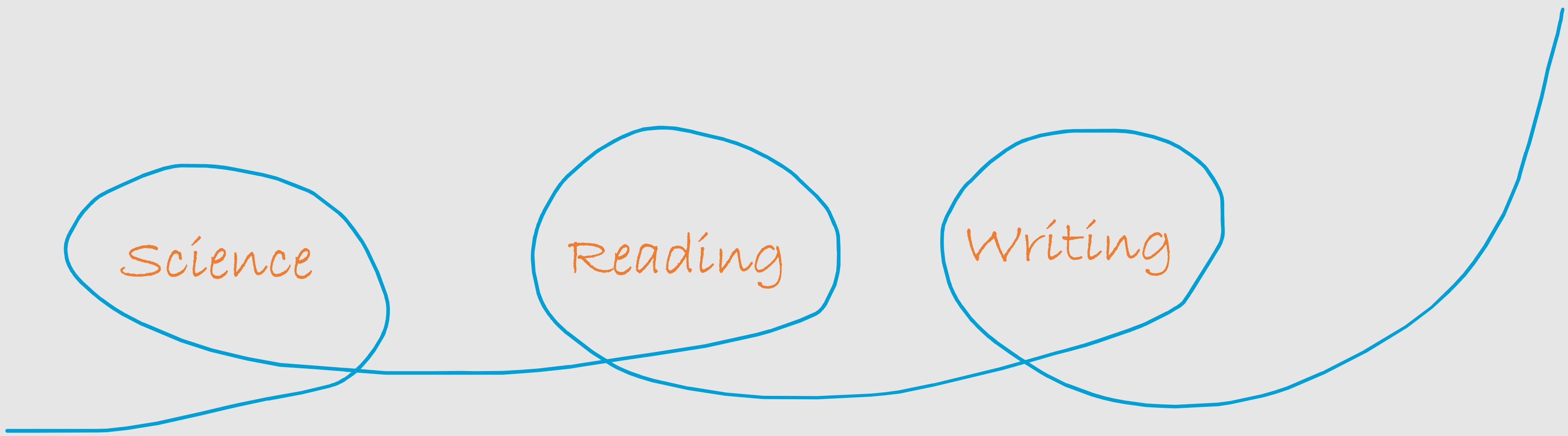


Part 3: Write about it

- Revisit the wave model. Use the article to make sure you understand the words wave, frequency, amplitude, and transverse wave.
- Write a letter to a friend who missed class today. Explain to your friend what these 4 words mean AND how you could see them illustrated in your wave machine.
- Include at least one drawing or diagram.
  - ➢What phrases will help you tell the reader what to look for in the image?

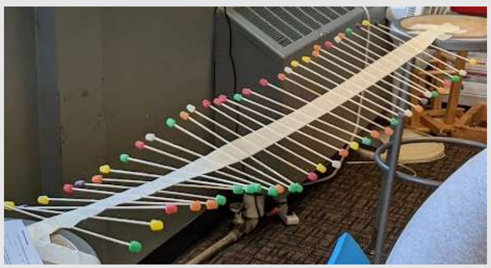
Questions? Comments?

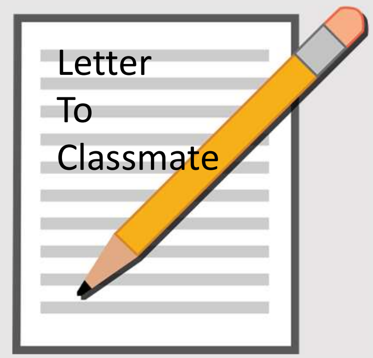


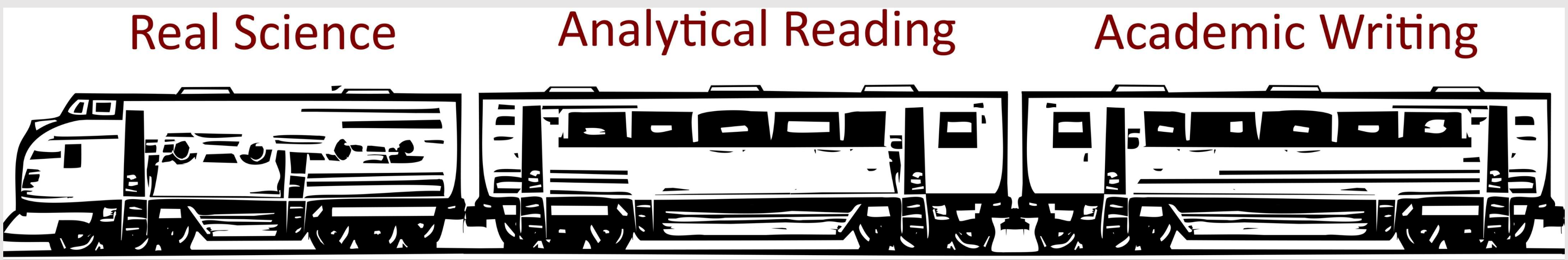
2. Literacy Learning Cycles

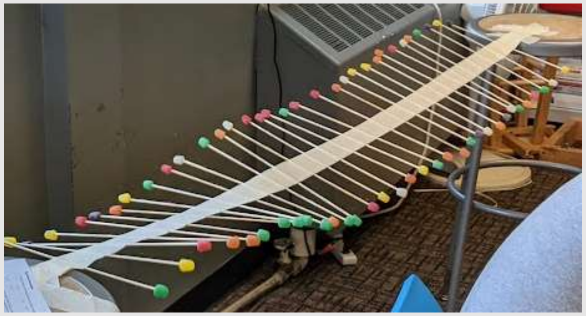
How this type of lesson is structured (and why!)

