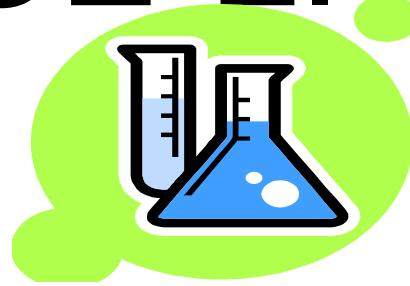


# **ENHANCING READING COMPREHENSION IN SECONDARY SCIENCE CLASSROOMS**

**Presentation at  
Secondary Reading League  
Day of Reading  
November 8, 2008**

**Dr. David Greenwood  
Dennis Szymkowiak  
Mundelein High School**

# SCIENCE LITERACY



- Where we started
- Where we've been
- Where we're going

# INITIAL THOUGHTS

## A Scientifically Literate Person:

- Locates, collects, analyzes, and evaluates sources of scientific and technological information and uses these sources in solving problems, making decisions, and taking action.

# A Scientifically Literate Person:

- Defends decisions and actions using rational arguments based on evidence.
- Analyzes interactions among science, technology, and society and their ethical aspects in relation to politics, economics, and morals.

From:

National Science Teachers Association (NSTA). (2002).

Science/technology/society: Providing appropriate science for all. In *NSTA Handbook 2002-2003* (pp. 226-228). Arlington, VA: Author.

**Locates, collects, analyzes, and evaluates sources of scientific and technological information and uses these sources in solving problems, making decisions, and taking action.**

- > Perform labs involving
  - 1. inquiry**
  - 2. collecting data****
- > Read and evaluate current periodicals related to science**
- > Manipulate and interpret data using technology to organize data (graphs)**
- > Differentiate quality of sources**
- > Connect concepts and labs with real-life situations**
- > Be willing to THINK!**
- > Assume motivation and accept opportunity to generate personal/individual questions and pursue answers**

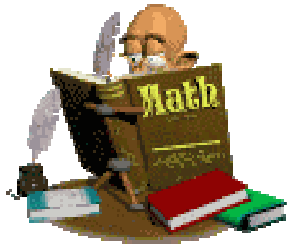
## **Defends decisions and actions using rational arguments based on evidence.**

- > Find evidence**
- > Differentiate between fact and opinion**
- > Recognize and utilize appropriate sources**
- > Leave emotions out**
- > Arrive at conclusion based on evidence only, not influenced by past experiences and / or what one thinks should happen**
- > Record specific, detailed observations**
- > Understand sources of errors occurring during lab procedures**
- > Analyze data to interpret meaning behind graphs, tables, etc.**
- > Develop content-specific meanings of words that may also be used in common, everyday language**
- > Eliminate personal opinions / pronouns**
- > Connect conclusions to appropriate sources**

**Analyzes interactions among science, technology and society and their ethical aspects in relation to politics, economics, and morals.**

- > Understand basic science concepts and identity**
- > Understand ethical implications of current science technology**
- > Present non-biased, multiple scientific perspectives**
- > Be able to “hear” all sides of an issue**
- > Develop a concept of systems – relationships among stakeholders, policies, social interests, political forces, etc. This may include drawing maps of these interactions**
- > See relationships between personal “values” and scientific theory that results in personal / individual actions**

