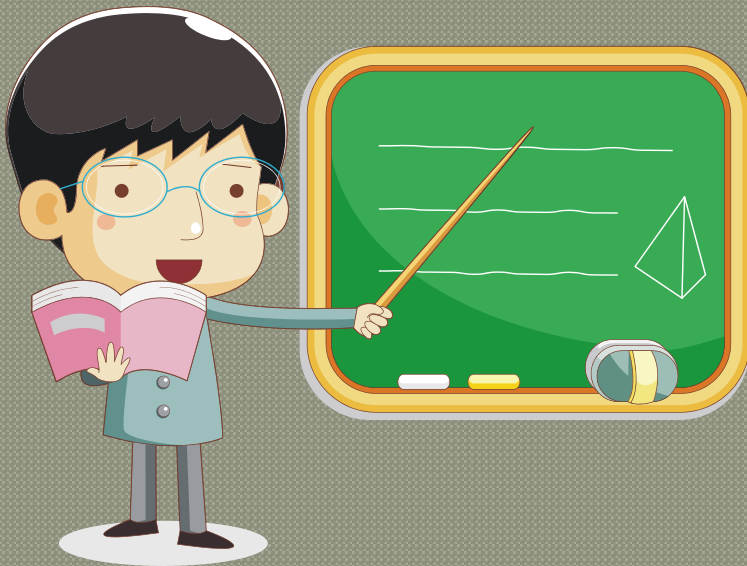


Teaching Science Vocabulary Conceptually

Genise Orberson
KYEDHH Conference
2012



Vocabulary is essential for communicating, reading, thinking, and learning. Vocabulary is “the storehouse of word meanings that we draw on to comprehend what is said to us, express our thoughts, or interpret what we read.”

Moats, 2005

Necessity of Content Vocabulary Instruction

- National Avg. → with 20% below 2nd grade
- Research indicates that students who are D/HH experience delays in building their vocabulary knowledge, have smaller lexicons, acquire new words at a slower rate, and have a narrower range of contexts that result in word learning.

(Lederberg & Spencer, 2001)

Necessity of Content Vocabulary Instruction

“Research and observation suggest a variety of reasons why students who are deaf or hard of hearing struggle to become fluent readers and writers. Five problems often cited are: obstructed access to the phonological code, limited fluency at the onset of formal schooling, inadequate literacy experiences in early childhood, delayed acquisition of vocabulary, and problems with lower-level skills.

(Luckner, et al, 2005)

Goal of Science Vocabulary Instruction

The goal of vocabulary instruction is for students to read (comprehend) science genre text and use appropriate terminology in their written explanations.



Common Vocabulary Misconceptions

- Definitions do the trick
- Weekly vocabulary lists are effective
- Teachers should teach all the hard words, especially those printed in bold or italics
- Latin and Greek roots are too difficult for young learners
- Word learning can't be fun

Vocabulary Exposure

VS.

Vocabulary Instruction

Every word

**Emphasize and
review critical terms**

...if it pops up

Planned

Define the word, once

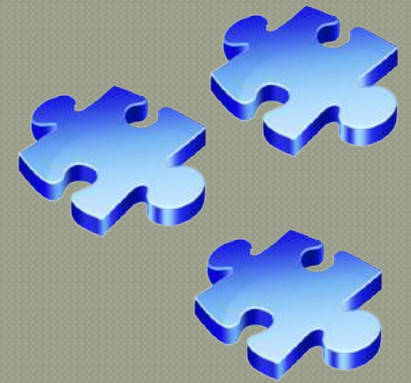
**Multiple definitions
and opportunities for
practice**

Introduce terms

**Explicit, Engaging,
Extra Practice,
Embeds literacy**

Vocabulary Instruction Must be Explicit

- Preselect Critical Vocabulary
- Teaching Whole to Part
- Text feature and glossary skills
- Utilize a variety of strategies



