

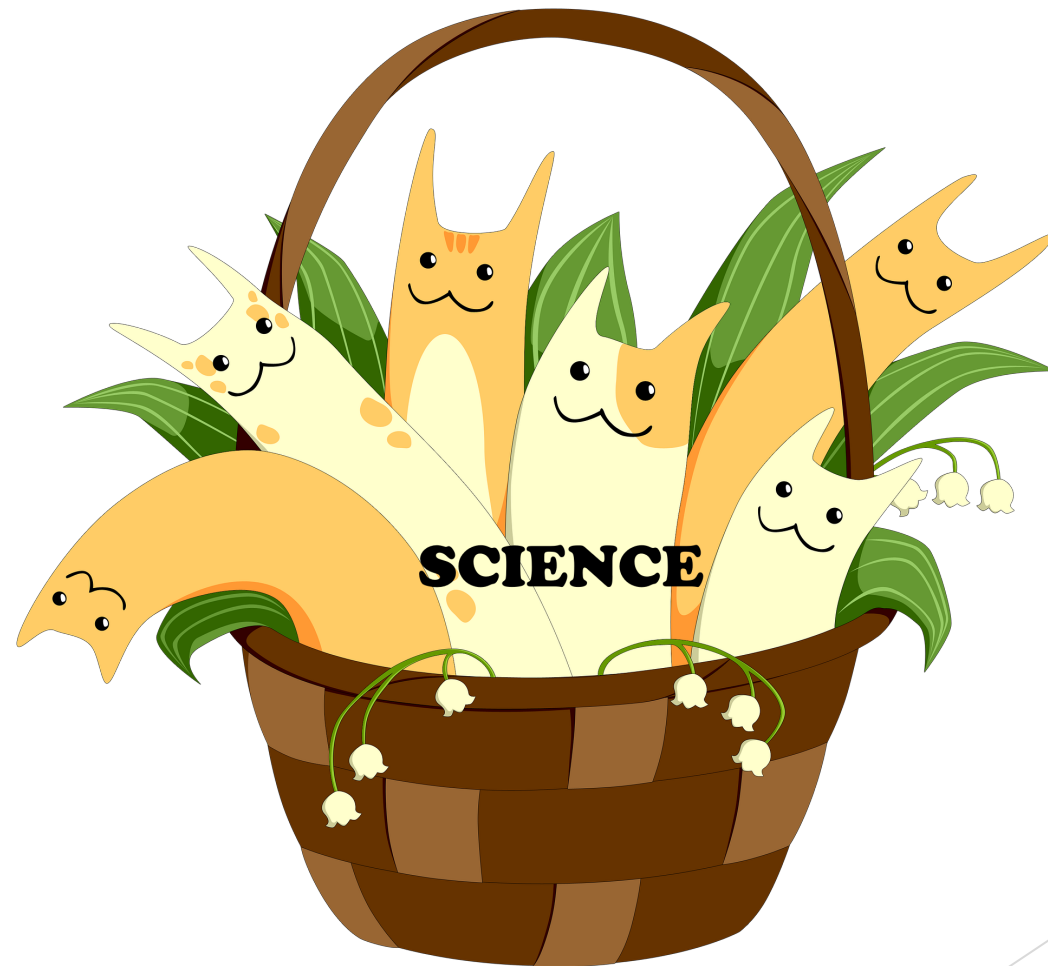


Read. Write. Science!

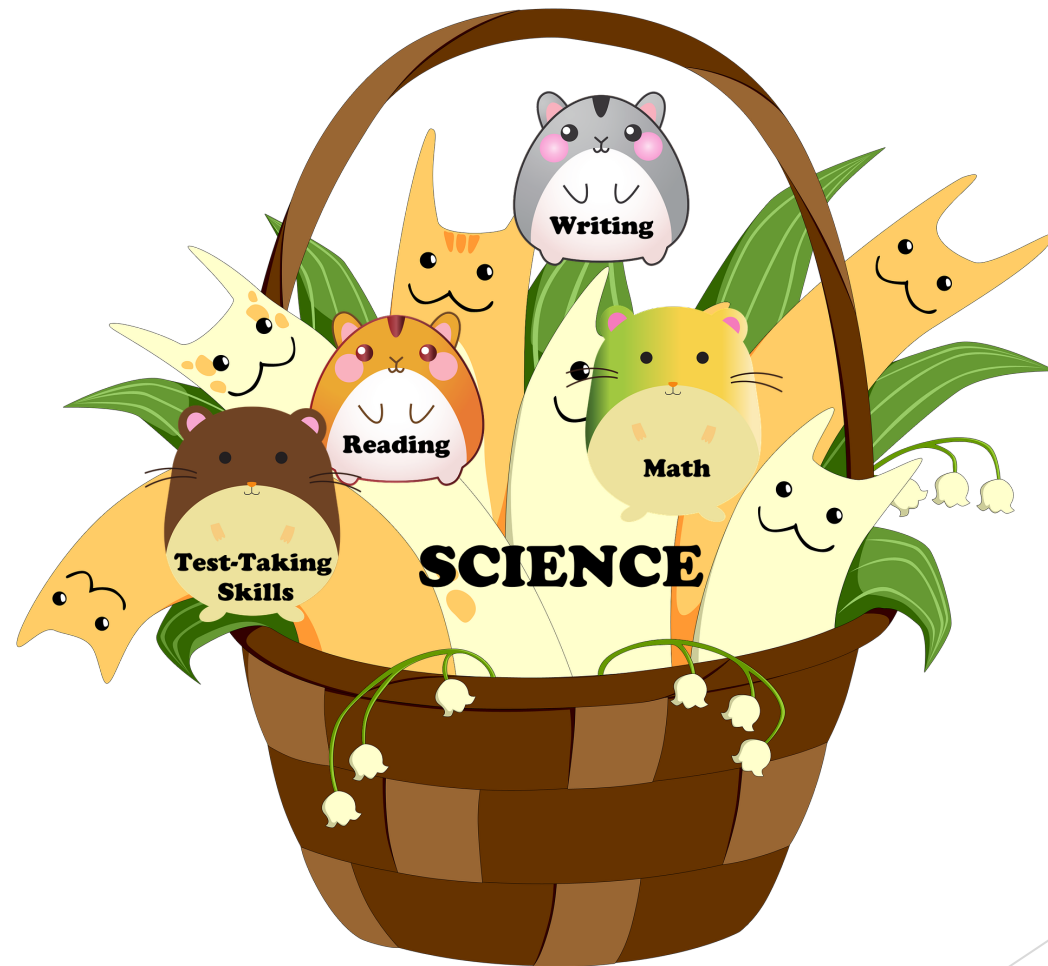
Literacy Strategies for 8th Physical and HS Biology

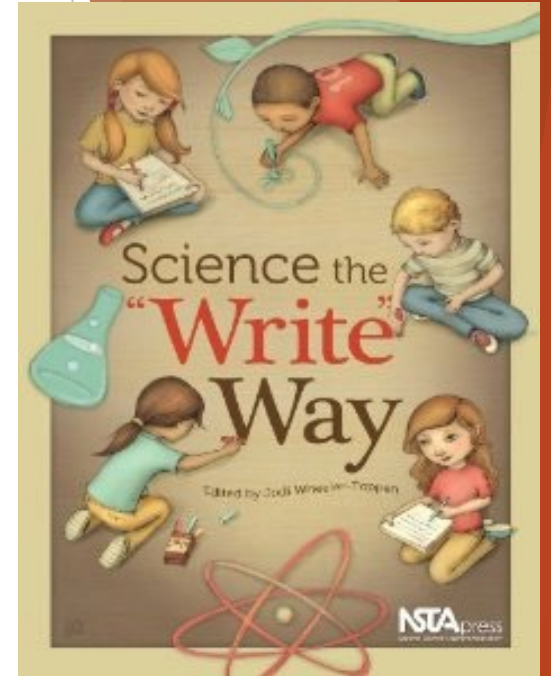
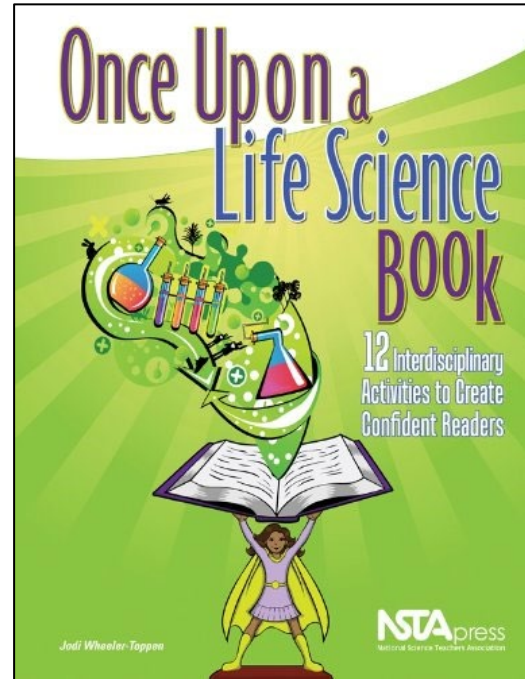
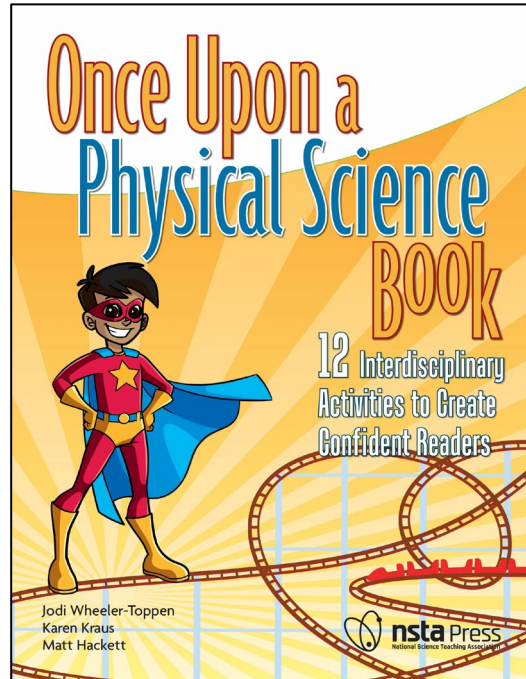
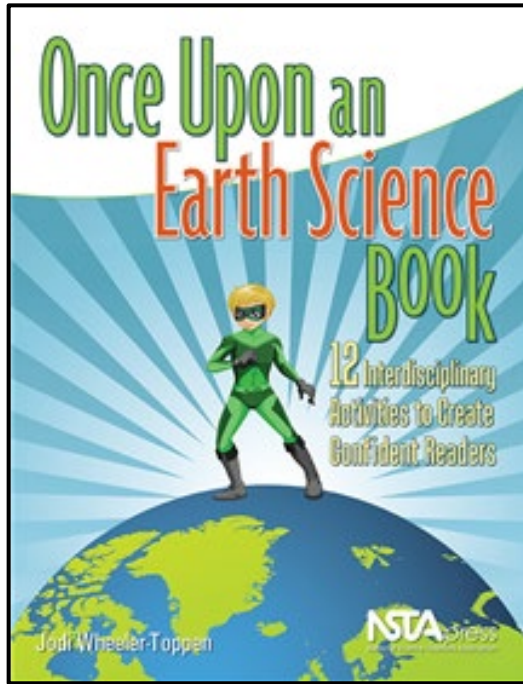
Jodi Wheeler-Toppen, Ph.D.