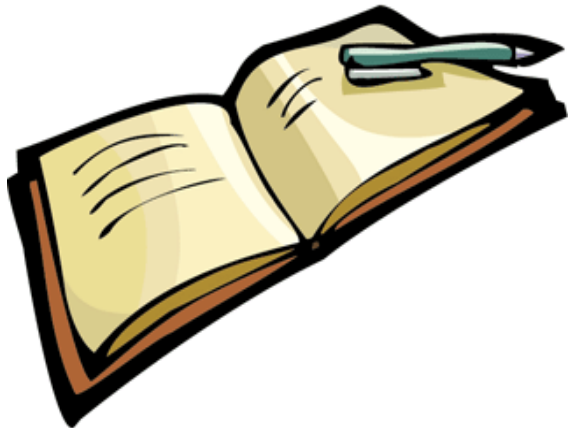
# Content Area Literacy



Literacy entails the acquisition of information

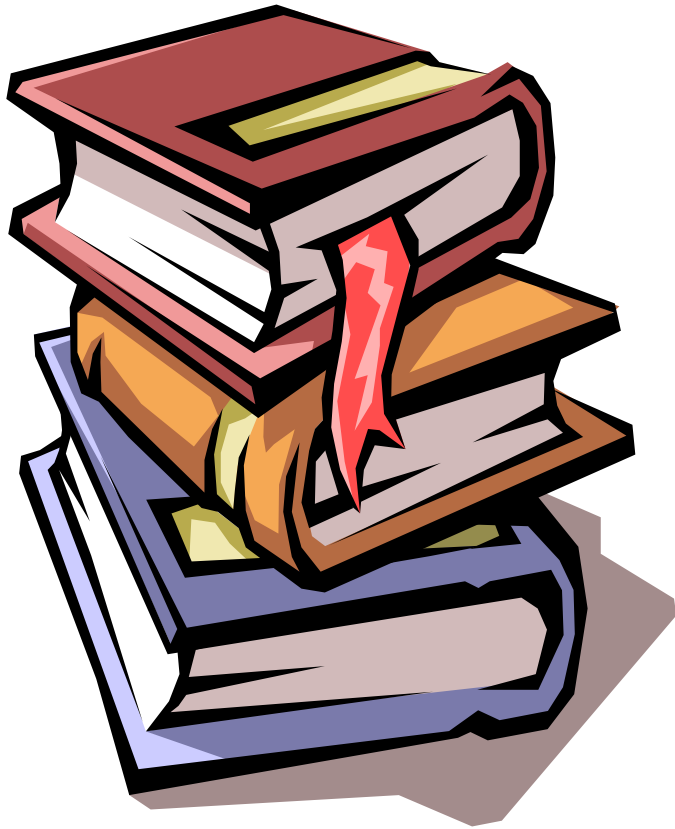


Literacy is knowing where and how to locate information



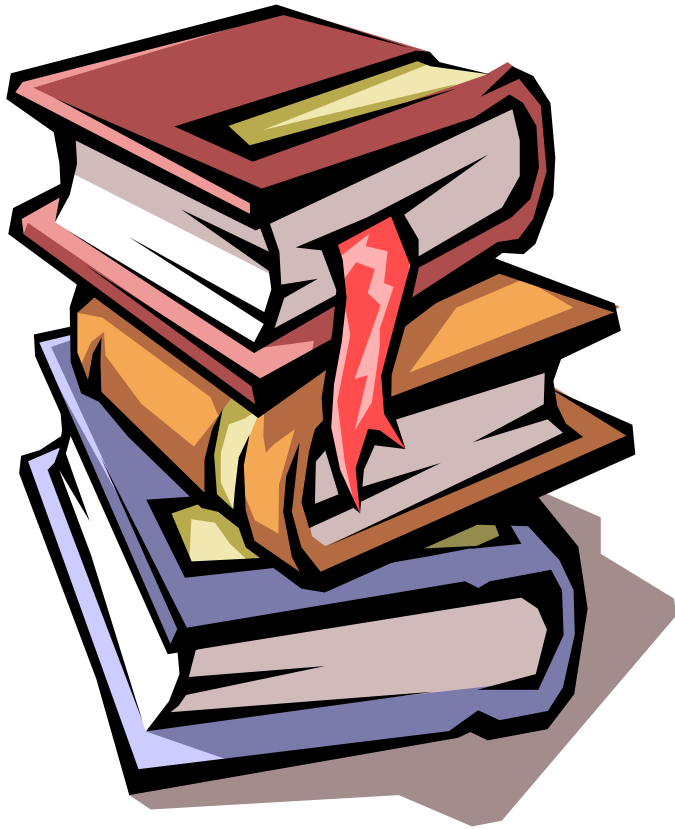
Literacy involves reading and writing

# CONTENT -AREA READING AND STUDY SKILLS



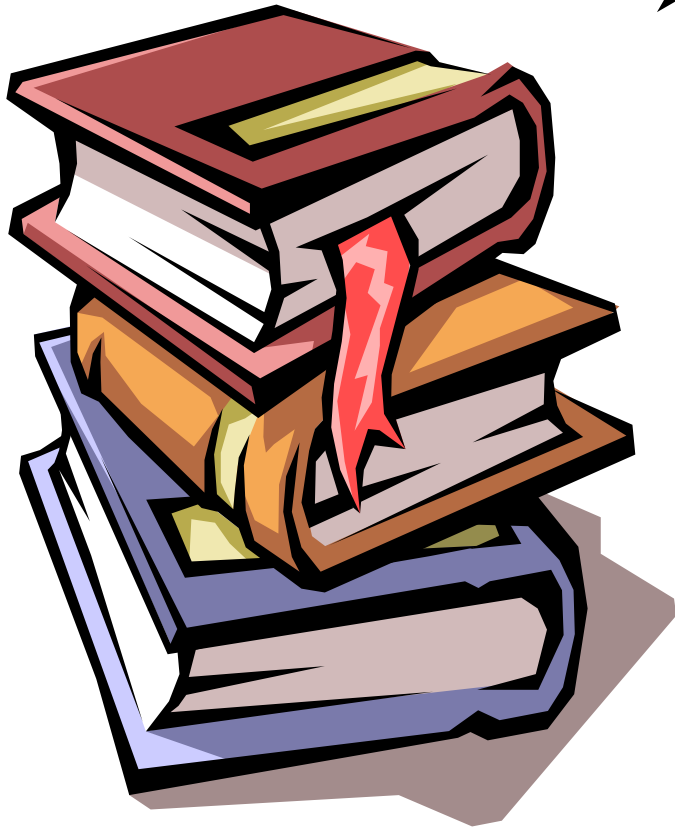
- The organization of narrative texts, and expository texts, which students are required to read in subject areas, differs greatly. Textual organization also differs among subject areas.

# CONTENT -AREA READING AND STUDY SKILLS



- Knowledge of book parts and general research skills helps children's comprehension and should be a part of reading instruction.

# CONTENT -AREA READING AND STUDY SKILLS



- Reading and content-area teachers who expect children to read texts in specific subjects must provide students with reading instruction connected to specific reading-related skills associated with that subject area.

## SCIENCE / READING REFLECTION

Name \_\_\_\_\_

Science Specialties Taught \_\_\_\_\_

Years Taught (total) \_\_\_\_\_ (at MHS) \_\_\_\_\_

What I do when I read science texts / science materials / science-related readings:

Do I highlight / underline / mark text in some fashion? \_\_\_\_

Which technique? \_\_\_\_\_

Why? \_\_\_\_\_

Do I use notes / comments in the margin(s)? \_\_\_\_\_

For what purpose? \_\_\_\_\_

Why? \_\_\_\_\_

Do I re-read? \_\_\_\_\_

When? \_\_\_\_\_ Why? \_\_\_\_\_

How do I know I am “getting” the information I need? \_\_\_\_

