# Read like a scientist

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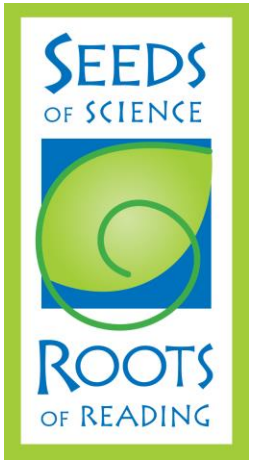
# The Learning Design Group




AmplifyScience.

www.scienceandliteracy.org
www.learningdesigngroup.org
www.argumentationtoolkit.org
www.sciencearguments.weebly.com

# We set out to investigate a model of science instruction that:

Includes a balance of learning modalities
DO-TALK-READ-WRITE

Employs reading and writing in ways that are authentic to science

Provides students (and teachers) with explicit instruction in literacy skills and strategies

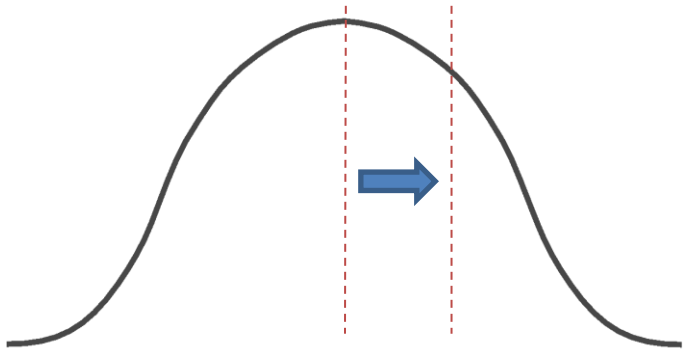
# Three Gold Standard Studies

- UCLA's CRESST
- 89 classrooms.
- Random assignment to treatment and comparison groups
- Comparison group: content-comparable, business-as-usual

# A Better Way to Learn Science

- Our combined science literacy program can elevate students previously scoring the 50th percentile in science into the top third of their peers.

Average effect size: 0.61 (Cohen's D)



# Gains in Literacy as well as Science

Positive Results Across the Board:

**STUDENTS**

Out-perform control students on measures of:

- science conceptual knowledge
- science vocabulary

Perform equivalently or higher than control students on measures of:

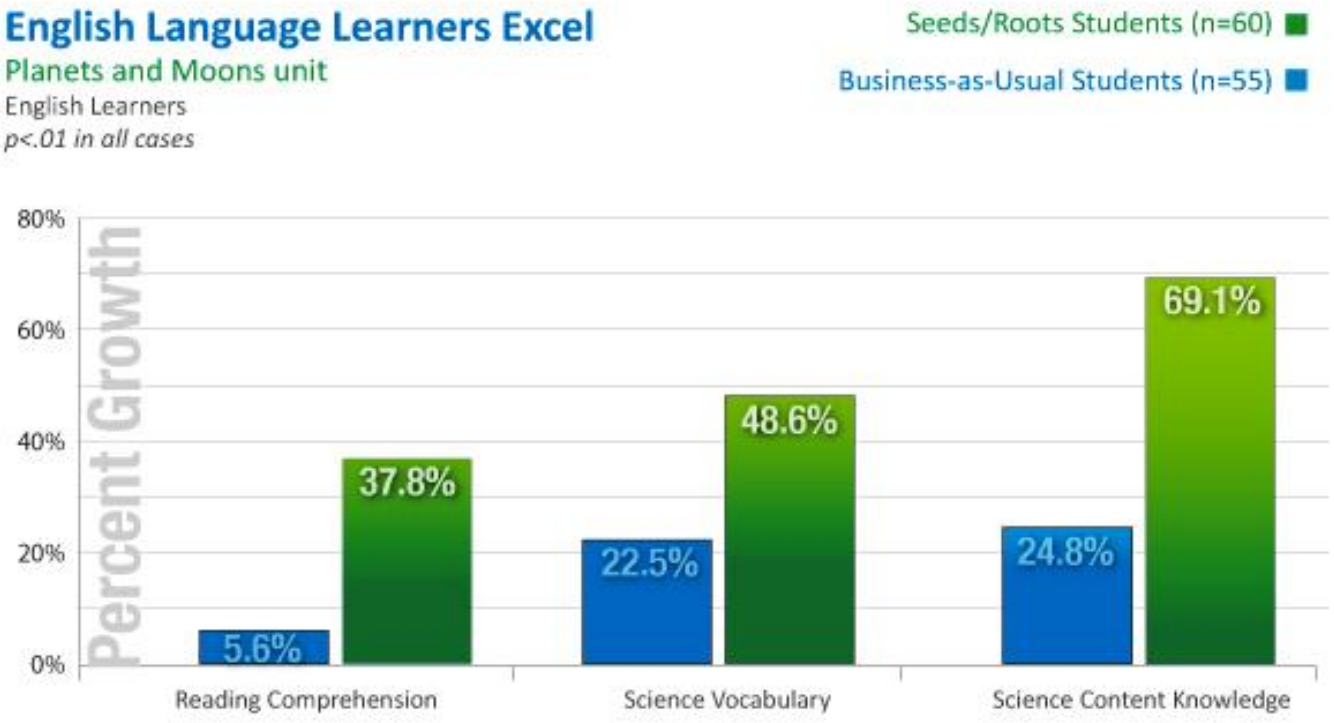
- science reading comprehension
- science writing