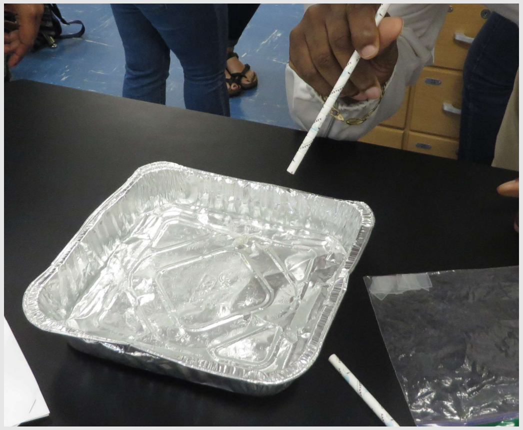
Lesson Structure

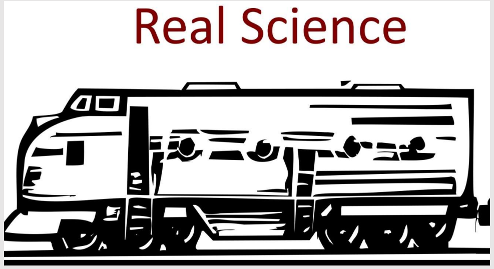






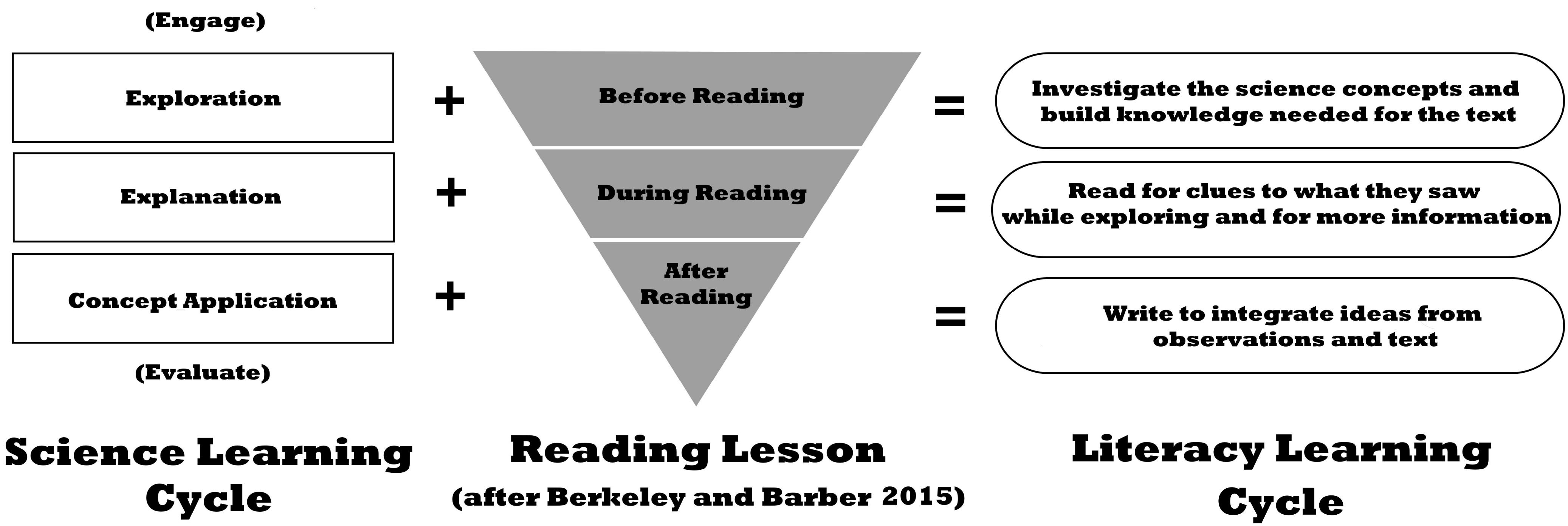


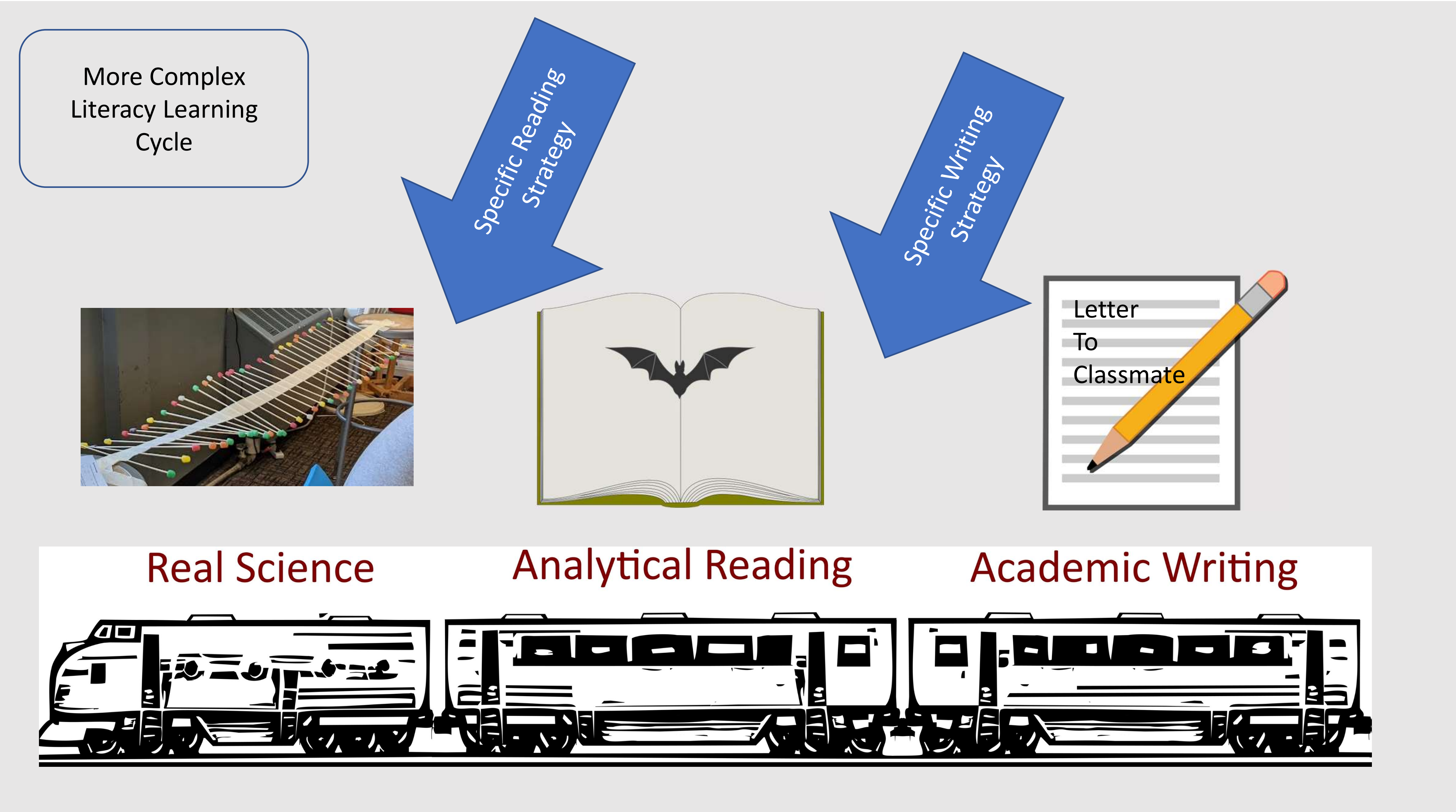




What advantages are there to starting with hands-on science?