Why are we doing this?



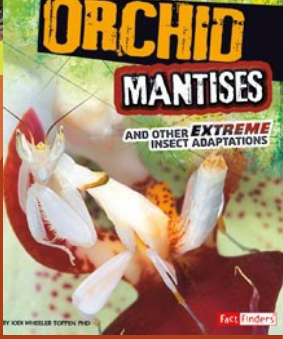
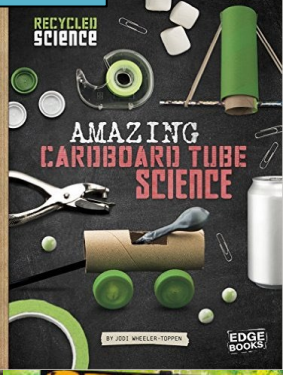
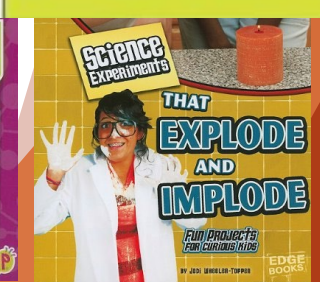
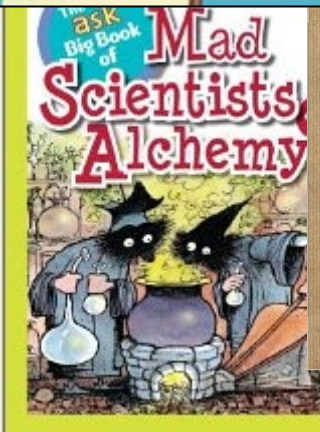
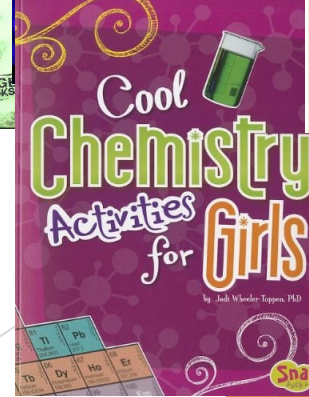
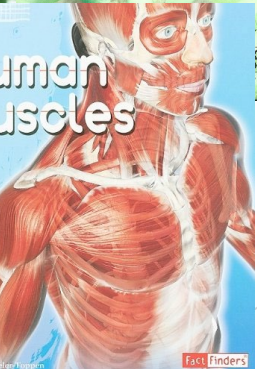
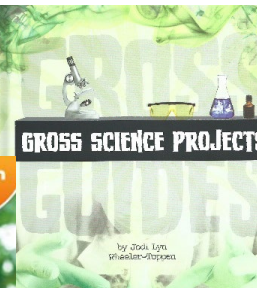
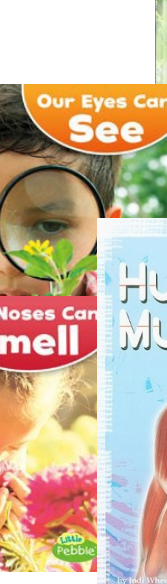
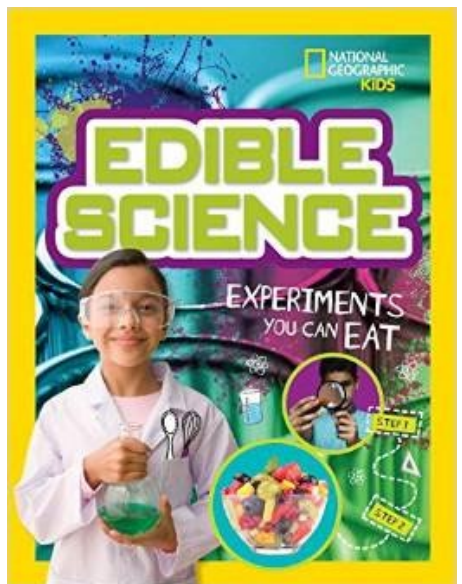
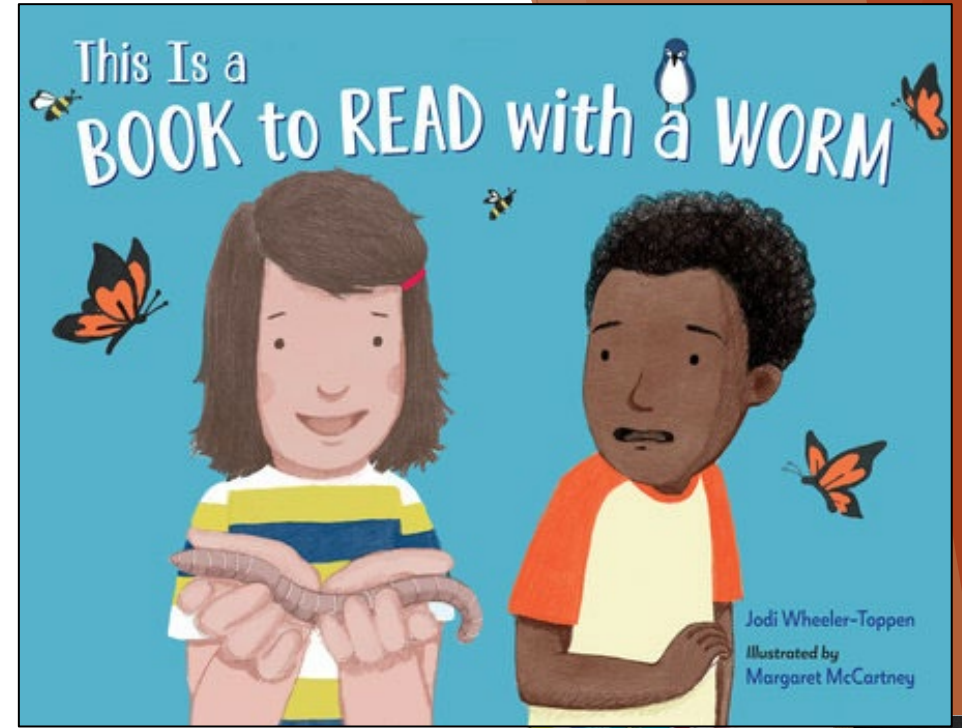
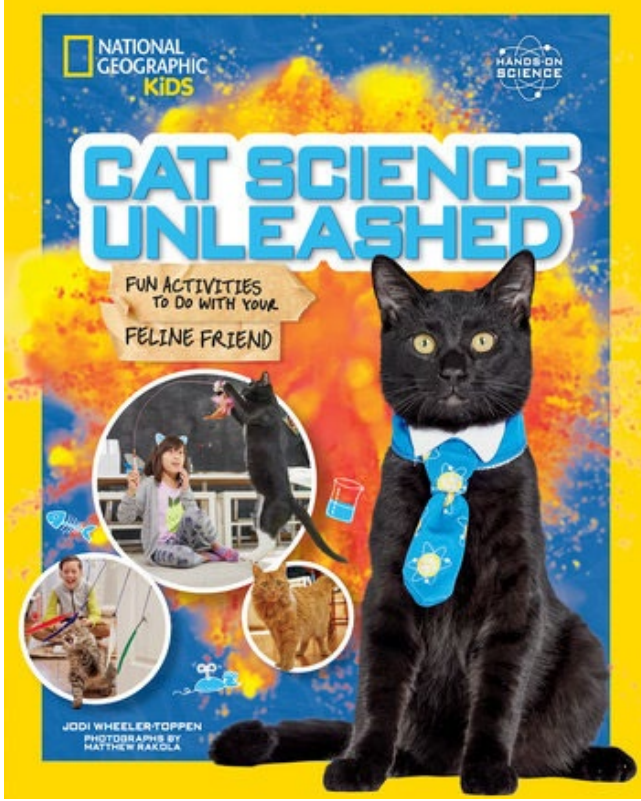
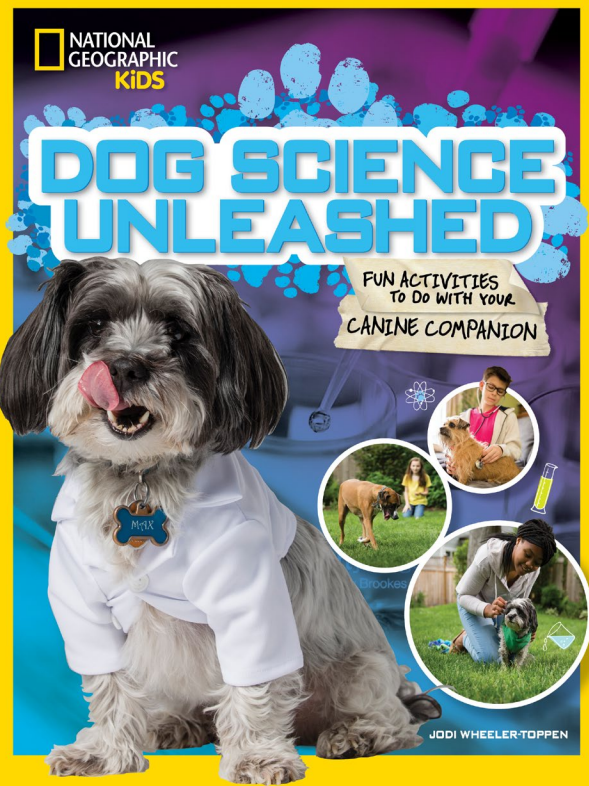
Why are we doing this?