**TEACHERS**

Spend more time teaching science than control teachers

Have more student-to-student talk in their classrooms

# Advantage Holds for English Learners



# Our Basic Approach to Literacy-Rich Science Learning

| | |
|---|---|
| DO | **TALK** |
| **READ** | **WRITE** |

# Doing Science

## Need a Question:
## What do Magnets Attract?

| | |
|---|---|
| DO | **TALK** |
| **READ** | **WRITE** |

# Our Approach

## Gather evidence from firsthand and secondhand sources

### DO: Search for Evidence through Experience

### READ: Search for Evidence in Text

| ct | Kind of metal | Does a mag attract it? |
|---|---|---|
| can | aluminum | no |
| r clip | steel (mostly made of iron) | yes |
| y | copper and zinc | no |
| | aluminum | no |
| | iron | yes |
| | zinc and iron | yes |
| n's necklace | silver | no |
| 's ring | gold | no |
| l wool | steel (mostly made of iron) | yes |
| in kitchen | steel (mostly made of iron) | no |
| under sink | copper | no |
| ng pan | iron | yes |
| lamp | brass (made of copper and zinc) | no |

# Our Approach

## Written + Oral Discourse
## (for a purpose)

### TALK: Discuss claims

### WRITE: Write explanations

# As Opposed to “Doing School”

DO: Students investigate with magnets

READ: Students read about magnets

WRITE: Students write what they learned about magnets

# Our Approach

Engage in the practices of science

| | |
|---|---|
| DO | **TALK** |
| **READ** | **WRITE** |

Have students **read**, **write**, and engage in **talk** as practices of science