- Build background for understanding text
- More likely to approach text in "curiosity mode"
- Allows deeper engagement with the text as it isn't the "introduction" to the new ideas
- Students have developed "something to say" by the time they need to write


(Engage)
Exploration
Explanation
Concept Application
(Evaluate)
+
+
+
Before Reading
During Reading
After Reading
=
=
=
Investigate the science concepts and build knowledge needed for the text
Read for clues to what they saw while exploring and for more information
Write to integrate ideas from observations and text
Science Learning Cycle
Reading Lesson
(after Berkeley and Barber 2015)
Literacy Learning Cycle


More Complex Literacy Learning Cycle
Specific Reading Strategy
Specific Writing Strategy
Letter To Classmate
Real Science
Analytical Reading
Academic Writing

3. Digging Deeper on Reading: Three Impediments to Learning from Text

The belief that reading is essentially a process of saying the words rather than actively constructing meaning from texts is widespread among many students. For instance, one of the students we interviewed looked surprised when he was asked to describe the topic discussed in a section of text he had just read.

"I don't know what it was about," he answered, with no sense of irony, ***"I was busy reading. I wasn't paying attention."***

(Schoenbach, et al.; Reading for Understanding)

Impediment 1

3 Impediments to Learning from Text

Impediment 1:

Students do not expect what they are reading to make sense.

Response: start a conversation

- Talk about needing to “figure out” as a normal part of reading science.
- Encourage students to pay attention to what they are thinking as they read.
- Model the kind of thinking that successful readers use through Thinking Aloud

Thinking Aloud

Sound Makes Waves

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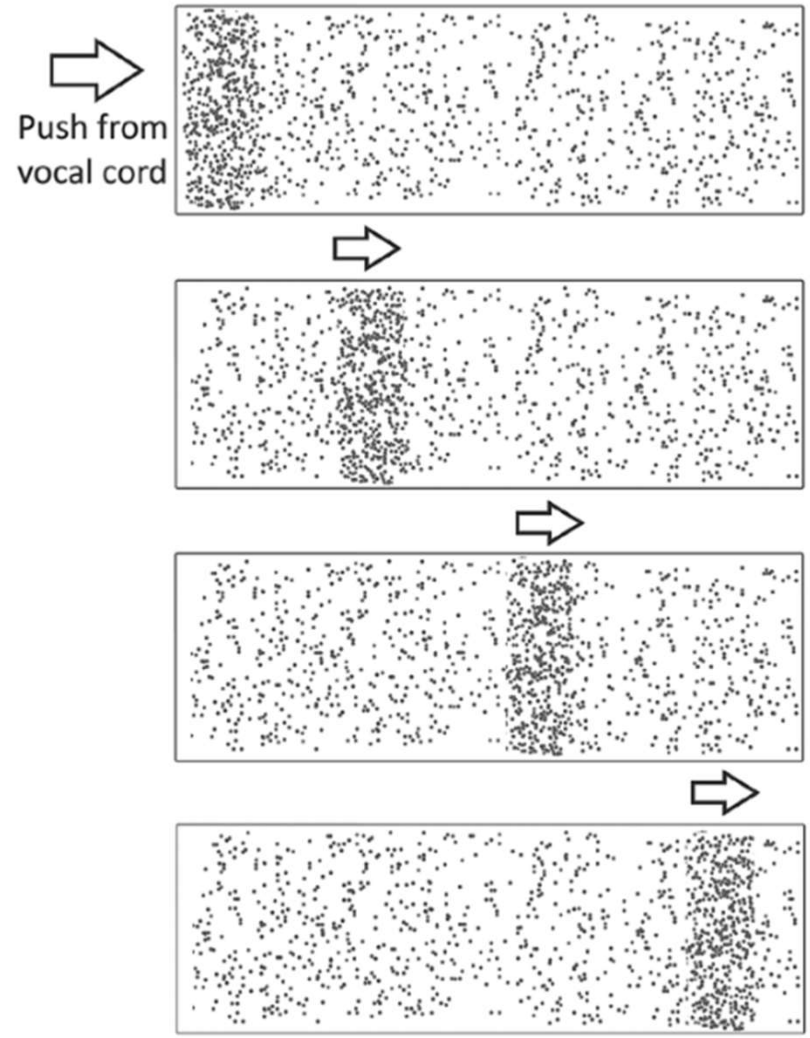


Somerset Draw with Durham Hands Notts the Title

After bowling the home side out for 320, Somerset were left needing 181 from 17 overs to guarantee the title. But, at 48-3, the chase was abandoned at Chester-le-Street and a draw agreed.

Fired-up Notts then took the three Lancashire wickets they required at Old Trafford to pick up a sixth bonus point and break Somerset hearts.

Eventually, Trego had Scott Rushworth caught behind and Benkenstein was caught at slip by skipper Marcus Trescothick off Charl Willoughby to set up the Somerset chase.

They went to the crease not knowing if a draw would be good enough to hold off Notts and immediately lost Kieswetter, promoted up the order, when he was bowled by Somerset old boy Blackwell.

Impediment 2

3 Impediments to Learning from Text

Impediment 2:

Students lack background knowledge assumed by the text.

(US Fish and Wildlife)

Young California Condor

"Some people were afraid the condor would soon be gone."

"I would think the people would be afraid when the condor was THERE."