\_\_\_\_\_

What do I do if I don’t “get” it? \_\_\_\_\_

Are you conscious of any other individual strategies you use when you read? If so, what are they? How did you begin using those strategies? \_\_\_\_\_

\_\_\_\_\_

# High Literacy

Langer, J. A. (2002). *Effective literacy instruction: Building successful reading and writing programs*. Urbana, IL: National Council of Teachers of English.

## **Learners gain:**

- > basic reading and writing skills**
- > content knowledge**
- > ways of structuring ideas**
- > ways of communicating with others**  
**consistent with content expert(s)**

# **High Literacy** (cont'd)

## **Learners acquire:**

- > ability to use language, content, and reasoning in appropriate ways**
- > ability to read social meanings, rules structures, and the linguistic and cognitive routines to function in the real world of English language use**

# **High Literacy (cont'd)**

## **Learners achieve:**

- > a deeper understanding of how reading, writing, language, and content work together**
- > the ability to engage in thoughtful reading, writing, and discussions in class settings**
- > the ability to use this knowledge and skills in new situations**
- > the ability to perform well on a wide variety of reading and writing tasks, including high-stakes tests**

# High Literacy – Science

Lemke, J. L. (2004). The literacies of science. In E. W. Saul (Ed.), *Crossing borders in literacy and science Instruction: Perspectives on theory and practice* (pp. 33-47). Newark, DE: International Reading Association.