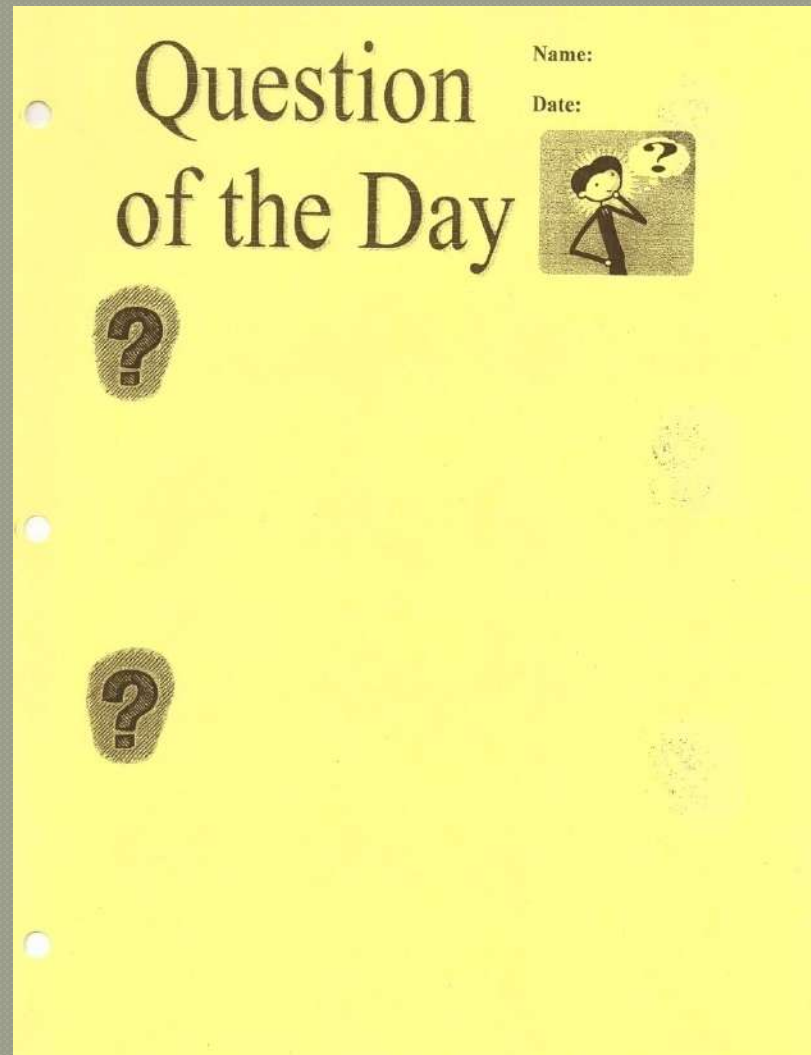
“Emphasis on item-specific rather than relational processing strategies reduce global understanding of text.”
(Richardson, et al, 1999)



Strategy 1:

Question of the Day

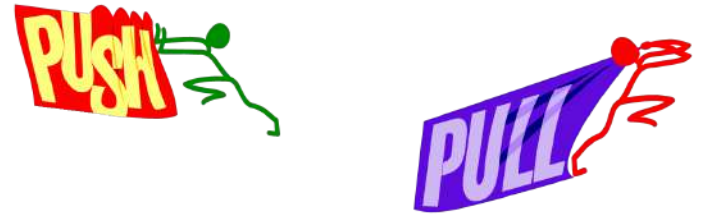
- Daily homework
- Preview/Review vocabulary
- Text feature practice
- Organization skills, locating information



Strategy 2: Vocabulary PowerPoint

- Introduction
- Scaffolding
- Homework Reference
- Formative Assessment

force



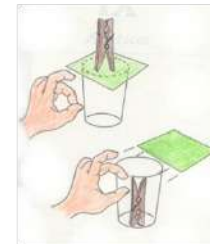
a push or a pull
(includes size and direction)

gravity



a force of attraction between objects due
to their masses

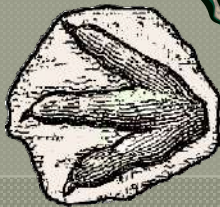
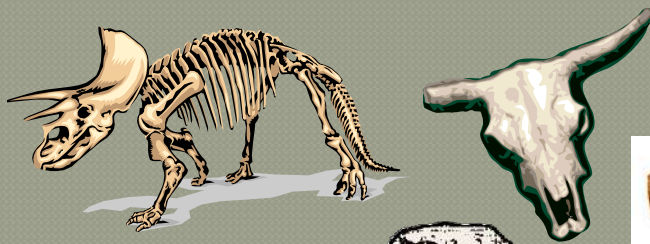
inertia