Image courtesy NSF

~~extinction~~

~~biodiversity~~

Background knowledge: non-science vocabulary

Adequate	Contradict
Tentative	Characteristic
Substance	Offspring
Deposit	Gradual

(All words used in academic writing, but not very often in speech)

Responses:

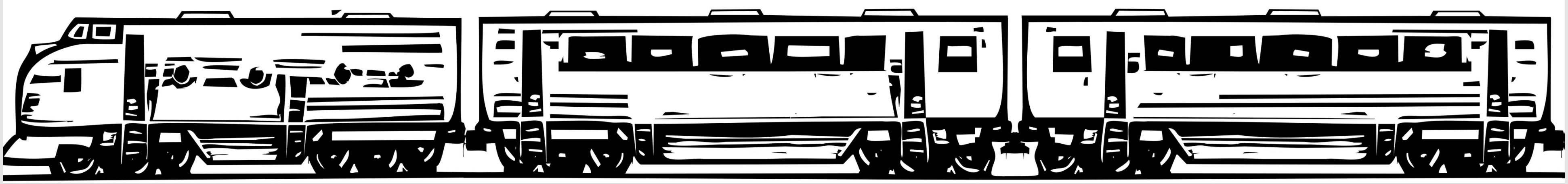
- Have students explore before reading!
- Read the text, looking for background they'll need.
- Listen, listen to what they say about the text.
- Consider reading groups or having students think aloud to each other.

Lesson Structure

Real Science

Analytical Reading

Academic Writing



Ferdie and Niddle gabbled on the plag, plag wert. “Pling,” Ferdie twaddled, “pling apie plee.” Niddle peedled and vang rue sot.

Comprehension Questions:

1. Where did Ferdie and Niddle gabble?
2. What did Ferdie twaddle?
3. What did Niddle do after he peedled?

*Critical Thinking:

4. Where else might Ferdie and Niddle gabble?

Impediment 3

3 Impediments to Learning from Text

Impediment 3:

They don’t have to read to do their school tasks.

Response:

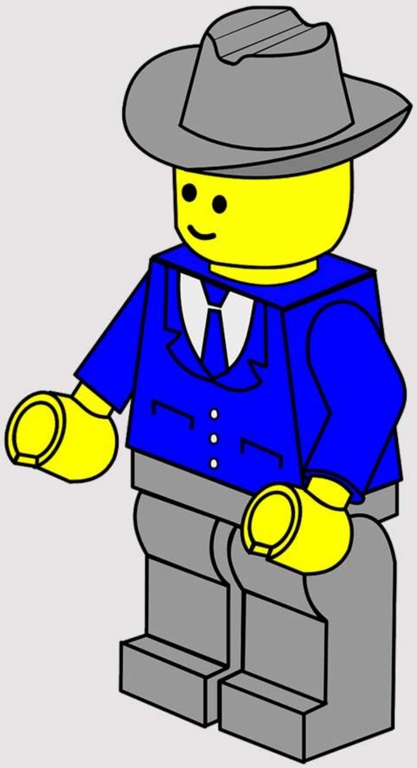
- Give them better tasks!

(That is, ask questions and give assignments that they cannot complete by just copying sentences.)

Questions? Comments?

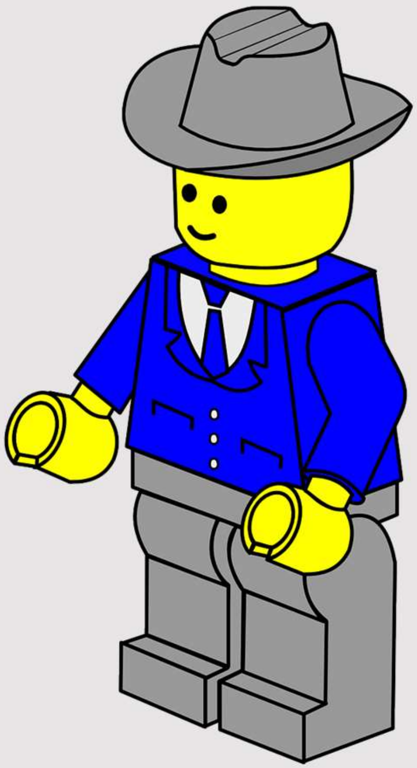
Literacy Learning Cycle:

Trash Soup



Suppose a child was on a ship off the coast of Georgia and accidently dropped a Lego man into the ocean.

Where would Lego man go?
What would determine his movement?



Part 1: Let’s do some activities to try to figure it out!

Part 2: Investigate through Reading

REMEMBER YOUR CODES

- ! This is important.
- ✓ I knew that.
- X This is different from what I thought.
- ? I don't understand.

The Garbage Collectors

In 1997, Charles Moore was heading home from a sailboat race. His team was in good spirits because they had won third place, and they had some extra fuel. So they decided to take a different route home, through a part of the ocean that is usually avoided: the North Pacific Subtropical Gyre. Most ships stay out of the gyre because the wind in the center is weak, and it isn't a good place to catch fish.

As he traveled through the gyre, looking out on the ocean, what Charles saw surprised him. His ship was alone in a barely traveled bit of ocean, yet there was evidence of people everywhere. As far as he could see, the ocean was littered with trash.

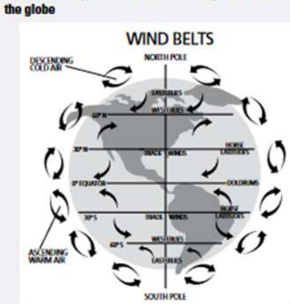
When he got home, he shared what he had seen. But not everyone was surprised by the discovery. In 1988, a group of scientists at the National Oceanographic and Atmospheric Administration had predicted that trash would be accumulating in this area. These scientists had sampled ocean water for trash and then used their knowledge of ocean currents and winds to determine where the trash was most likely to gather.

Why Here?

The large surface currents in the ocean are caused by wind. In the polar regions at the top and bottom of the Earth, the air is cold. Molecules of cold air pack together and are dense. Near the equator, the Sun's heat warms the air. The molecules spread out and form a low-pressure zone. The polar air rushes toward the equator, where it warms and completes the loop. In addition to moving north and south on the globe, air currents also circulate higher and lower in the atmosphere. As a result, there are a series of circulating air pockets that move heat around the world, as shown in Figure S11.1.