## **Language of science is unique hybrid –**

***“ . . . natural language as linguists define it, extended by the meaning repertoire of mathematics (the set of possible meanings that can be made with mathematical symbols and the conventions for interpreting them), contextualized by visual representations of many sorts, and embedded in a language (or, more properly, a semiotic) of meaningful, specialized actions afforded by the technological environments in which science is done” (p. 33).***

# **High Lit. – Science (cont'd)**

*I want to encourage science educators not only to study how teachers and students read, write, and talk science but also to learn more about how and why scientists do so, and to share with colleagues in literacy education the unique insights into the nature of literacy practices and literate texts that come from the perspective of science (p. 34).*

# **Core Strategies**

- **Anticipation Guides**
- **Entrance/Exit Slips**
- **'Post-It' Notes**
- **T-Notes (Cornell Notes)**
- **Rate Your Words**
- **Word Map**

# Anticipation Guide – Science

## Classifying Matter

Read each of the following statements. If you agree with the statement as written, place an **X** in the space provided. Leave the space blank if you do not agree with the statement.

Agree    Statement

\_\_\_\_\_ Atoms are the most basic unit of matter.

\_\_\_\_\_ Mixtures consist of elements that are bonded together.

\_\_\_\_\_ Elements in a compound keep their individual properties.

\_\_\_\_\_ A molecule consists of two or more atoms of different elements.

\_\_\_\_\_ A homogenous mixture is uniformly mixed.

**VOCABULARY:**

# **RATE YOUR WORDS**

**A = I do not know**

**C = I might know**

**B = I think I have seen/heard it**

**D = I know and can use it**

<b>Word</b>	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>Example</b>

# Nine Reading Skills

- 1. Identify and infer main ideas
- 2. locate and interpret important details
- 3. order sequence of events
- 4. identify comparative relationships
- 5. identify cause-effect relationships,

# Nine Reading Skills

- 6. determine meanings of words
- 7. phrases or statements
- 8. make generalizations
- 9. development of vocabulary.

# Course Teams

- Biology
  - Development of Vocabulary
  - Order sequence of events

# Course Teams

- Chemistry
  - Identify main ideas
  - Identify comparative relationships
  - Develop vocabulary

# Course Teams

- Physics
  - Identify main ideas
  - Development of Vocabulary

# Getting Started

Provided some tools and examples of activities for the reading skills chosen.

Presented several strategies for developing Vocabulary to Biology

- Create Vocabulary lists for each unit
- Vocabulary acquisition
- Vocabulary practice