the tendency of an object to resist a
change in motion

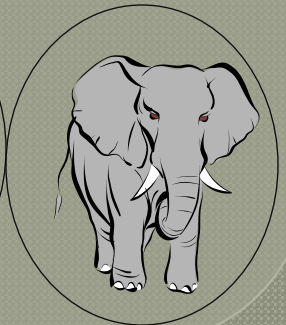
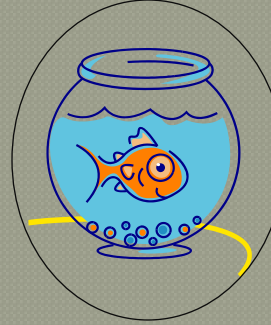
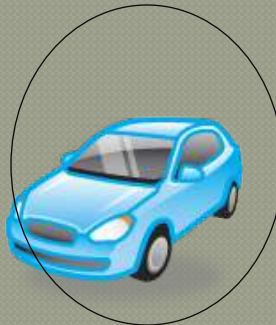
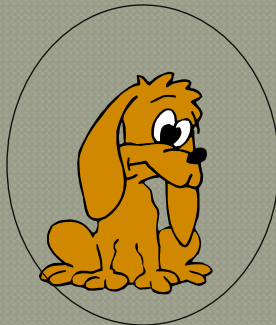
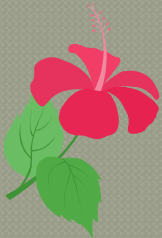
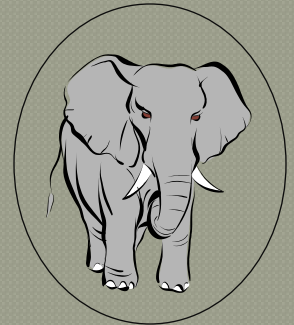
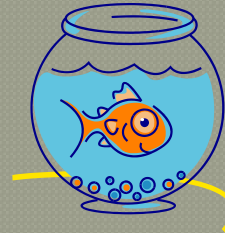
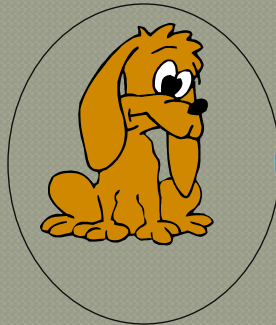
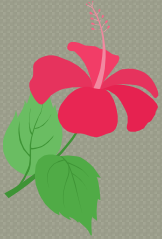
Strategy 3: Item/Card sorts

- Classification is a science process skill
- Students can create their own categories and analyze relationships
- Provides insight into student thinking
- Collaboration
- Try again



Strategy 4: Justified Lists

- Big concepts
- Identify misconceptions
- Example: Which of these are organisms?



Strategy 5:

Word Wall or Folder

- Picture representation
- For a chapter or unit
- Older students could find or draw pictures
- Or make a poster for each unit or chapter

Ecosystems
Vocabulary
3rd Grade

Strategy 9:

Chaining & Sandwiching

- “Chaining and sandwiching bridge the sign with the print or fingerspelling and need to be a regular part of classroom instruction for students who are deaf or hard of hearing.

(Padden and Ramsey, 1998)

- Chaining can include speech or visual phonics.