Figure S11.1. Winds and Atmospheric Circulation

Wind moves up and down in the atmosphere and across the globe



However, Earth's rotation complicates the wind patterns. Because Earth is turning on its axis, the path of the wind, as it is traced across the land, seems to bend. It turns clockwise relative to the Northern Hemisphere and counterclockwise relative to the Southern Hemisphere. This twisting is called the Coriolis effect.

But first, a quick reading skill:

In 1997, Charles Moore was heading home from a sailboat race. His team was in good spirits because…

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…they had won third place, and
they had some extra fuel.

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So *they decided to take a different route home*, through a part of the ocean that is usually avoided: the North Pacific Subtropical Gyre.

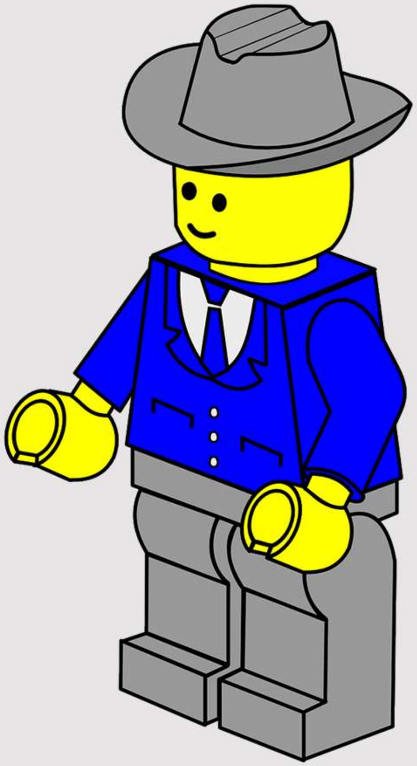
Most ships stay out of the gyre because the wind in the center is weak, and it is not a good place to catch fish.

Cause		Effect
Wind in the gyre is weak and fishing is bad	→	Ships stay out of the gyre

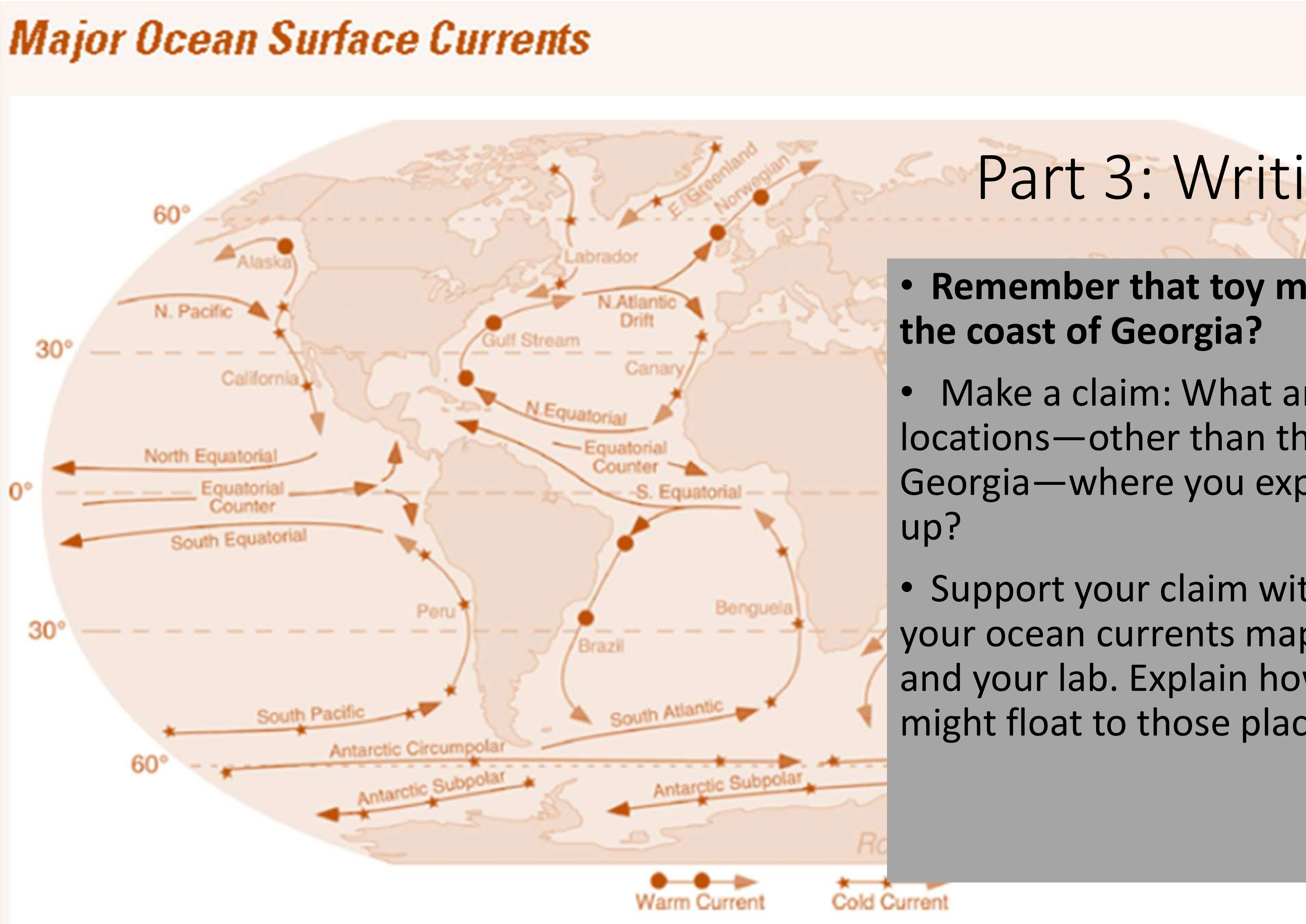
What are some other words that can signal cause and effect?

- Cause/ are caused by
- Consequently
- As a result
- Therefore
- For this reason
- Thus
- Hence
- In response to
- Since

Reading Prompts:



As you read, think about Lego man. What would affect his movement around the ocean?