## Biology

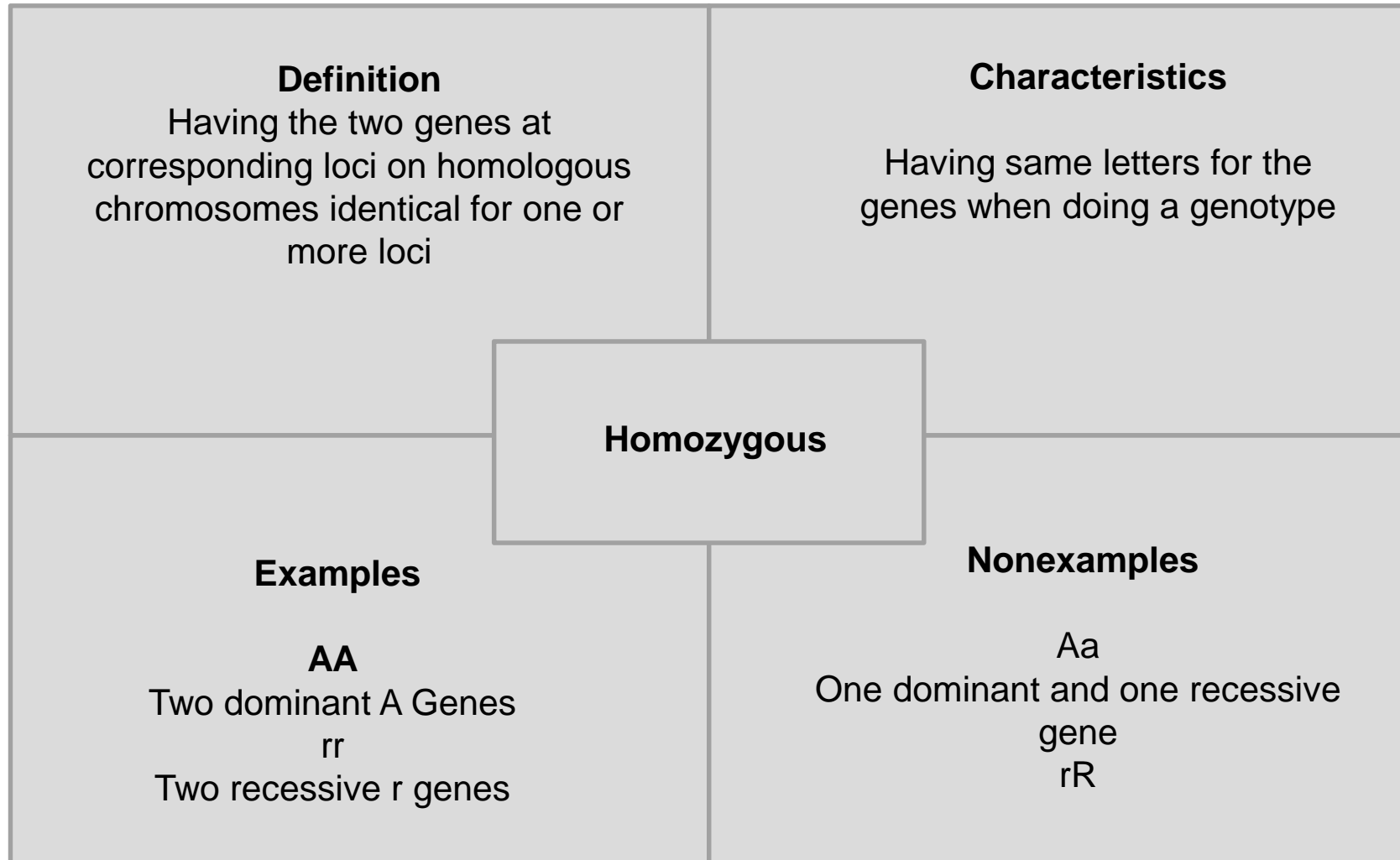
### Genetics Chapter

1. Mitosis
2. Genetics
3. Mendel
4. Gene
5. Chromosome
6. Centromere
7. Sister Chromatid
8. DNA
9. Interphase
10. Prophase
11. Metaphase
12. Anaphase
13. Telophase
14. Dominant
15. Recessive
16. Punnett Square
17. Allele
18. Heterozygous
19. Homozygous
20. Phenotype
21. Genotype

### Chapter 12

1. Double Helix
2. DNA
3. Nucleotide
4. Nitrogen Base
5. Deoxyribose
6. Phosphate
7. Chromosome
8. Gene
9. DNA Replication
10. RNA
11. mRNA
12. tRNA
13. rRNA
14. Protein Synthesis
15. Transcription
16. Translation
17. Uracil
18. Protein
19. Amino Acid
20. Ribose
21. Ribosome
22. Frameshift Mutation
23. Point Mutation
24. Mutation
25. Watson & Crick
26. DNA Polymerase
27. Hershey & Chase
28. Rosalind Franklin
29. Codon
30. Anticodon
31. Hox Genes
32. Exon
33. Intron
34. RNA Polymerase
35. Histone
36. Operon
37. Nucleosome
38. Promoter