Visual
Phonics

English

Picture

ASL

VOY

vote



CS

stuck



CK

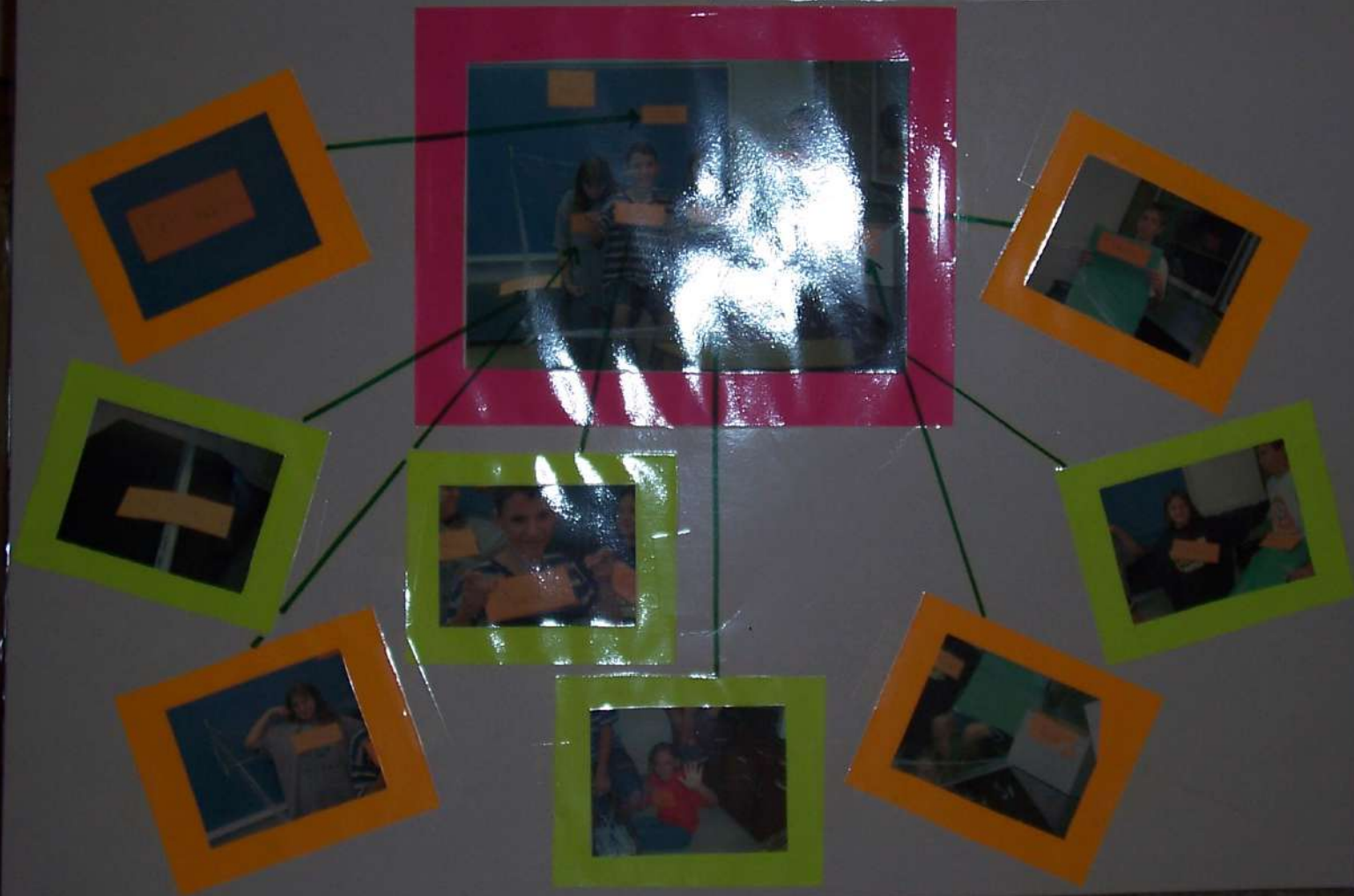
king



Strategy 10: Semantic Association

- Sacred cow in deaf education
- Protons have a positive charge
Neutrons have no charge
Electrons have a negative charge
- Human Cell Models

Human Model of a Plant Cell



Strategy 11: Semantic Maps /Graphic Organizers

- Show the big picture
- Summarizes big concepts on one paper
- Excellent resource for homework, notes

NAME _____ DATE _____ CLASS _____

CONCEPT MAPPING Chapter 16
Geologic Time

Complete the following concept map using the following terms: Precambrian, Mesozoic, Cenozoic, Paleozoic, early history, middle and recent history, soft body, hard body, dinosaurs, Homo sapiens, 225, 570, 4.6, 65.

```
graph TD
    GT[geologic time] --> B1[ ]
    GT --> B2[ ]
    B1 --> E1[____ era]
    B1 --> E2[____ era]
    B2 --> E3[____ era]
    B2 --> E4[____ era]
    E1 --> T1[____ billion years ago]
    E2 --> T2[____ million years ago]
    E3 --> T3[____ million years ago]
    E4 --> T4[____ million years ago]
    T1 --> LF1[life forms]
    T2 --> LF2[life forms]
    T3 --> LF3[life forms]
    T4 --> LF4[life forms]
    LF1 --> BF1[ ]
    LF2 --> BF2[ ]
    LF3 --> BF3[ ]
    LF4 --> BF4[ ]
    LF2 --> P1["Cambrian, Ordovician, Silurian, Devonian, Mississippian, Pennsylvanian, and Permian periods"]
    LF3 --> P2["Triassic, Jurassic, and Cretaceous periods"]
    LF4 --> P3["Tertiary and Quaternary periods"]
```

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Strategy 11: Semantic Maps /Graphic Organizers