Part 3: Writing Task

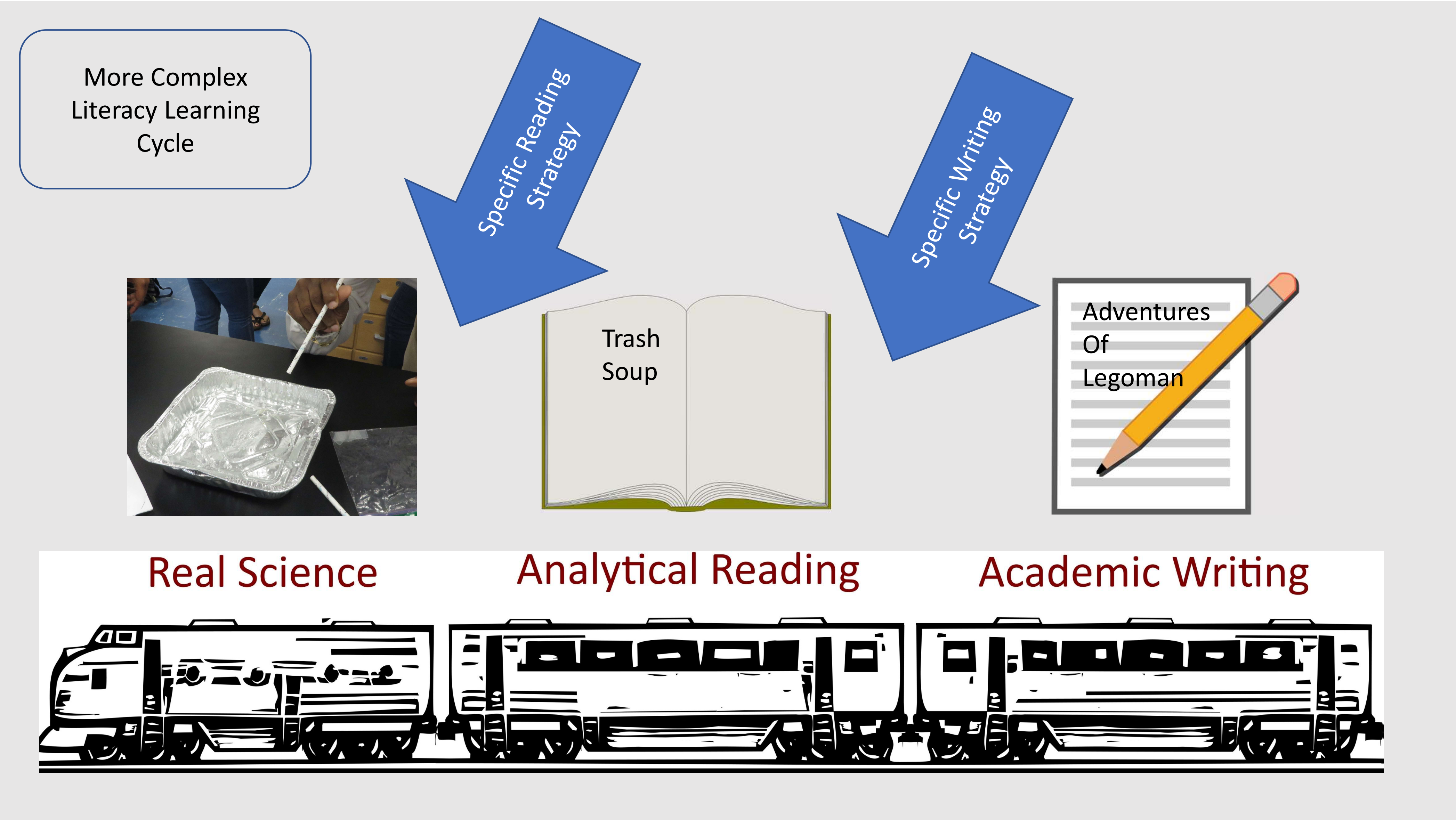
- **Remember that toy man, dropped off the coast of Georgia?**
- Make a claim: What are two locations—other than the coast of Georgia—where you expect him to turn up?
- Support your claim with evidence from your ocean currents map, your reading, and your lab. Explain how and why he might float to those places.