Who I am and
How I ended up here

e



Find Powerpoint here.
Also, sign up for
newsletter!



OnceUponAScienceBook.com



wheelertop@gmail.com



WheelerToppen



@JodiWheelerToppen



@WheelerToppen

Connect with Me

Your Turn!

- ▶ Please share your name and something you are passionate about in your teaching.

What problems do we want to solve?

- ▶ Please share specific
 - ▶ problems that arise around reading and writing in your classroom
 - ▶ administrative requests (demands?) around reading or writing that you are having a hard time meeting

Agenda

- ▶ Work through a sample lesson (Physical Science—wave motion)
- ▶ Literacy Topic (Literacy Learning Cycles)
- ▶ Work through a sample lesson (Biology—evidence of evolution)
- ▶ Literacy Topic (Reading Struggles)

Break

- ▶ Work through a sample lesson (Physical Science—chemical equations)
- ▶ Literacy Topic (Choice and Resources)
- ▶ Work through a sample lesson (Biology—cell division)
- ▶ Literacy Topic (Reflection)

Sample Lesson 1: Wave Motion

Chapter 13 of *Once Upon a
Physical Science Book*



Part 1: Explore the wave machine

- ▶ Questions are on page 187-189 of Once Upon a Physical Science Book

Part 2: Learn About Waves

- ▶ Article on pages 190-192 (Chapter 13)

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

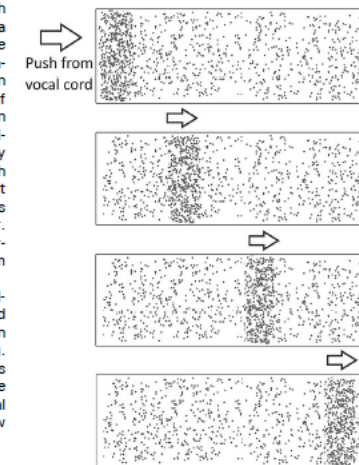
- I This is important.
- ✓ I knew that.
- X This is different from what I thought.
- ? I don't understand.

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



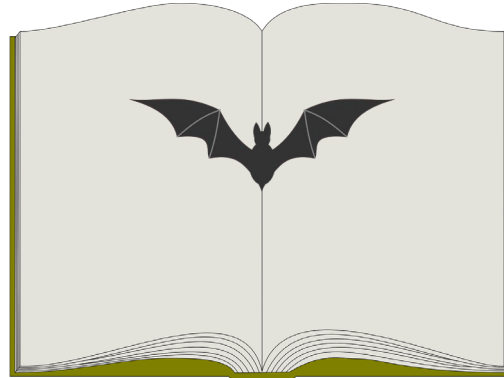
Part 3: Write about it

- ▶ Revisit the wave model. Use your 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. Feel free to include drawings or diagrams if they would be helpful!

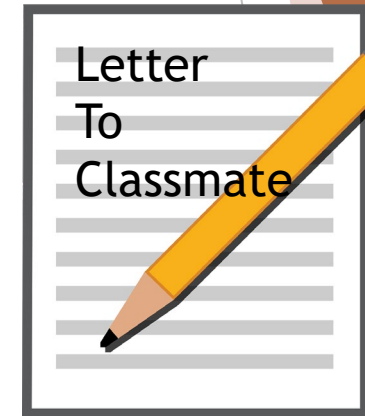
Lesson Structure



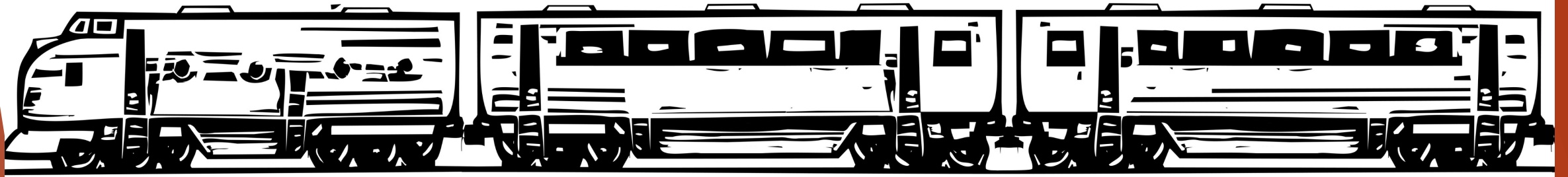
Real Science



Analytical Reading



Academic Writing



(Engage)

Exploration

Explanation

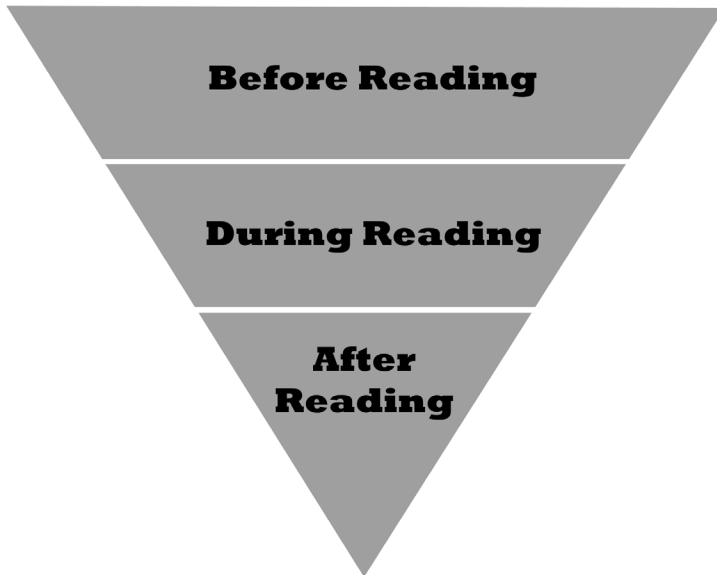
Concept Application

(Evaluate)

+

+

+



=

=

=

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

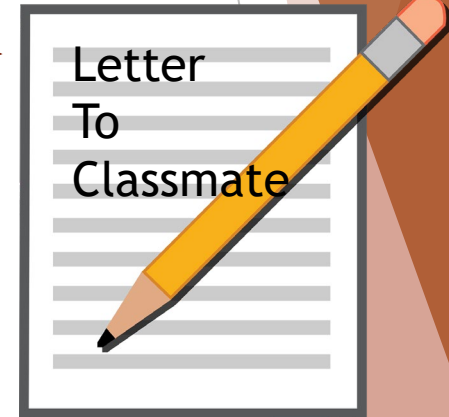
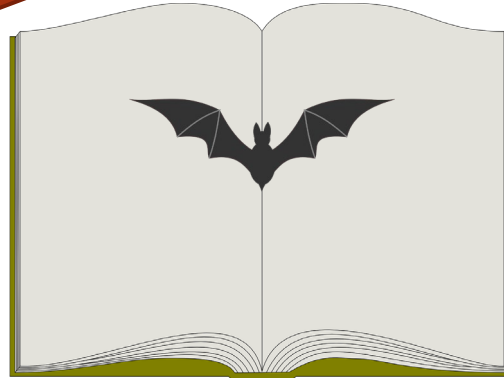
Reading Lesson
(after Berkeley and Barber 2015)

Literacy Learning Cycle

More Complex
Literacy Learning
Cycle

Specific Reading
Strategy

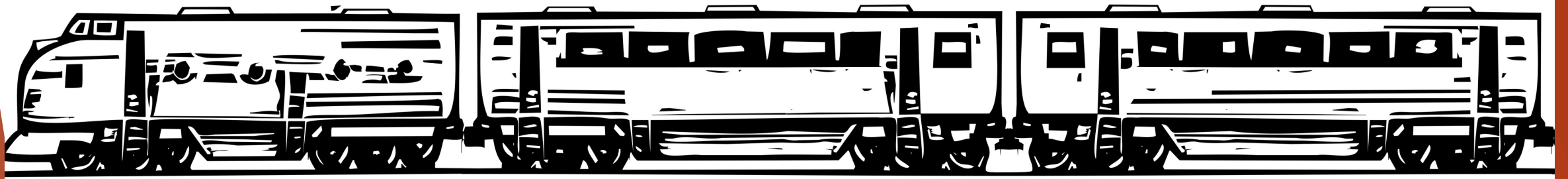
Specific Writing
Strategy



Real Science

Analytical Reading

Academic Writing



Reflection Point 1

Jot your thinking at this point. Consider questions such as:

- ▶ What part of what we've been doing/ talking about makes sense to you?
- ▶ What ideas for your own class do you have now?
- ▶ What do you disagree with or what would you do differently?
- ▶ What thoughts do you just need to get out of your head?
- ▶ What questions do you have?

Would anyone like to share any thoughts or questions?

As we go through the next sample lesson, be looking for these parts of a literacy learning cycle.



Humpback Whale
Photo by Lou Romig. CC-BY-3.0.
<http://www.fotopedia.com/items/louromig-8P4w6xtSgbY>

Sample Lesson 2: Hunting The Ancient Whales

(evidence of evolution)

From Chapter 15 of Once Upon a Life Science Book

Help! My Museum Display is a Mess!



Arrange the pictures in order from the one that looks the most like a land animal to the one that looks most like modern whales.

Jot down the order you pick. You can just write the first few letters of each name if you want!

Now we're going to read an article that explains more about these ancient whales, and how they were discovered. You can see if your order was correct!

► But First...

Reading Skill: Comprehension Coding

As you read, mark the article with the following codes:

! This is important

✓ I knew that

x This is different from what I thought

? I don't understand

You don't have to mark every sentence!