- Show relationships between words and concepts

NAME _____ DATE _____ CLASS _____

CONCEPT MAPPING Chapter 4

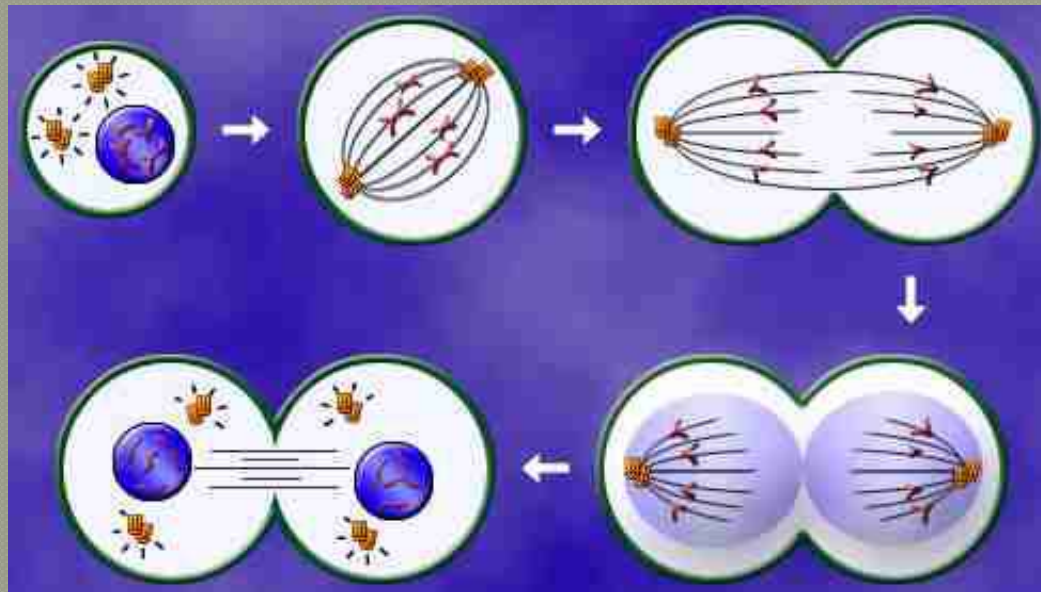
Parts of an Atom

Complete the concept map for the parts of an atom using the following terms once: electrons, negatively charged, neutrons, nucleus, protons, positively charged.

```
graph TD; atom[atom] -- consists of --> box1[ ]; atom -- consists of --> electron_cloud[electron cloud]; box1 -- consists of --> box2[ ]; box1 -- consists of --> box3[ ]; electron_cloud -- consists of --> box4[ ]; box2 -- which are --> box5[ ]; box3 -- which are --> box6[neutral]; box4 -- which are --> box7[ ];
```

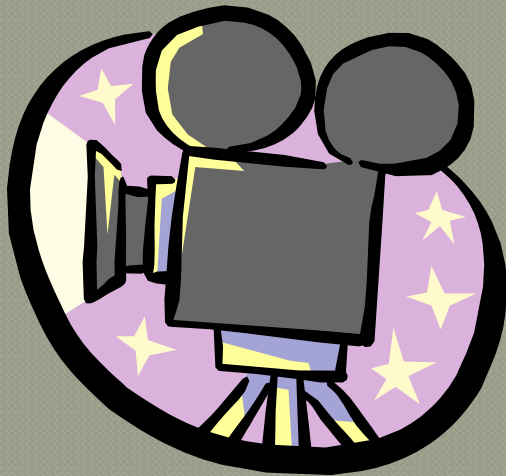
Strategy 11: Semantic Maps /Graphic Organizers

- Show a process (Mitosis)
- Students add labels and a brief description



Strategy 11: Semantic Maps /Graphic Organizers

● List, Group, Label



List, Group, Label

Topic: Plants

List:

- maple
- cosmos
- grass
- daffodil
- lavender
- aspen
- gerbera
- daisy
- marigold

