Developing Visual Literacy in Science K-8

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Developing Visual Literacy
How often do you think about your students’ understanding of the visuals when you are teaching?

Type in the chat.
“Visual tools are a breakthrough in education and not just another tool on the sagging tool belt of endless and uncoordinated ‘best practices’ for teachers.”

David Hyerle (2009)

“Neuroscience research tells us that the brain has dynamic spatial architecture that networks and maps information.”

Pat Wolfe (2009)
Using the Right Visual Tool

- Photographs
- Charts, graphs, diagrams
- Student Constructed Visual Thinking Tools
  - Three dimensional graphic organizers
  - Graphic organizers
  - Science notebooks
Poll Question

Have you ever used ‘foldables’ before?

✅ Yes  ❌ No
Foldables

**Foldables** – three-dimensional, interactive, student-made graphic organizers

- **Reading Tool** – give students way of organizing information in a fun and creative way
- **Study Tool** – provide way for students to self-check their understanding or to use as reference guides
- **Assessment Tool** – provide way for teachers to diagnose misconceptions, monitor comprehension, assess understanding
Let’s pause for questions from the audience.
Let’s Fire Up Your Neurons!

- Before you observe the next picture, number your paper from 1-6.
- As you see the visual, write down what you think it is.
Let’s see how well you did.
THE FIVE AMIGOS
WE GOT IT!

Rinaldo  Raul  Lombardo  Ramon  Nestor

HAPPY FEET
Let’s pause for questions from the audience.
List some of the skills you think a visually literate person should possess.

Type your answer in the chat.
A visually literate person should be able to...

► Interpret, understand and appreciate the meaning of visuals
► Communicate more effectively by applying concepts of visual design
► Use visual thinking to conceptualize solutions to problems
► Produce visual messages using computers and other technologies

- International Visual Literacy Association

Humans see an average of 36,000 images every hour.
Developing Visual Literacy

SEE - SCAN - ANALYZE

EYES SEE

BRAIN PROCESSES

OBSERVATIONS  INFERENCES  EMOTIONS

Make 3 section foldable and label: 
See – Scan – Analyze

Inside label:
Observations – Inferences – Emotions

Analyze image and record ideas on foldable

Share ideas in the chat.
Your eyes read and then your mind processes in order to “make meaning.”
The brain works in two ways:
- **rote memory**, which we may remember for Friday’s test
- **associate new learning** with something already known or experienced
The Brain is a sieve!

99% of information is discarded immediately!
If students tag or link new learning...

Then they will remember it because they’re adding to their knowledge base.
When students **activate** and **use their prior knowledge** then they will make the necessary connections between what they know and the new information.
Let’s pause for questions from the audience.
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SEE - SCAN - ANALYZE

EYES SEE

BRAIN PROCESSES

OBSERVATIONS  INFERENCES  EMOTIONS

Praying Mantis
Order Mantodea

- Head
- Antennae
- Compound eyes
- Chewing mouthparts
- Thorax
- Fixed legs, modified for grasping
- 2 Pairs of wings
- Abdomen
- 3 Pairs of jointed legs
According to research on the dual-coding theory of information, information is stored in two ways:

- **linguistic** – “words and phrases”
- **nonlinguistic** – “mental pictures”
Therefore it is necessary for [students] to consciously “chunk” information together, in other words they must “recompose” the information, otherwise the working memory will become overloaded and the information will be lost.

David Hyerle (2004)
Tree Diagram

Praying Mantis

Head
Thorax
Abdomen
Student Created Tree Diagram

- Animal
  - Arms
    - Spikes
    - Claws
  - Back
    - Foot look blends in camouflage round
    - Feet are flat
    - Feet have texture different joints brown spots
  - Legs
  - Head
    - Kangaroo
    - Kangaroo
    - Long straight colored on body
  - Neck
  - Reach his mouth camouflage to hide & get bugs
  - Eats bugs: wise jaw, spikes on arms, mouth by arms
  - Move: jumps, strong legs, bent (grasshopper)
  - Flies: back looks like leaf, move wings
Three Dimensional Graphic Organizer
Like all insects, praying mantises have six legs, but their front legs are not used for walking. The legs are attached to the thorax as well as the four wings.
Incomplete Metamorphosis

Tiny baby mantis came out of the egg case. They eat, grow and molt several times.

egg case

Incomplete Metamorphosis

adult
Complete Metamorphosis

- Egg: A larva is born. It grows and grows.
- Ladybug
- Pupa
Let’s pause for questions from the audience.
How People Learn: Brain, Mind, Experience, and School

I. Develop a deep foundation of **factual knowledge**

II. Understand facts and ideas in the **context of a framework**, and

III. **Organize knowledge** in ways that facilitate, retrieval and application.

*Bransford, Brown, and Cocking (2000), p. 16*
Developing Visual Literacy

Why teach visual literacy?

Visual learning can foster the obtainment of knowledge that students may not get from verbal text alone.