Read like a scientist

Write like a scientist

Discuss like a scientist

Argue like a scientist

Practice 1:
Ask questions

Practice 4:
Analyze and
interpret data

Practice 5:
Use mathematics
computational thinking

# Read like a scientist

Practice 6:
Construct
explanations

Practice 7:
Engage in argument
from evidence

Practice 8:
Obtain and evaluate
information

# 3 Important Shifts

Read like a student → Read like a scientist

- Goal for reading
- Approach to reading
- Purpose for reading

# Different outlook about the goal of reading

## How do students view reading?

- With the goal of absorbing what the text says

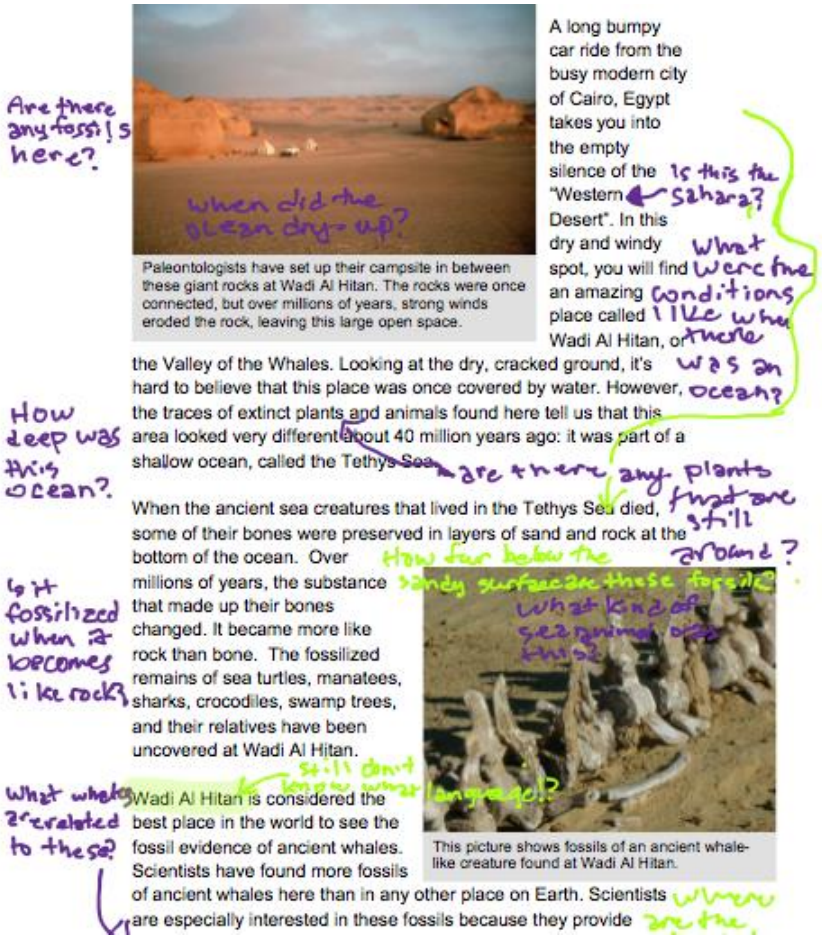
## How do scientists view reading?

- As an act of inquiry

# Different outlook about the goal of reading

## How do scientists view reading?

- As an act of inquiry



What language is this?

# Wadi Al Hitan (Valley of the Whales)


Paleontologists have set up their campsite in between these giant rocks at Wadi Al Hitan. The rocks were once connected, but over millions of years, strong winds eroded the rock, leaving this large open space.

Are there any fossils here?

A long bumpy car ride from the busy modern city of Cairo, Egypt takes you into the empty silence of the "Western Desert". In this dry and windy spot, you will find an amazing place called Wadi Al Hitan, or the Valley of the Whales. Looking at the dry, cracked ground, it's hard to believe that this place was once covered by water. However, the traces of extinct plants and animals found here tell us that this area looked very different about 40 million years ago: it was part of a shallow ocean, called the Tethys Sea.

Is this the Sahara?

What were the conditions like when there was an ocean?

How deep was this ocean?

are there any plants that are still around?

When the ancient sea creatures that lived in the Tethys Sea died, some of their bones were preserved in layers of sand and rock at the bottom of the ocean. Over millions of years, the substance that made up their bones changed. It became more like rock than bone. The fossilized remains of sea turtles, manatees, sharks, crocodiles, swamp trees, and their relatives have been

How far below the sandy surface are these fossils?

What kind of sea animal is this?

Is it fossilized when it becomes like rock?

# Supports for learning how to read like a scientist

## Provide explicit instruction in:

- how to have a conversation with the text
- comprehension strategies, such as asking questions making inferences, setting a goal for reading, making predictions

# Our Approach

## Don't Assume

| | |
|---|---|
| DO | **TALK** |
| **READ** | **WRITE** |

That students know how to

**read** science text, **write** science text,

and engage in science **talk**

# Different approaches to reading

## How do students read?

- From beginning to end

## How do scientists read?

- Skip around
- Use headings
- Read captions
- Compare text descriptions to visual representations
- Check their understanding

# Different approaches to reading

## How scientists read

- Skip around

### Contents

# Different approaches to reading

## How scientists read

- Compare text descriptions to visual representations

Poison oozes from a rough-skinned newt's skin.