Coding

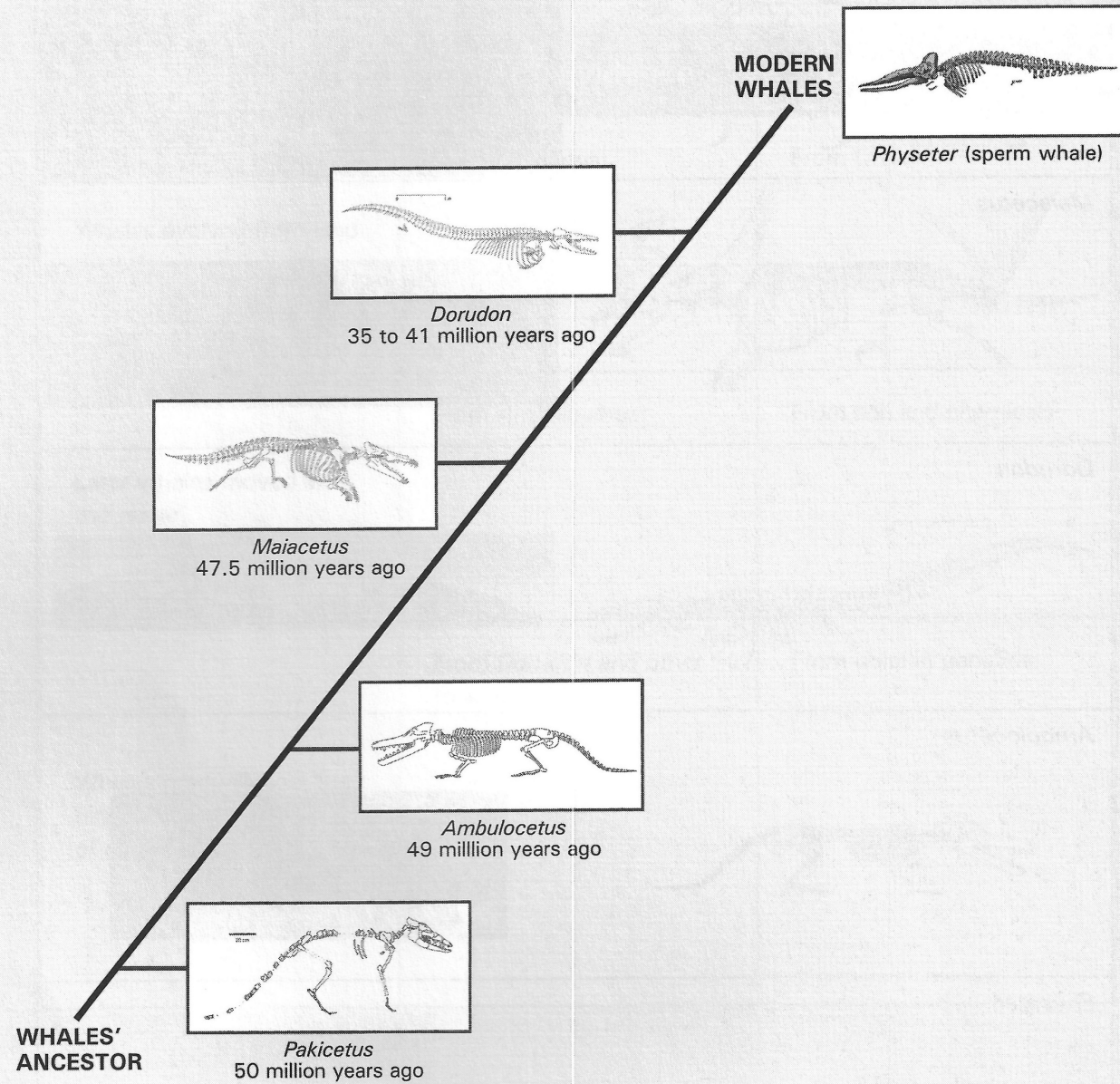
- ! *This is important*
- ✓ *I knew that*
- x *This is different from what I thought*
- ? *I don't understand*

Humans and whales are both mammals ✓. We both produce milk for our babies. We both have hair, although whales don't have very much. And some whales, like the bowhead, have even more in common with humans. They have small leg bones^{x,?} buried deep in their layers of fat. The whales don't need these bones. They are leftovers ! from millions of years ago, when whales walked on land.

Read 'Hunting the Ancient Whales' on p.150-151.

- ▶ Code. Use sticky notes if you are using a book.
- ▶ As you read, look for whether your cards were in the right order!

Relationships Between Some Whale Fossils



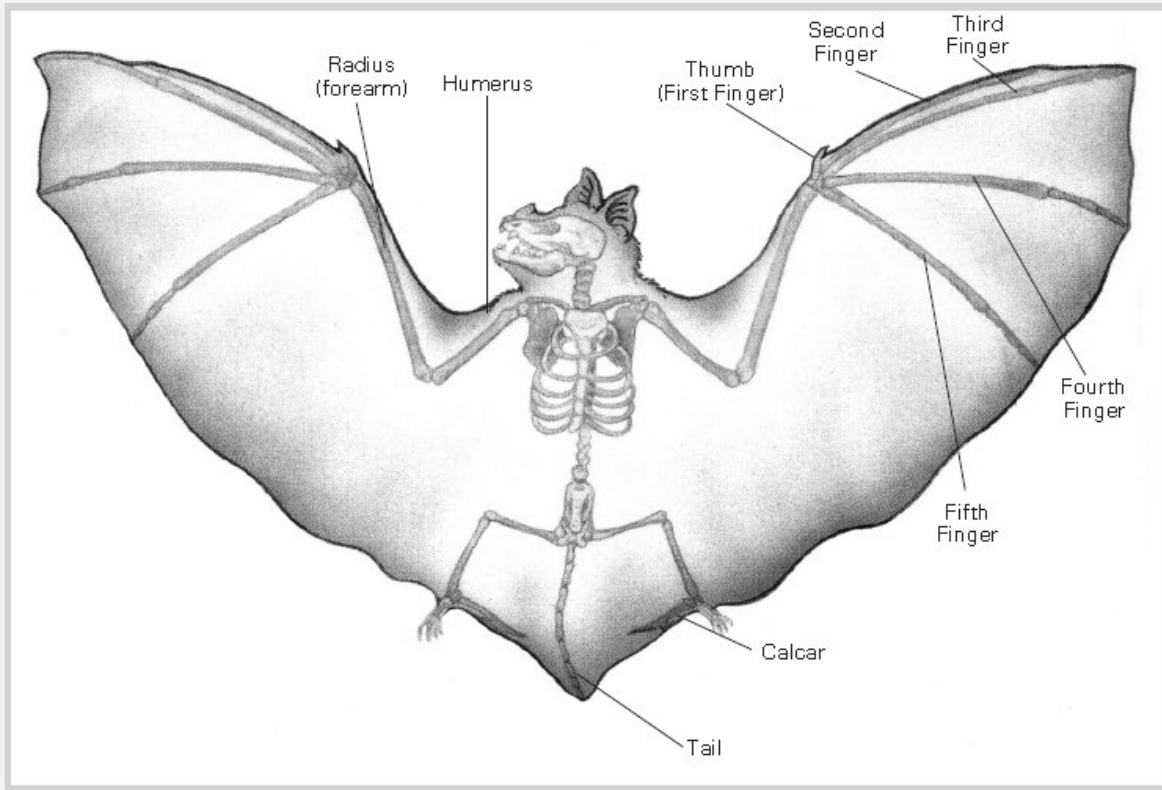
After Reading (p. 152)

Claim	Fossil Evidence	Other Evidence
Whales evolved from land animals.	From <i>Pakicetus</i> :	From DNA:
Later whales moved into the water.	From <i>Ambulocetus</i> :	From soil and chemicals:
Whales gradually lost their hind legs over the course of evolution.	From <i>Dorudon</i> and other fossils:	From dolphin genetics:

Writing Prompt

Going Batty

Horseshoe Bat Skeleton



Bats also have an interesting evolutionary history. They are mammals, like humans and whales, but they fly in the air like birds. Bat ancestors would have lived on the land. How did they develop into flying mammals? Scientists haven't collected as much information on bat evolution as they have on whale evolution, but they are working on it.

Suppose you were a scientist who wanted to study bat evolution. What kinds of evidence would you look for? What would you hope to find out from each kind of evidence?

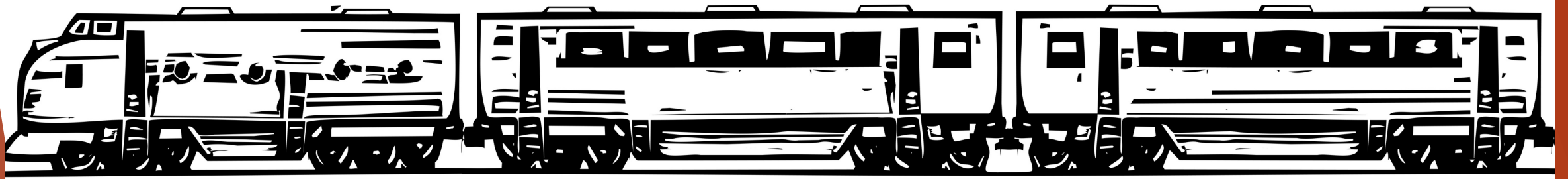
(Hint: if you get stuck think about the types of evidence scientists used to learn about whale evolution.)

What were our lesson parts?

Real Science

Analytical Reading

Academic Writing



Three Impediments to Reading Success



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)

3 Impediments to Learning from Text

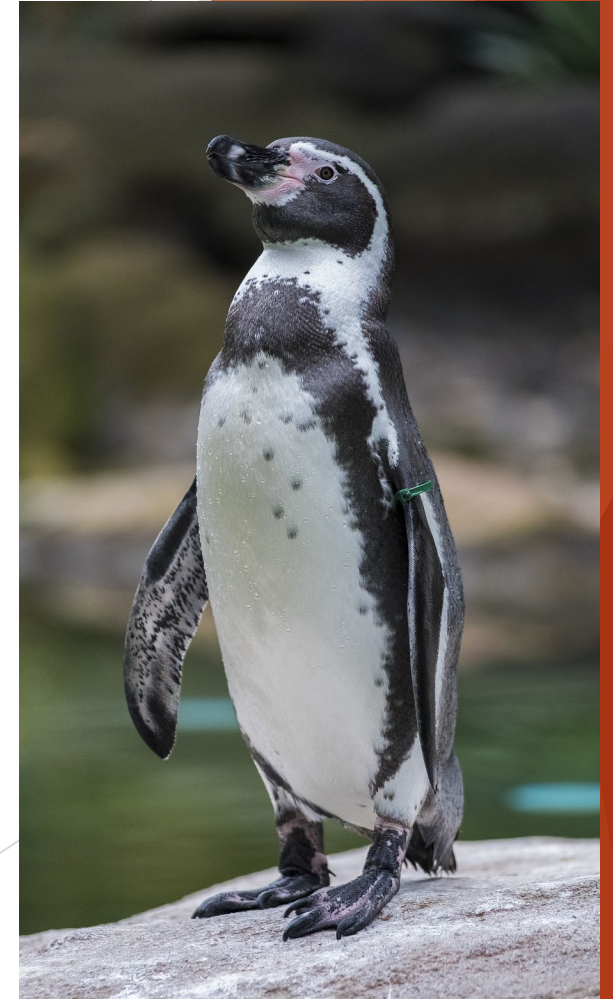
Impediment 1: Students do not expect what they are reading to make sense.