- dianthus
- shrub
- petunia
- salvia
- flower
- evergreen
- dogwood
- pine

- geranium
- ash
- tulip
- tree
- olive
- aster
- iris
- day lily

Perennials

- lavender
- day lily
- geranium
- gerbera
- daisy

Annuals

- aster
- dianthus
- cosmos
- marigold
- petunia
- salvia

Trees

- maple
- olive
- dogwood
- evergreen
- pine
- aspen
- ash

Bulbs

- tulip
- daffodil
- iris

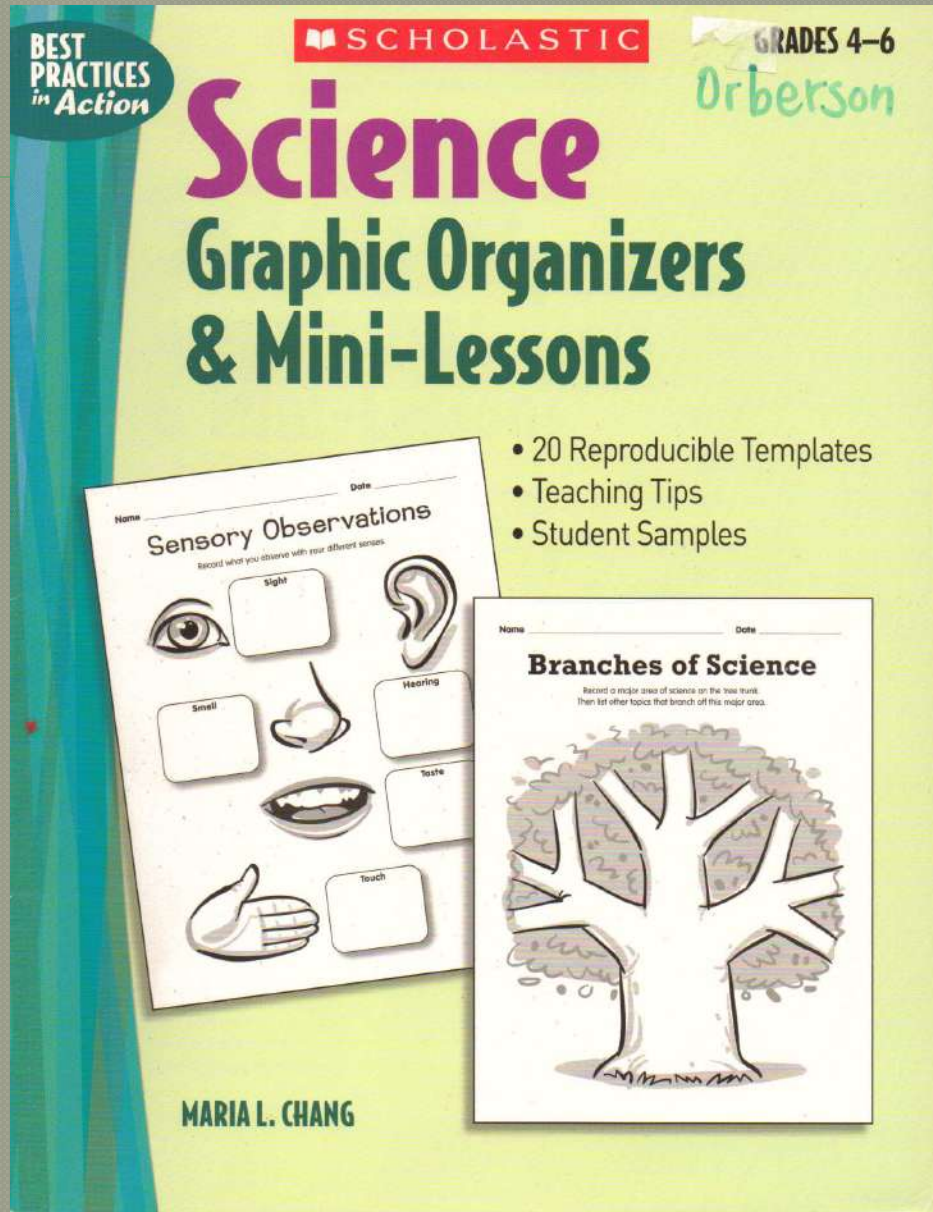
Source: Reading Strategies for Science p. 80

Strategy 11: Semantic Maps /Graphic Organizers

● Vocabulary knowledge rating scale

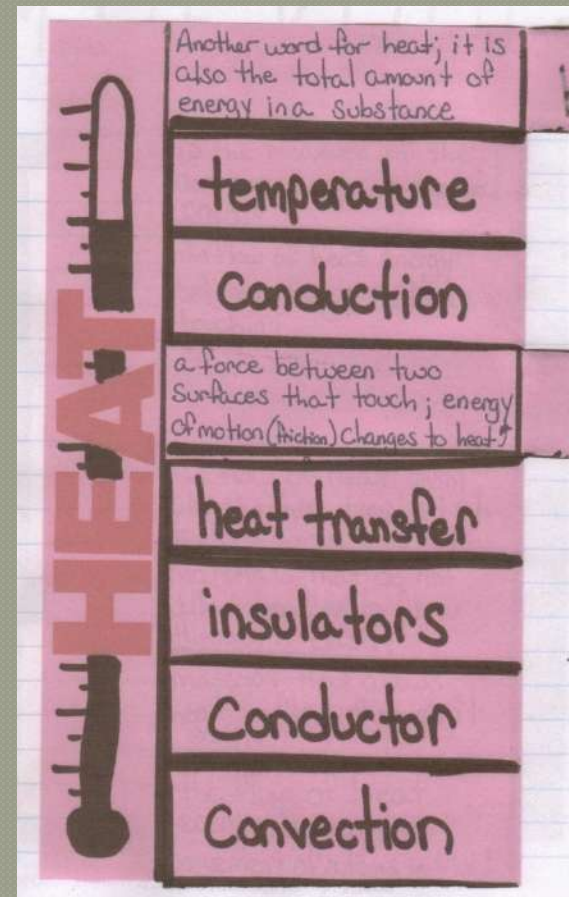
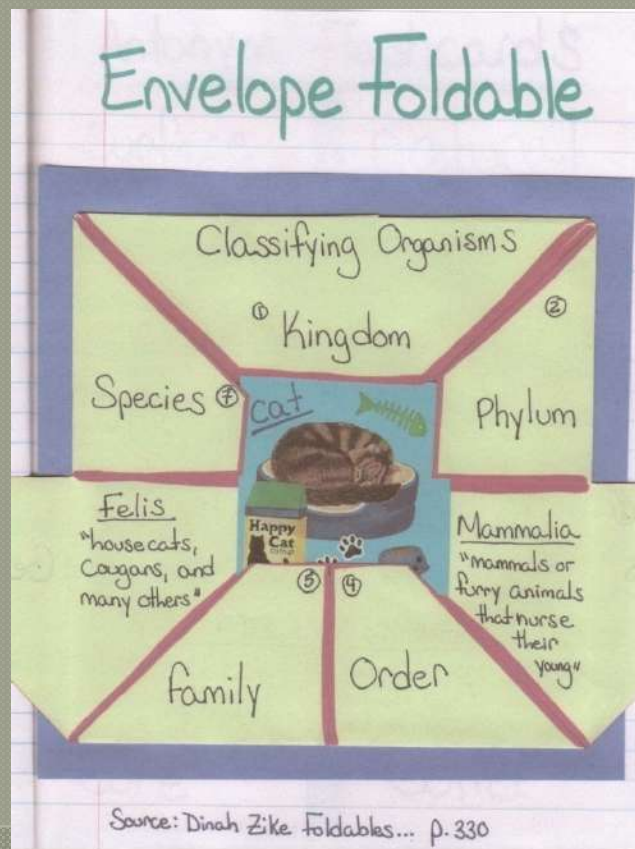
Vocabulary Knowledge Rating Scale					
	No idea	Seen before	Somewhat understand	I can explain	Definition
chromosome	✓				
mitosis		✓			
genes			✓		
dominant			✓		
recessive			✓		