# Supports for learning how to read like a scientist

## Provide explicit instruction in:

- use of text features
- interpreting visual representations
- Comparing text and visual representations

# Different purposes for reading

## Why do students read?

- Because the teacher assigned a reading
- To learn information

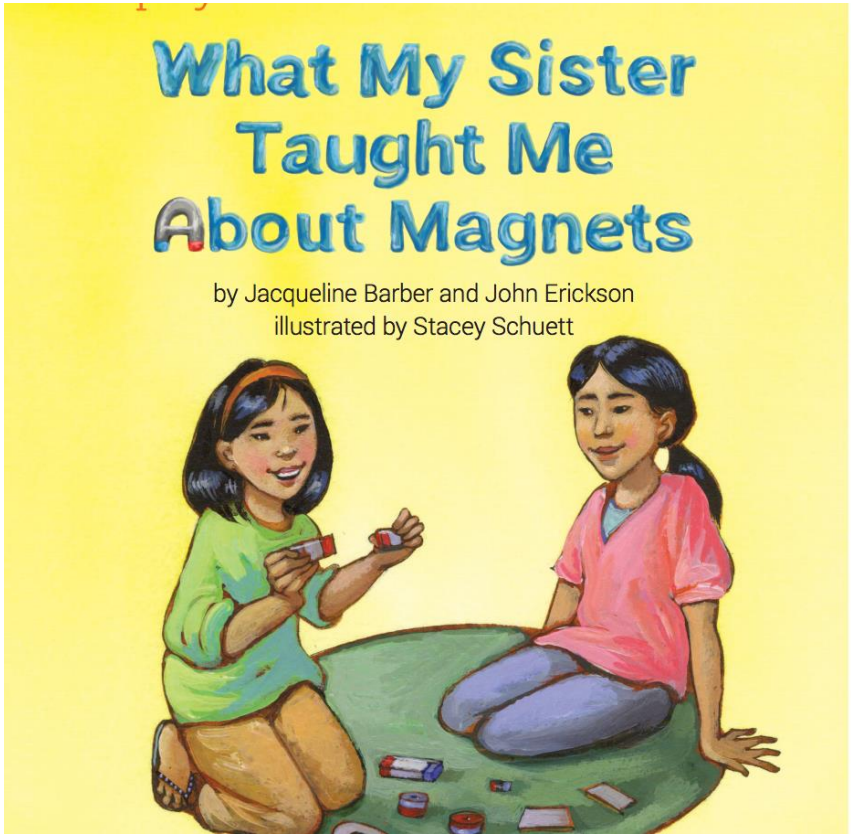
## Why do scientists read?

- To situate their research
- To interpret others' data and critique their findings
- To find specific information to support their own investigations
- To learn about others' procedures and experiments
- To learn what other scientists are learning

# Opportunities for students to engage in reading for multiple purposes

## Why Scientists Read

- To situate their research
- To interpret others' data and critique their findings
- To find specific information to support their own investigations
- To learn about others' procedures and experiments
- To learn what other scientists are learning