# Four Square/Frayer Model



# Password/\$20,000 Pyramid

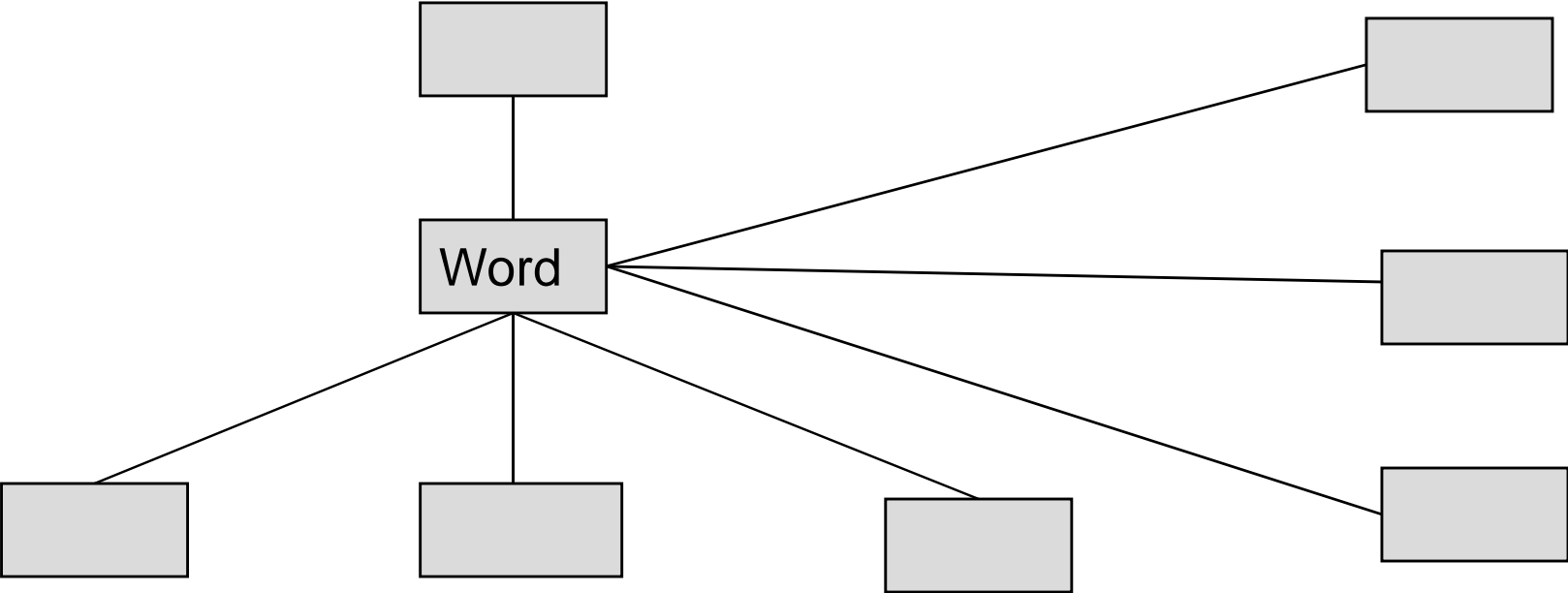
- Chemistry
- Atom
- Vocabulary
- Biology
- Mammal
- Compare Contrast

**Vocabulary:**

# Word Map

What is it?