Step 3
Assemble top frame
You will need: left frame, right frame, two 1/4-20 x 1/2 inch bolts, two nylon washers and a 7/16 inch wrench.
Note - Work on carpeted area (on grass or one of the boxes) to protect the finish during frame assembly.
Lay the leg pieces as shown so the leg tabs point up. Figure 2.
Slip the two frame pieces together with the tabs inside. Figure 2 (a). Slip washers on bolts, insert bolts as shown and tighten. Figure 2 (b). (If you try to insert a bolt and there are no holes, you have the left frame turned the wrong way. Turn the left frame around.)
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Making the Learning Interactive – Student Created Thinking Tools

“…explicit engagement of students in the creation on non-linguistic representations stimulated and increased the activity in their brains.”

- Gerlic & Jausovec (1999)
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Making the Learning Interactive – Thinking Tools

Graphic Organizers

Reading Skill ✔
Sequence
First
Next
Last

Reading Skill ✔
Compare and Contrast
Different
Alike
Different

Reading Skill ✔
Problem and Solution
Problem
Steps to Solution
Solution

Reading Skill ✔
Summarize
Summary

Reading Skill ✔
Main Idea and Details
Main Idea
Details
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Making the Learning Interactive – Thinking Tools

Concept Maps

- The Solar System
  - planets
  - dwarf planets
  - Venus
  - Jupiter

- Rocks
  - Metamorphic
  - Igneous
  - Sedimentary
    - organic
    - cemented pieces
    - layers
  - surface
  - beneath surface
  - banded
  - nonbanded
Charts, Graphs, Diagrams
Macro to Micro Views

Visual Check: Which part of the salt crystal is attracted to the oxygen in the water molecule?
Different features of illustrations affect the comprehension of the message transmitted by the image.

- use of color
- use and placement of arrows
- mix of real and symbolic entities
- highlighting of words or parts of image
- integration of multiple images into one visual

Pinto & Ametller (2002)
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Simple Diagrams - labeled drawings (pictures with labels)

Plant Cell

- vacuole
- nucleus
- cytoplasm
- mitochondria
- chloroplast
- cell membrane
- cell wall
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Simple Diagrams - labeled drawings (pictures with labels)

Parts of a Leaf

Dotted line inset
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Synthetic Diagrams - connect parts together via arrows or numbers
Developing Visual Literacy

Synthetic Diagrams - connect parts together via arrows or numbers

Land Food Chain

- producer
- primary consumer
- secondary consumer
- decomposer

Read a Diagram
Which organism in this land food chain eats the berries?
Clue: Follow the arrow that leads from the berries.

Louisiana Food Chain

- Sun
- heron
- stone fly
- algae
- sunfish

Read a Diagram
Where does the fish in this diagram get its energy?
Clue: Look for where the arrow that points to the fish comes from.
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Synthetic Diagrams - Linear

1. A female damselfly lays eggs on the stem of a water plant.
2. A young damselfly, or nymph (NIMF), hatches from an egg.
3. The nymph leaves the water. It sheds its skin and grows small wings.
4. The nymph molts several times. Then it becomes an adult.
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Synthetic Diagrams - Cyclical Diagrams

The diagram illustrates the water cycle, showing the flow of water from the sun (solar energy) to the earth through processes like precipitation, infiltration, runoff, condensation, evaporation, and back to the sun. The cycle also highlights the movement of water through different environmental systems.
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Synthetic Diagrams - Tree Diagrams

Vascular

- Seedless
  - Fern
  - Horsetail

- Seed
  - No flowers
    - Douglas fir
  - Flowers
    - Hydrangea
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Synthetic Diagrams - Graphs

Number of Animal Species

Animal Phyla Key
- Arthropods
- Mollusks
- Worms
- Chordates
- Porifera
- Cnidaria
- Echinoderms

Read a Graph

Which animal phylum contains the most species? Which contains the fewest species?
Clue: Compare the number of species for each different phylum.
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Synthetic Diagrams - Grid Patterns

cold

hot

wet

dry

taiga

deciduous forest

dsavanna

tundra

desert
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Making the Learning Interactive – Student Created Thinking Tools

Foldables

Biomes
- taiga
- grassland
- tropical rain forest
- tundra
- deciduous forest
- desert

The taiga is a cool forest biome of conifers found in the northern regions. The taiga is the world’s largest biome. The taiga is able to grow pines, firs, spruces, and other coniferous evergreen trees.

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“A poorly designed image may transmit a wrong idea and at the same time a lack of knowledge of the visual language may hinder the interpretation of the image.”

“Misuse of the visual language can affect the communication of the concepts intended to be represented by the image.”

Pinto & Ametller (2002)
Do alligators really undergo metamorphosis?
Let’s pause for questions from the audience.
Importance of Developing Visual Literacy

► **Growing emphasis on the ‘must have’ skills**
  ▶ Emphasis on what students *can do with knowledge*, rather than what units of knowledge they have

► **Global economy with multiple languages**
  ▶ Greater emphasis on using visuals to *convey information*, ideas, and complex concepts than words

► **Reflects today’s multimedia environment**
  ▶ Increased access to and use of technology as the vehicle for *information delivery*
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