# Why do some metals attract magnets and some do not?

## Why Scientists Read

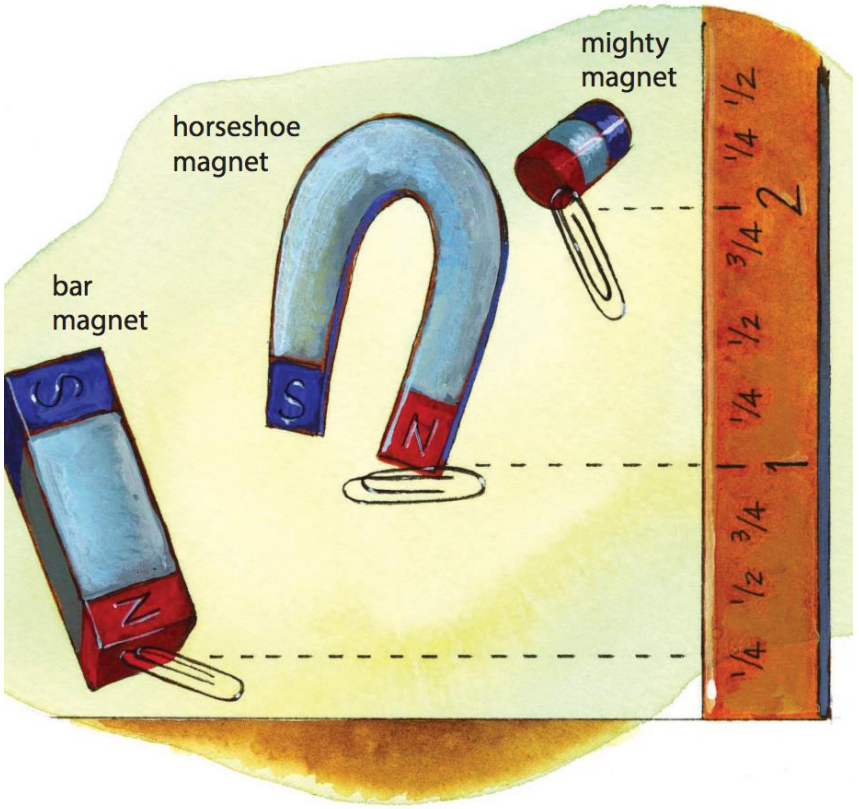
- To interpret others' data and critique their findings
- To find specific information to support their own investigations

| Object | Kind of metal | Does a magne attract it? |
|---|---|---|
| Juice can | aluminum | no |
| Paper clip | steel (mostly made of iron) | yes |
| Penny | copper and zinc | no |
| Foil | aluminum | no |
| Nail | iron | yes |
| Nail | zinc and iron | yes |
| Mom's necklace | silver | no |
| Dad's ring | gold | no |
| Steel wool | steel (mostly made of iron) | yes |
| Sink in kitchen | steel (mostly made of iron) | no |
| Pipe under sink | copper | no |
| Frying pan | iron | yes |
| Tall lamp | brass (made of copper and zinc) | no |

# Do all magnets have the same magnetic force?

## Why Scientists Read

- To learn about others' procedures and experiments



# Models Scientific Explanations

## Why Scientists Read

- To learn what other scientists are learning

"So?" I said. "What's your explanation?"

She said, "I think the horseshoe magnet is stronger than the bar magnet. It can pull with more magnetic force. A stronger magnet will pull the paper clip up from farther away."

Then she gave me a big smile. She showed me a little magnet called a mighty magnet. She held it over the paper clip. The paper clip jumped almost two inches in the air to reach the strong mighty magnet!

# Connects to the importance of magnet investigations in the world outside the classroom

## Why Scientists Read

- To situate their research

Inventing with Magnets

# Supports for learning how to read like a scientist

- Frame instruction as questions to figure out
- Provide texts that:
  - introduce secondhand (text) sources of evidence that complement the evidence students are gathering from firsthand sources
  - are closely aligned to what students are trying to figure out
  - enable students to read for the variety of purposes that scientists read

# A Broader Definition of Science and Engineering Practices

1. Asking questions
2. Developing and using models
3. Planning and carrying out investigations
4. Analyzing and interpreting data
5. Using mathematics and computational thinking
6. Constructing explanations
7. Engaging in argument from evidence
8. Obtaining, evaluating, and communicating information

# 3 Important Shifts

Read like a student → Read like a scientist

- Goal for reading
- Approach to reading
- Purpose for reading

# 3 Important Factors

- The role of text
- How students interact with text
- The nature of the text

# Disciplinary Literacy
# Strategy Guides for Grades K-5

- Gathering Information from Science Texts
- Interpreting Visual Representations
- Teaching About Multiple Meaning words
- Teaching Concept Mapping
- Teaching Text Structure
- Using Anticipation Guides
- Using Visual Evidence to Make Inferences

# Disciplinary Literacy
# Strategy Guides for Grades 6-8

- Reading Arguments
- Understanding the Role of Relevant Evidence in Supporting a Claim
- Using the Reasoning Tool to Develop a Strong Written Argument
- Practicing Oral Discourse Skills

http://scienceargumentsweebly.com/teaching-strategies.html

www.scienceandliteracy.org
www.learningdesigngroup.org
www.argumentationtoolkit.org
www.sciencearguments.weebly.com

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