Start the 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.
 - ▶ *You can introduce this idea with drawing (which is non-verbal).*
- ▶ Model the kind of thinking that successful readers use through Thinking Aloud

Model What Strong Readers Do (Think Aloud)

All penguins, even those that live in the tropics, have thick, waterproof feathers that keep them warm and dry in the water. These feathers are organized in a pattern called countershading. When they swim, the black feathers on their backs help them hide from any predators looking down from above at the dark ocean water. Similarly, the white feathers on their bellies blend into the light of the sky if they are viewed from below.



3 Impediments to Learning from Text

Impediment 1: Students do not expect what they are reading to make sense.

Responses:

- Start a classroom conversation about making sense of what you read.
- Model what successful readers do.

Impediment 2

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.

3 Impediments to Learning from Text

Impediment 2: Students do not know the things that the author assumes they already know.



Young California Condor

(US Fish and Wildlife)



“Some people were afraid
the condor would soon be
gone.”

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



~~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)

3 Impediments to Learning from Text

Impediment 2: They lack background knowledge assumed by the text.

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.

Impediment 3

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?

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 that they cannot answer by just copying sentences. Make them use the text in sensemaking!)

Reflection Point 2

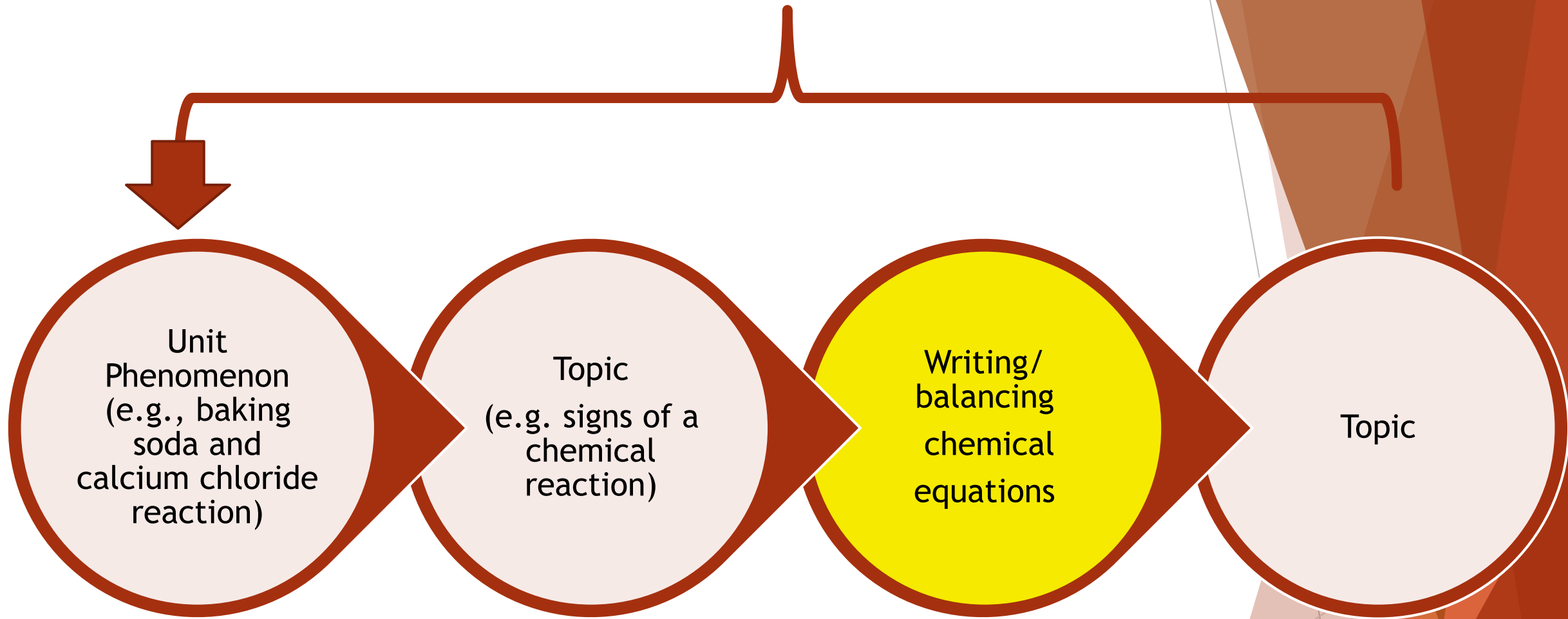
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- ▶ What part of what we've been doing/ talking about makes sense to you?
- ▶ What ideas for your own class do you have now?
- ▶ What do you disagree with or what would you do differently?
- ▶ What thoughts do you just need to get out of your head?
- ▶ What questions do you have?

Would anyone like to share any thoughts or questions?



Sample Lesson 3: Chemical Reactions (Equations)



Unit: Chemical Reactions

1

Soak your iron wool pad in vinegar *to remove the coating*. Then squeeze out as much vinegar as you can.

2

Put the iron wool in your plastic bag with the thermometer.

3

Write down the temperature on your thermometer.

4

Leave the bag slightly open, thermometer visible.

What can we observe at the macro level?

- ▶ What observations can you make?
- ▶ What kinds of guesses do you have about what is happening?

Let's explore what's happening on the molecular level with a model.

What are our ingredients?



What is being made?

We can represent this equation with symbols, and that poses a particular reading challenge.

Chemical equations can be used to describe what is happening in a chemical reaction. The reaction for creating rust might be written:



In this equation, iron and oxygen are the starting materials, called reactants. Fe_2O_3 , the new molecule of rust, is called the product. Notice that as a reactant, oxygen is written O_2 . Oxygen atoms do not hang out by themselves. An individual oxygen atom will join another oxygen atom to form one molecule. Oxygen gas is written as O_2 in equations to show that the oxygen is present in pairs. There is a problem with this equation, however.

Reading: Frostbite Free

- ▶ Remember to use “back and forth” reading to make sense of the equations.
- ▶ Try to figure out what is going on inside a handwarmer.

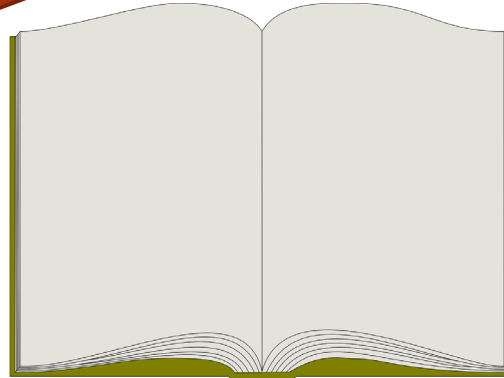
Write It!

- ▶ Imagine that you are writing an insert for the package to explain to users how the handwarmer works. Include at least one *equation* in your answer.

More Complex
Literacy Learning
Cycle

Specific Reading
Strategy

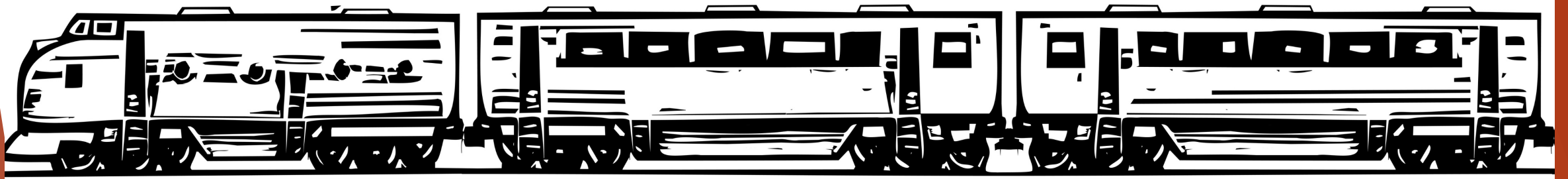
Specific Writing
Strategy



Real Science

Analytical Reading

Academic Writing



Biology Resource

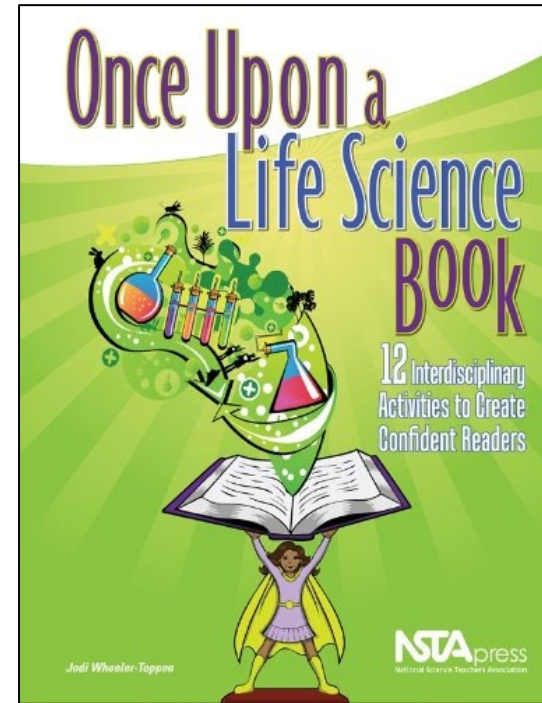
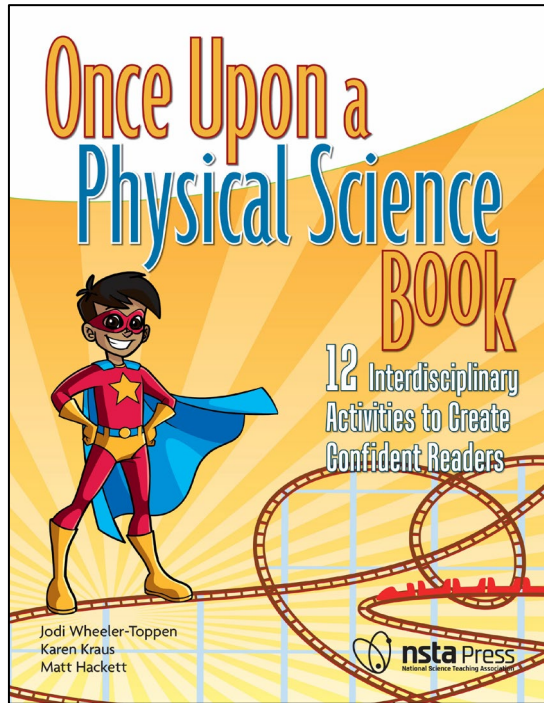
Similar activity based on photosynthesis and respiration

<https://www.calacademy.org/educators/lesson-plans/modelling-photosynthesis-and-cellular-respiration>

You could use an excerpt from a textbook for your text to read after the simulation.