Elementary Resource



Strategy 12: Guided Notes

- Can be fill in the blank, draw a picture
- Foldables



Strategy 13:

Word Study

- Helps students recognize the difference between words that look similar in print (fraction and friction)
- Distinguish scientific meaning vs. every day use of the word (work)
- Teaching key prefixes and suffixes

bio = life

geo = earth

prefix	meaning	example
a	not	abiotic
micro	tiny	microorganism
endo	within	endothermic
exo	outside	exothermic
hetero	different	heterogeneous
homo	same	homogeneous
hydro/a	water	hydrosphere
inter	between	interactions

prefix	meaning	example
photo	light	photosynthesis
trans	Across	transpiration
therm	Heat	thermometer
epi	above	epicenter
meteor	weather	Meteorologist
qual	characteristic	qualitative data
quant	how much	quantitative
solu	dissolve	insoluble

suffix	meaning	example
asis	condition	homeostasis
ist	someone who specializes in	dentist
ology	study of	geology
synthesis	put together make	photosynthesis
ular	of, resembling	cellular
ism	condition	parasitism
mea	pass through	permeate

Vocabulary Instruction Must be Engaging

- Begin with student ideas
- Promote independent work
- Vocabulary Dash & other games
- Mix it up



Geologic Time Answers

- middle/late history
- early history
- hard body
- homo sapiens
- dinosaurs
- soft body
- 570 millions years
- Paleozoic
- Mesozoic
- Cenozoic
- Precambrian
- 4.6 billion years
- 225 million years
- 65 million years

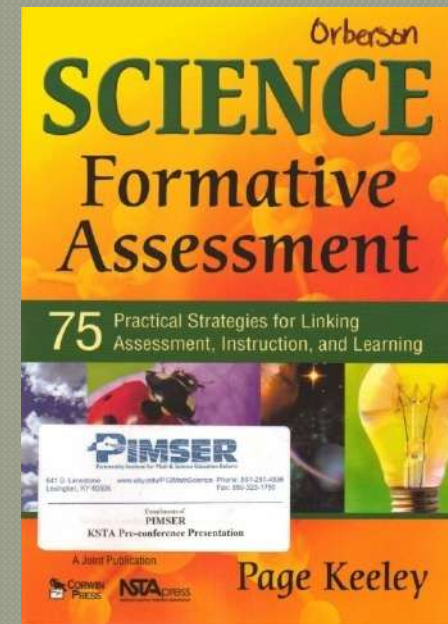
Vocabulary Instruction Must Be Engaging

Behaviors such as learned helplessness can be minimized when teachers use the following techniques: give students more opportunities to respond to questions (more opportunities to be right) and provide praise, praise the process, and model how to deal with difficult tasks (by thinking aloud).

(Sutherland & Singh, 2004)