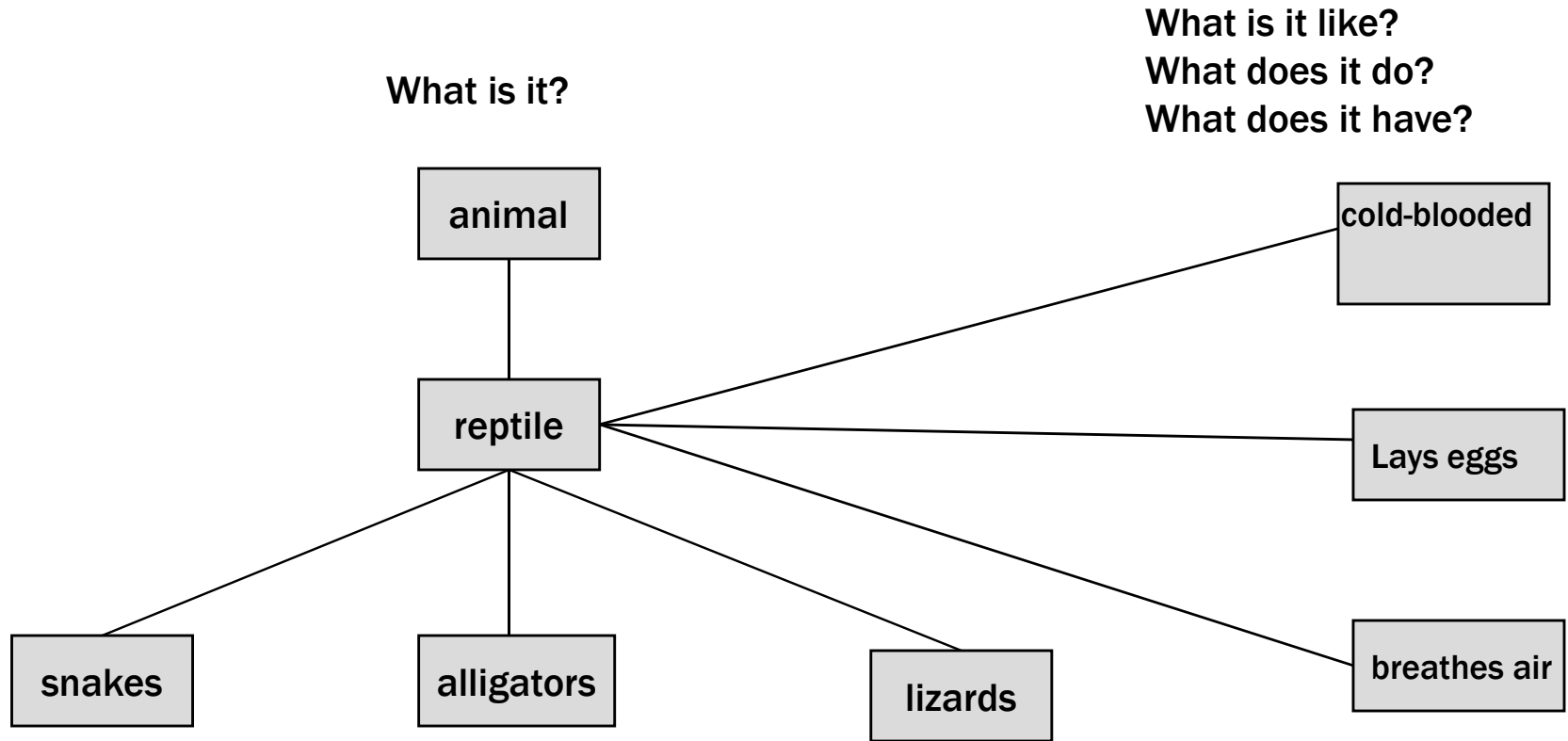
What is it like?  
What does it do?  
What does it have?



What are some examples?

**Vocabulary:**

# Word Map



What are some examples?

# Vocabulary Shout outs

Hand out two slips of paper to each person:  
1 definition of a term and 1 term

Someone reads her/his definition and  
whoever has the corresponding term  
shouts it out

That person reads his/her definition and  
whoever has that corresponding terms  
shouts it out.

# Identifying Main Idea

Read passages then pair/share what the main idea is.

Interactive reading notes – post it notes

As we practiced we developed rubrics for the students and ourselves

# Determining Main Idea Rubric

## Determining Main Idea Rubric

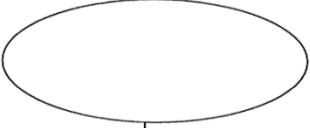
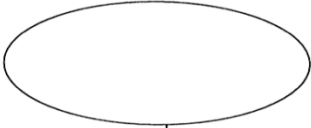