Literacy Topic: Choice and Resources

Video (pick a topic); Looking through the life/ physical books; resources on website related to the books; GADOE lessons

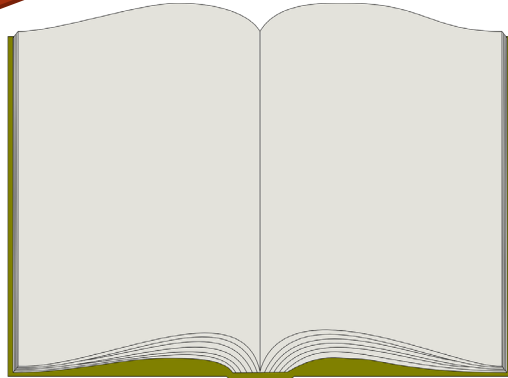


Where can I find Literacy Learning Cycles?

More Complex
Literacy Learning
Cycle

Specific Reading
Strategy

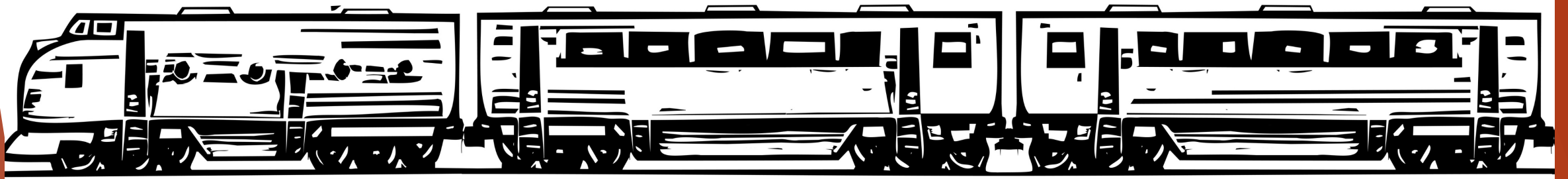
Specific Writing
Strategy



Real Science

Analytical Reading

Academic Writing



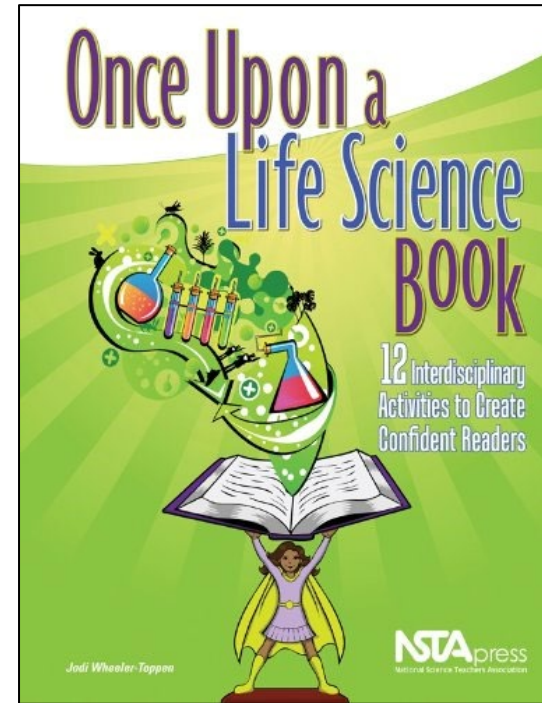
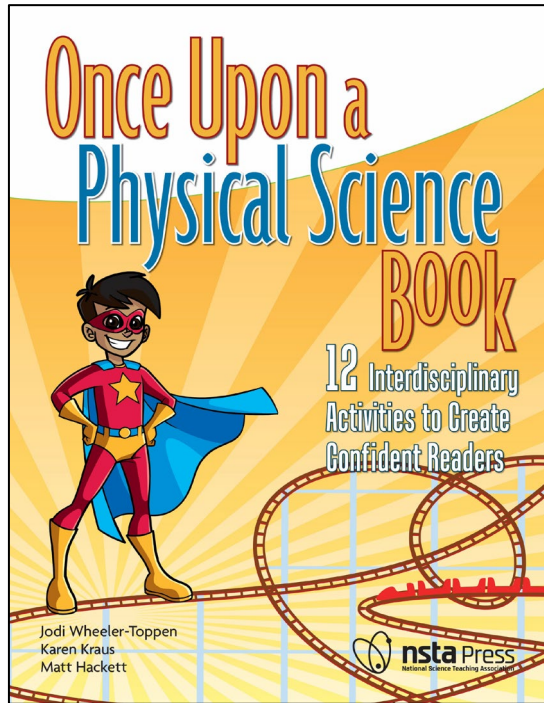
Related Resources

- ▶ <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>

Georgia DOE Literacy Learning Cycles

- ▶ 6th Grade Science Literacy Task: Tornadoes
- ▶ 7th Grade Science Literacy Task: Cells
- ▶ 8th Grade Science Literacy Task: Mixtures

GA DOE may be looking for writers for this style lesson for next summer. I can put your name in if you are interested.



Where can I find more support for reading and writing strategies?

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](#)

Reflection Point 3

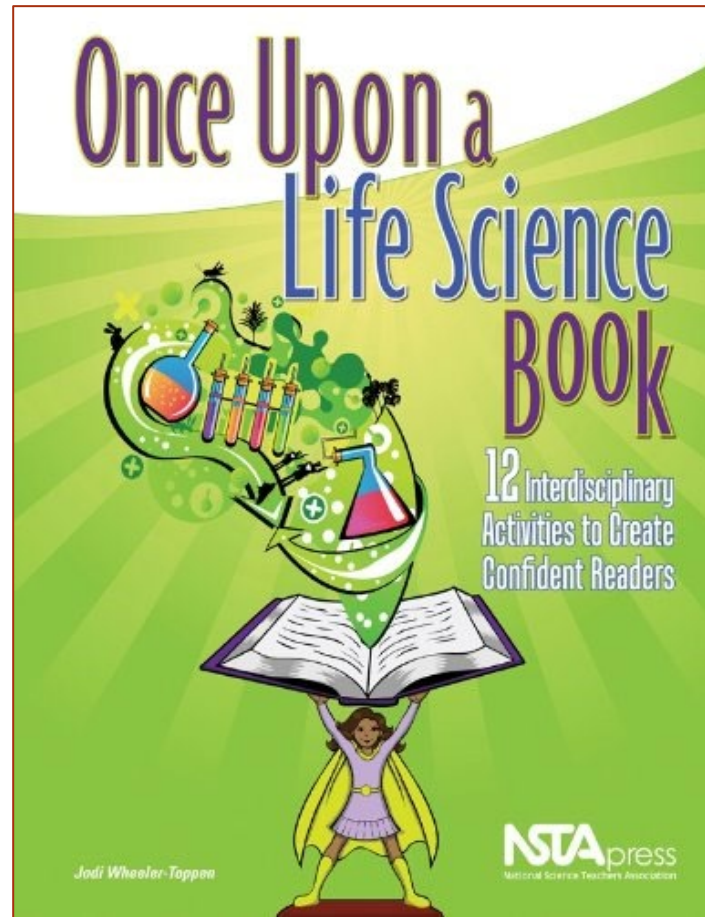
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Would anyone like to share any thoughts or questions?