Vocabulary Instruction Includes Extra Practice

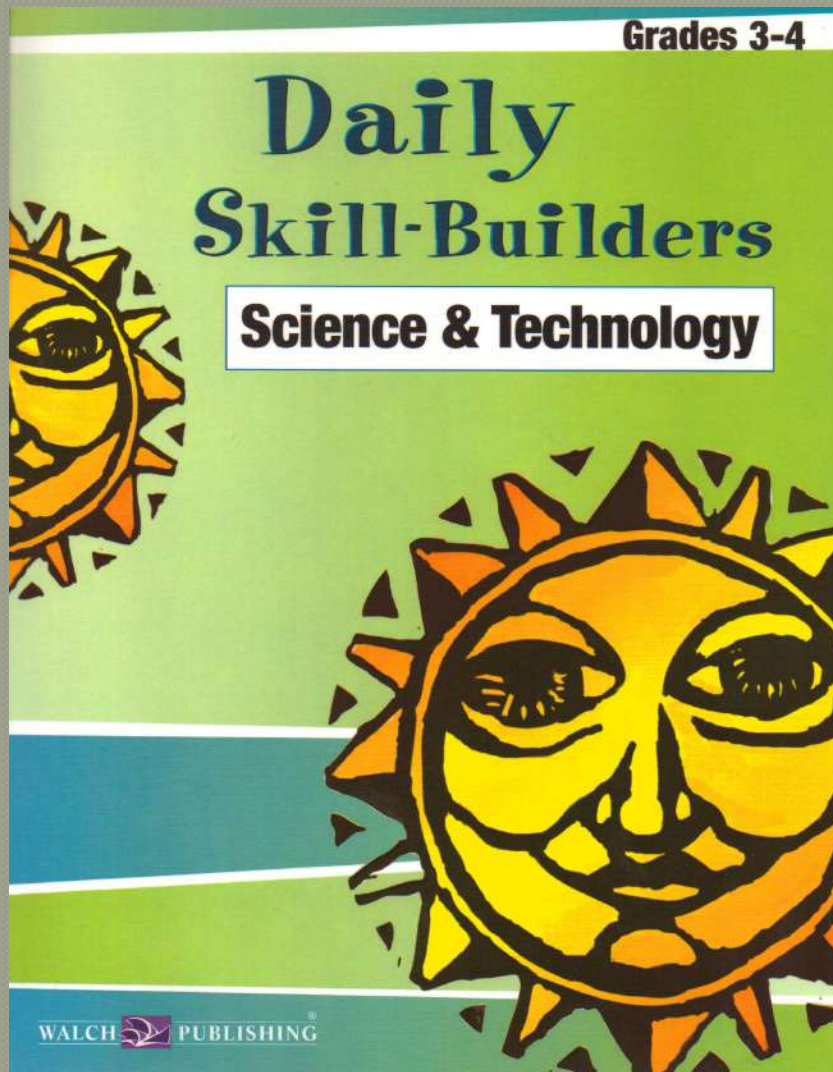
- Humans understand words in a sequence of stages: (1) unknown, (2) acquainted, (3) established. (Armbruster, et al, 2003)
- Creating Models and Diagrams
- Rephrase definitions
- Formative assessments
- Vocabulary hangman



Teaching Atomic Structure

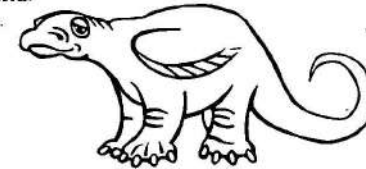
- What is a model? ... notes
- Diagram on the board with colored magnets or markers
- Floor model
- Worksheet (definitions and diagram)
- Using the periodic table
- M&M models - independently
- Atomic particles worksheet
- Individual sticker models

A Helpful Resource



Mystery Animal

You and your lab partner have discovered a new animal. Choose three scientific tools from the box below. Then describe how you would use each tool to study your find.



thermometer	barometer	telescope
scale	rain gauge	microscope
clock	measuring tape	magnifying glass
blood pressure gauge	stethoscope	

Tool 1: _____

Tool 2: _____

Tool 3: _____

Questions for thought: What other tool might you like to have on your lab shelf? Why?

Vocabulary Instruction Embeds Literacy

- Question of the Day
- Anticipation Guides
- Use science genre (leveled) text
- Science Journal prompts
- Teaching Text Features
- Self Assessment
- Scientific Explanations: Claim, Evidence, Reasoning

(Michaels, et al, 2008)

Vocabulary Instruction Embeds Literacy

- Model the skills of summarization:
 - ✓ Identify the main information
 - ✓ Delete trivial information
 - ✓ Delete redundant information
 - ✓ Relate the main idea and supporting information

(Pressley, et al, 1995)

Reading Process for Scientific Literature

- 1) Possess the ability to read scientific or scientifically related texts
- 2) Recognize the salient science
- 3) Identify sources of uncertainty and methodological flaws
- 4) Distinguish observations from inferences, arguments from explanations, and claims from evidence
- 5) Judge the validity of claims (previous research and potential bias of researcher)

Instruction with Authenticity

- Newman (2001) drives for authentic pedagogy where (1) students use their prior knowledge to address real problems/tasks, (2) the skills and standards match that of true professionals, and (3) the tasks have “value beyond school” or “connections beyond the classroom.”

NGSS Science & Engineering Practices

- Asking questions & defining problems
- Developing & using models
- Planning & carrying out investigations
- Analyzing & interpreting data
- Using mathematics information & computer technology, & computational thinking
- Constructing explanations & designing solutions
- Engaging in argument from evidence
- Obtaining, evaluating, & communicating information

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