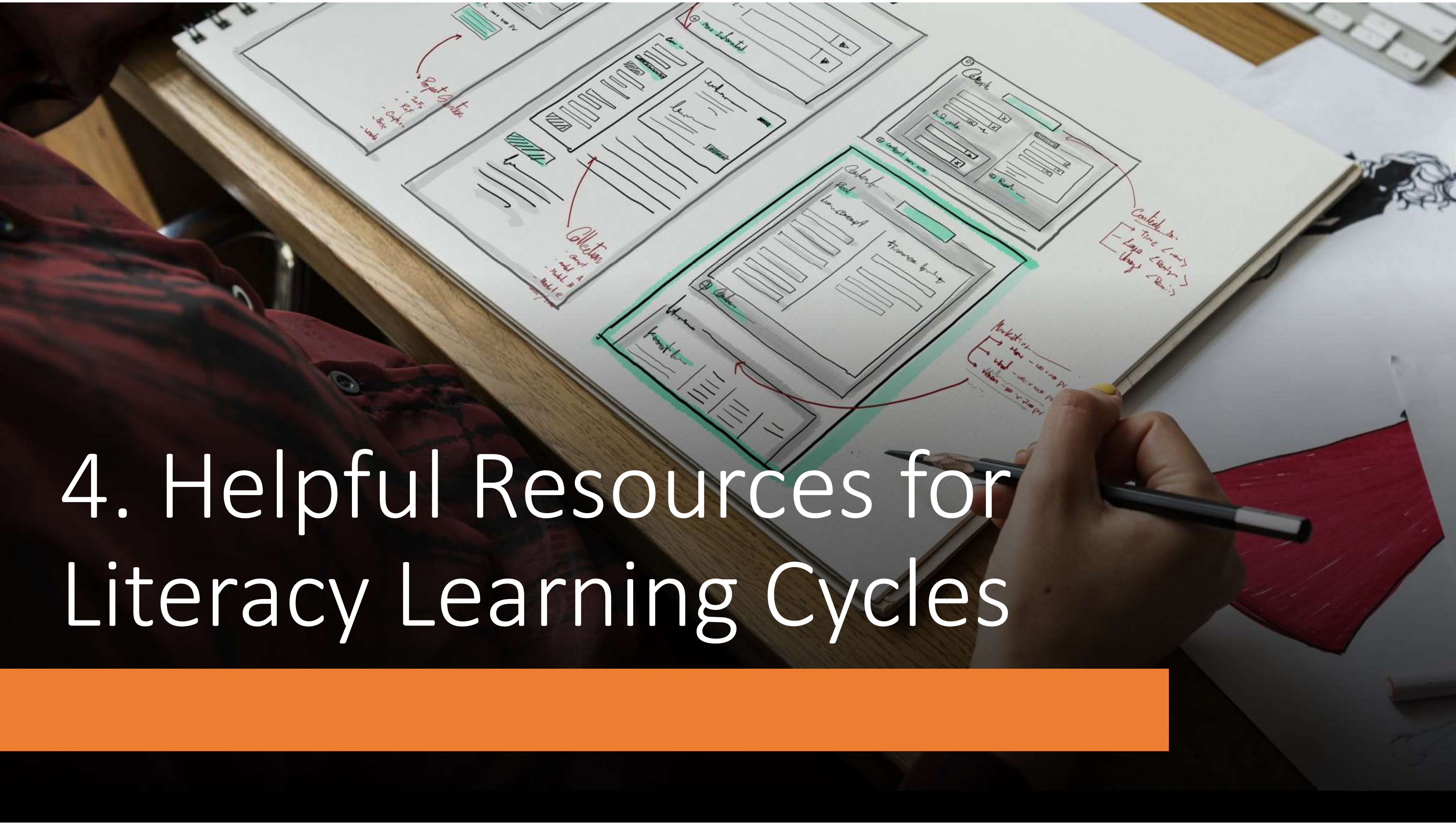
Prewriting Questions

- Science ideas: What evidence will you want to use from your lab? What reasons will you want to use from the article?
- Science words: What science vocabulary will you want to use?
- What writing words might you use? *(cause and effect words, such as **because, due to, since, as a result,** and **therefore** might be good choices for this assignment)*

Handouts for Lab and Reading Available Here:

https://wheelertoppen.files.wordpress.com/2023/10/ocean-in-motion-and-trash-soup.pdf.pdf


More Complex Literacy Learning Cycle
Specific Reading Strategy
Specific Writing Strategy
Trash Soup
Adventures Of Legoman
Real Science
Analytical Reading
Academic Writing



4. Helpful Resources for Literacy Learning Cycles

Short Videos

Elementary:

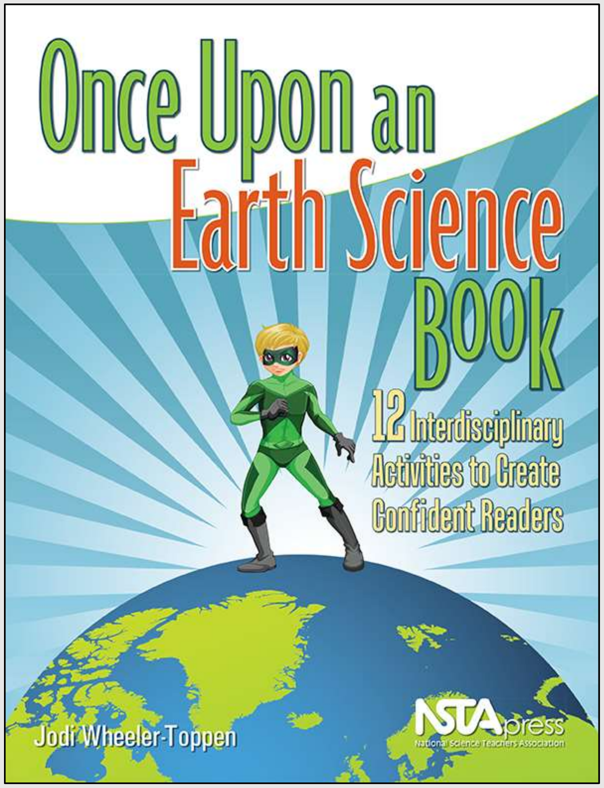
- Integrating Writing and Science
- Integrating Reading and Science
- Writing about Claims, Evidence, and Reasoning
- Sentence Frames for Reading, Writing, and Forming Science Knowledge

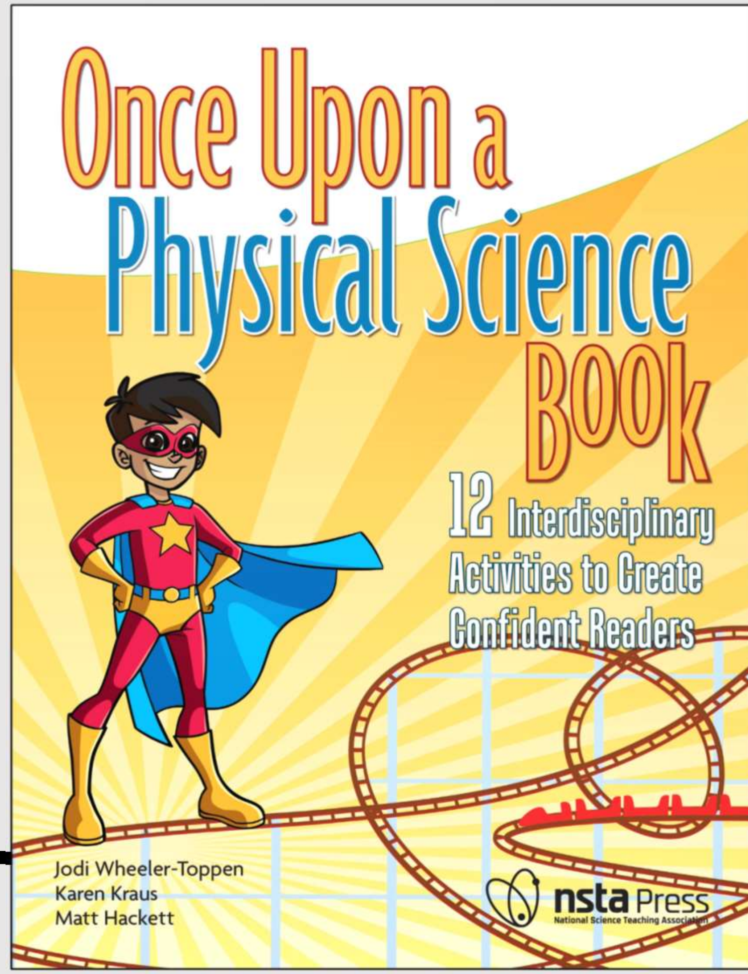
Middle/High:

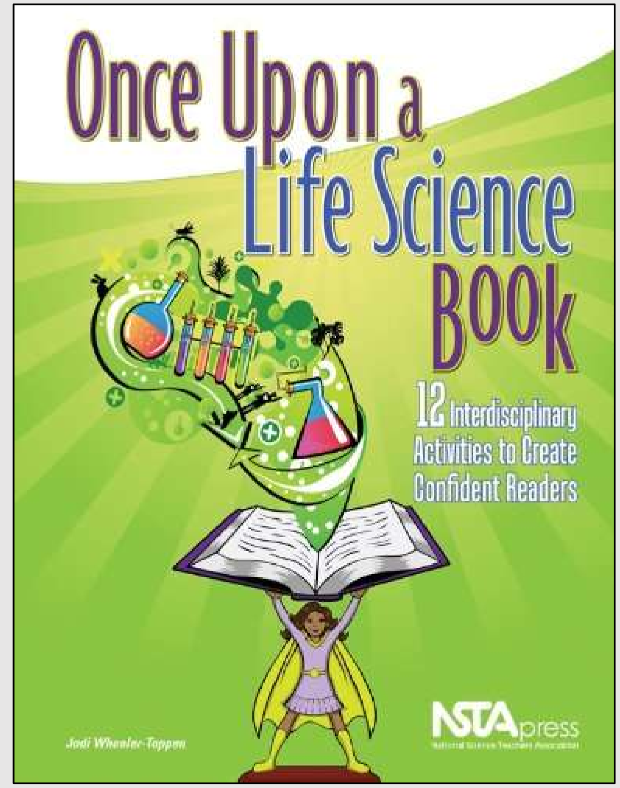
- Integrating Writing and Science:
- Integrating Reading and Science:
- Signal Words for Reading, Writing, and Forming Science Knowledge
- Writing about Claims, Evidence, and Reasoning:

K-12:

- Reading Strategies Part 1: Make it Make Sense: For Teachers in Grades K-12
- Reading Strategies Part 2: Problem-Solving Tools
- Knowing Enough to Read: How Background Influences Science Comprehension
- Before and After Writing: Prewriting and Evaluation
- Integrating Reading, Writing, and Science in the K-8 Classroom: A Call to Action for Administrators

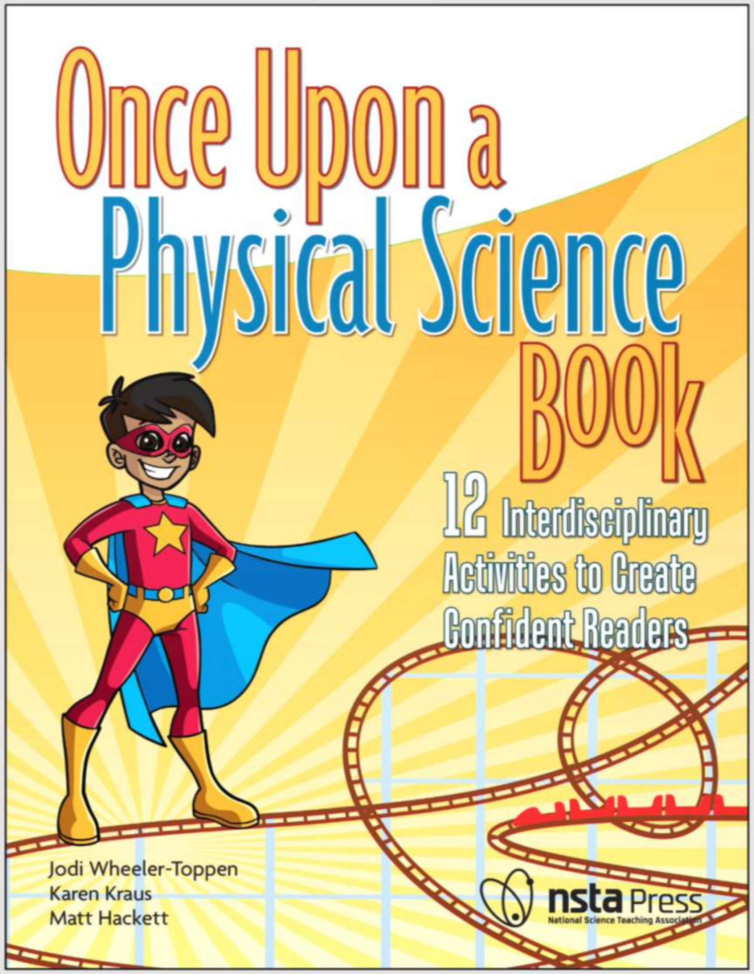

Once Upon an
Earth Science
Book
12 Interdisciplinary
Activities to Create
Confident Readers
Jodi Wheeler-Toppen
NSTApress
National Science Teachers Association


Once Upon a
Physical Science
Book
12 Interdisciplinary
Activities to Create
Confident Readers
Jodi Wheeler-Toppen
Karen Kraus
Matt Hackett
nsta Press
National Science Teaching Association


Once Upon a
Life Science
Book
12 Interdisciplinary
Activities to Create
Confident Readers
Jodi Wheeler-Toppen
NSTApress

Each chapter includes:

- A hands-on exploration
- An engaging article to read, paired with
  - An appropriate reading strategy and instructions for introducing it
  - A short journal question about the strategy
- A writing prompt that draws from the exploration and the reading
- A “Thinking Mathematically” or “Thinking Visually” activity



Related Resources for the Books

- https://onceuponasciencebook.com/for-educators/resources-for-teaching-online-with-the-once-upon-books/
- https://wheelertoppen.files.wordpress.com/2017/03/georgia-standards-of-excellence-correlations-life-science.pdf
- https://wheelertoppen.files.wordpress.com/2017/03/georgia-standards-of-excellence-correlations-earth-science.pdf

- https://forms.gle/keUNmLZd449FZiXe7

Session Evaluation

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