Healing Powers

Chapter 6

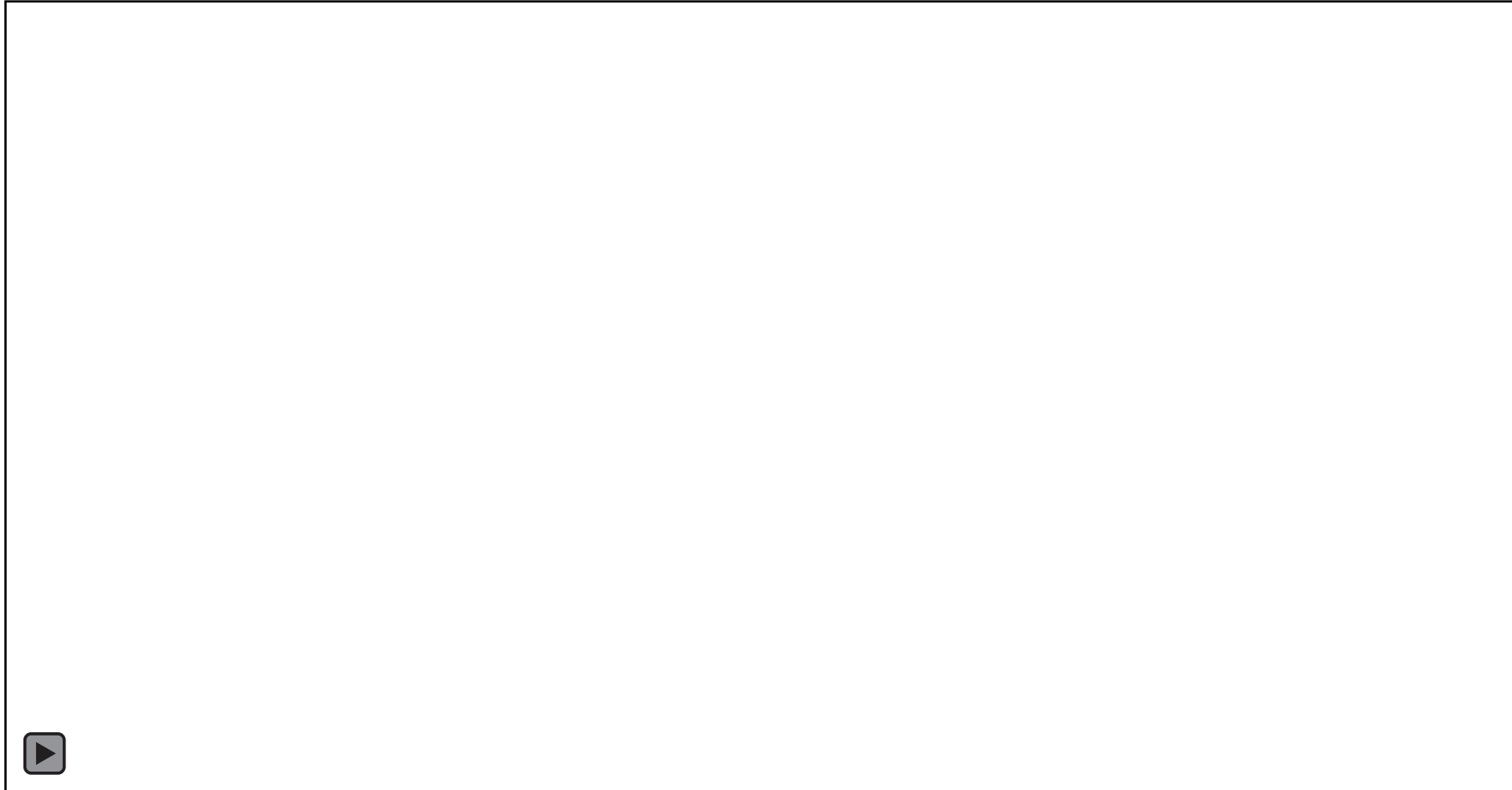


Be the Narrator!

- ▶ https://www.cellalive.com/mitosis_js.htm



(Set Up)



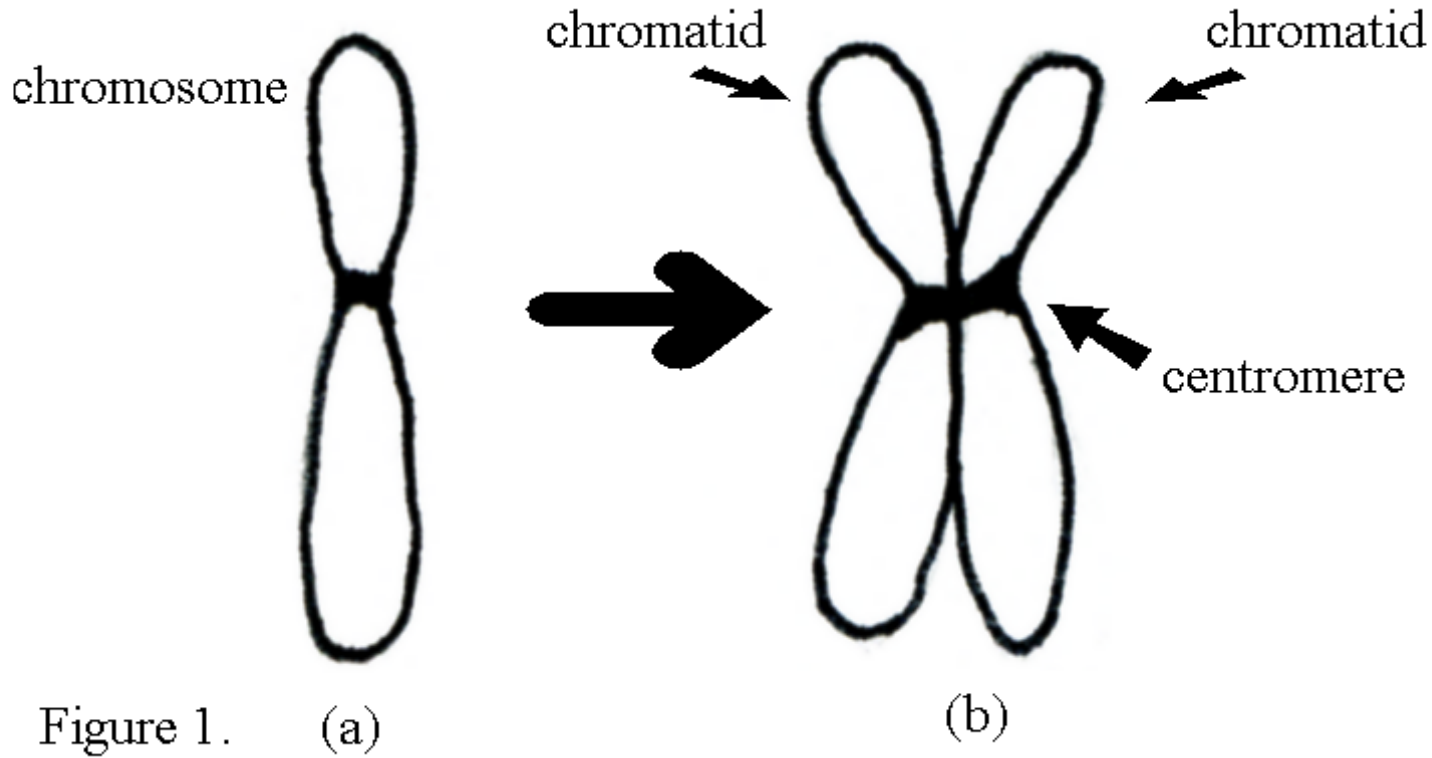
What process do you think the video was showing?

- ▶ This process is fairly simple, but biologists use a lot of vocabulary to describe it. You'll be reading an article that will explain the process and teach the words that biologists use when talking about cell division.

Reading Strategy: Previewing Diagrams and Illustrations

Because pictures in science books
MATTER!

Grab a Partner.



Partner 1: Does this look like anything you saw in the video?

Partner 2: What does the diagram tell you about the X's you saw in the video? What are they called?

Partner 1: Prediction--What do you think the diagram is showing in part B?

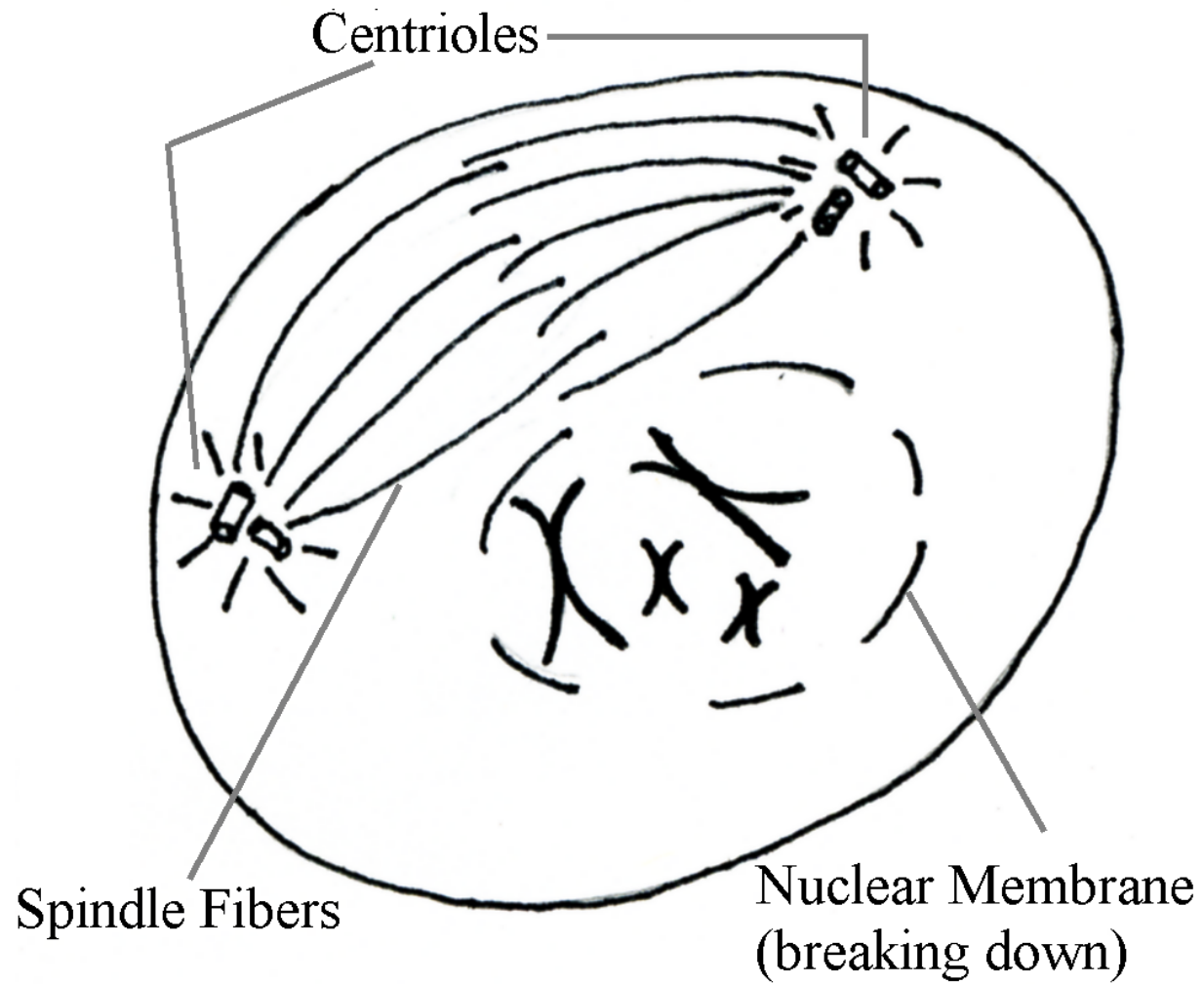


Figure 2. Prophase

Partner 2: What new cell parts are shown in this diagram?

Partner 1: Prediction--What might those parts do?

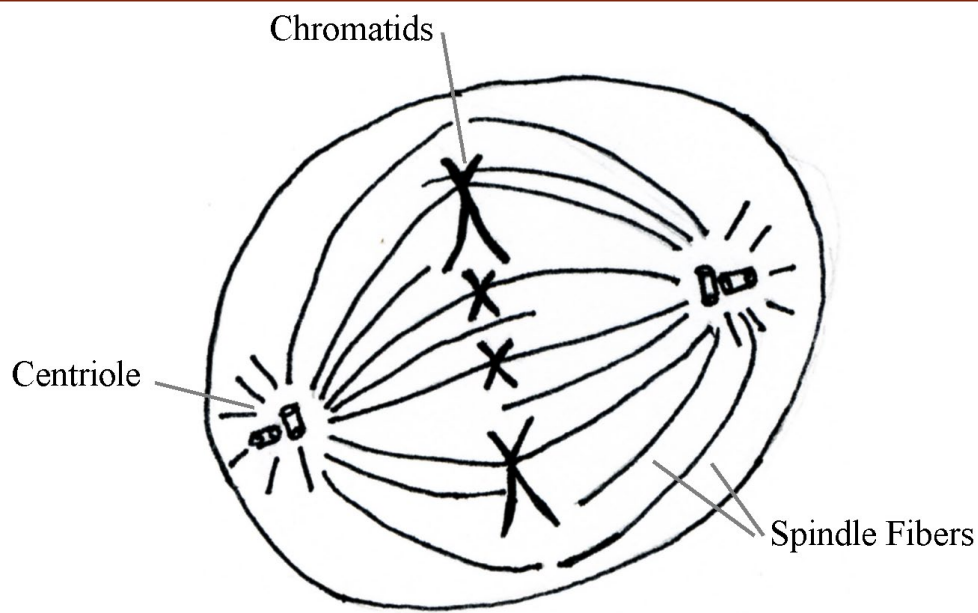


Figure 3. Metaphase

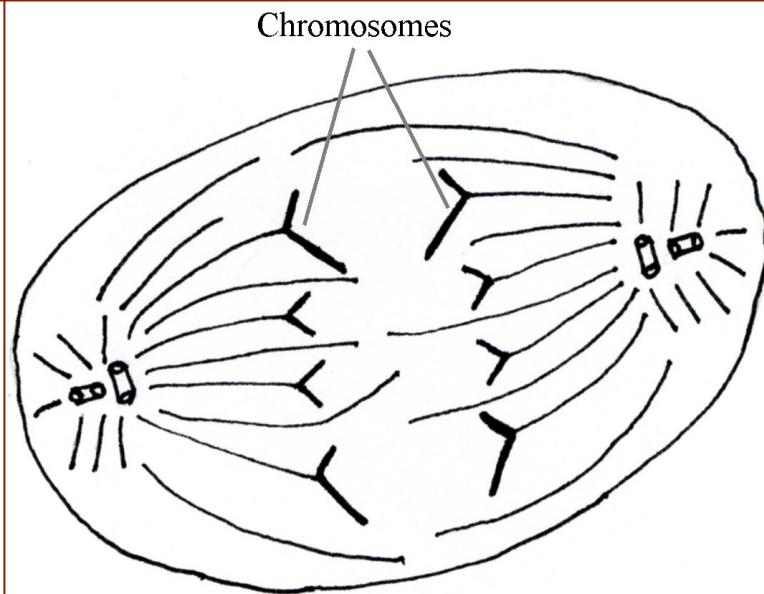


Figure 4. Anaphase

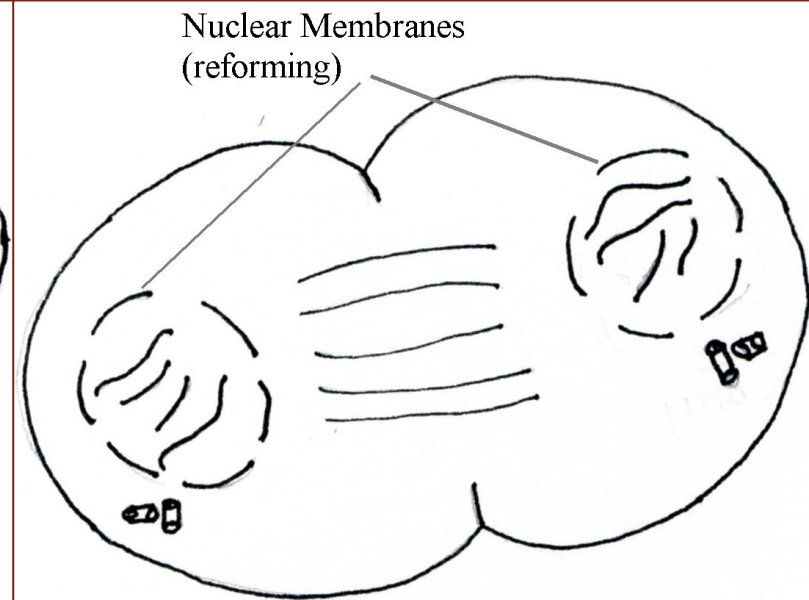
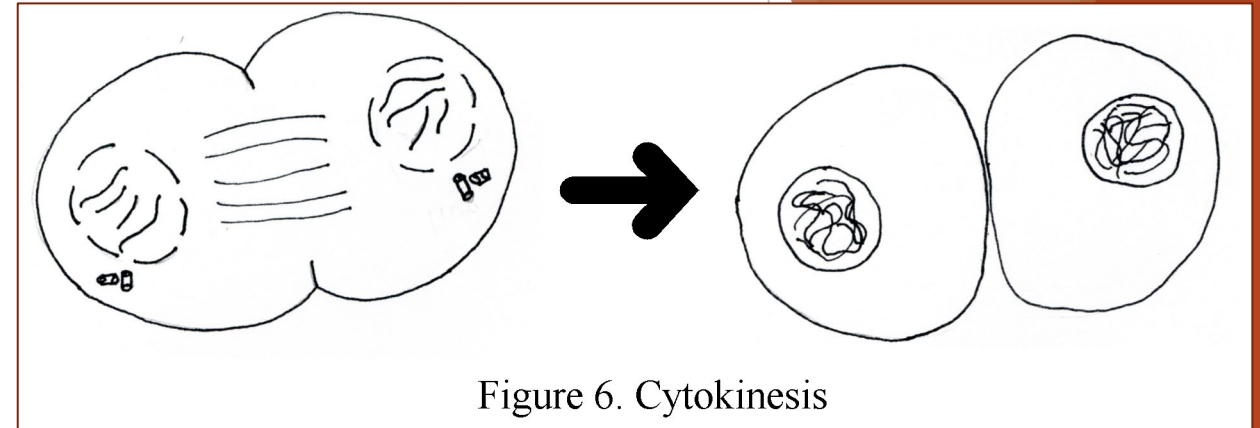
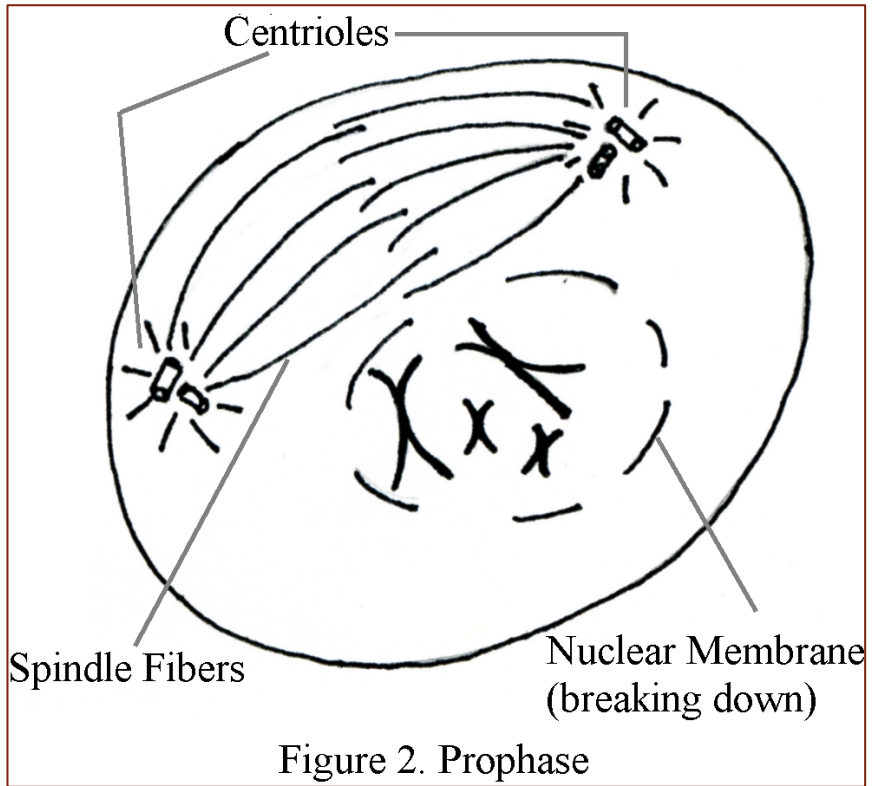


Figure 5. Telophase

Partner 2: Do you notice anything that looks different from what you saw in the animation?

Partner 1: What cell part reappears in Figure 5?



Partner 2: How many cells were there to start?

Partner 1: How many cells are there after the arrow in Figure 6?

Partner 2: How many chromosomes were in the cell originally?

Partner 1: How many are in each nucleus at the end?

Read the article *Healing Powers*
(p. 57-59).

Be watching to see if your
predictions were correct!

Writing Assignment:

- ▶ Revisit the description that you wrote while viewing the animation. Now you know all the correct vocabulary to use to describe what's happening.
- ▶ Translate what you wrote into “science language” using the new words you learned from the article.

What vocabulary will you want to be sure to include?

Literacy: *Moving Forward*

- ▶ Let's revisit the concerns from the beginning of the session.

Reflection Point 4

- ▶ **Action Items.** List specific things you want to do to follow-up on things you learned/ thought about today.
- ▶ Plan to put this list somewhere where you will see it and act on those items.

Would anyone like to share any thoughts or questions?

Reflection Point 4

- ▶ **Challenge.** We will have a follow-up gathering in January. Between now and then, try at least one time to teach using a literacy learning cycle (with or without a specific reading or writing skill).
- ▶ Take a few minutes now to think about what topic you might try this on. What might you do for each phase of the lesson?

Would anyone like to share any thoughts or questions?

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