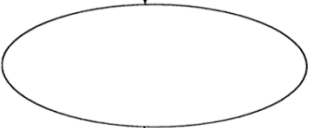
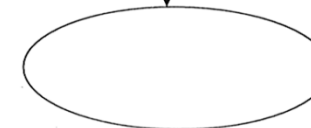
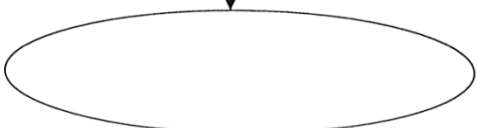
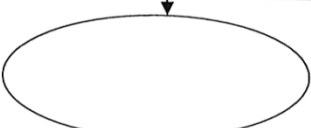
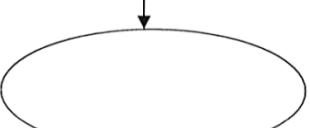
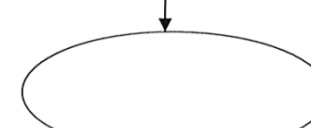
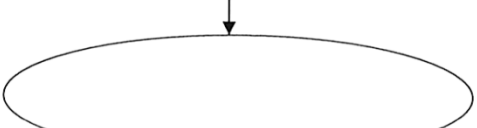
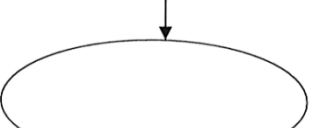
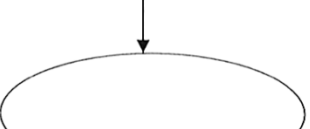
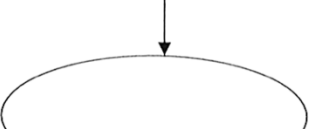
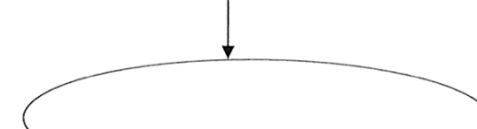
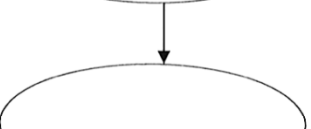
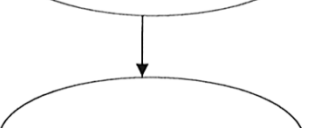
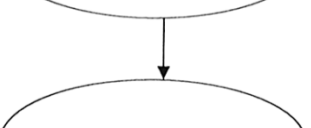
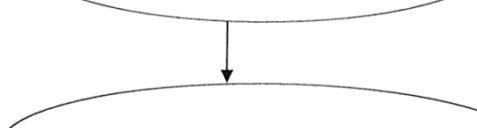
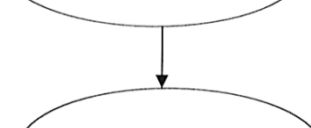
Skill	Not Present	Needs Growth	Basic Skill	Mastered
Choice of Main Idea		Interesting fact but not directly related to the main idea	Idea or topic related to main idea	Main idea is identified
Reason for Choice		Choice based upon student interest	Choice based on context of reading	Choice based upon context of reading material and Science/Society

# Interactive Reading Notes Rubric

Reading Notes  
Chapter \_\_\_\_\_

Section/Objective	0 pts Missing	1 pt Inaccurate and/or Incomplete	2 pt2 Accurate and complete
Section _____			
1			
2			
3			
4			
5			
Section _____			
1			
2			
3			
4			
5			
Section _____			
1			

# Sequences

	Name of Phase	Drawing	Student Name: _____ Description	Memory Cue
<b>M I T O S I S</b>				
				
				
				
				

# Compare/Contrast

While reading students would fill in visual organizers

We developed a rubric as we practiced.

# Compare/Contrast

## Unit 6 Chemical Bonding (Chapters 5-6)

### CHEMICAL BONDS NAMING ORGANIZER

Type of Bond	Description of electrons using special vocabulary words	Examples of substances illustrating this type of bond	Characteristics of this type of bonding	Rules for Naming & Formula Writing
Metallic	Electrons move freely between atoms in the sample.  Electron sea or fluid  Delocalized		1. Always conducts electricity  2.  3.  4.	No special rules have been given to name metallic substances
Ionic			1.  2.  3. Solutions conduct electricity  4.	
Covalent			1.  2. May exist in all phases at room temperature  3.  4.	

# Compare/Contrast

2007-08

## Unit 3 – Atomic Structure (Chap.3)

### Atomic Theory People Organizer

Name	Major Experiment	Major ideas about the atom	Picture of person's atomic model
Democritus			
Dalton			
Thompson			
Rutherford			
Bohr			
Schrodinger			

# Compare/Contrast Rubric

## Rubric for Comparison/Contrast

Skill	Not Taught	Not present	Needs growth	Basic Skill	Mastered
Comparing of multiple characteristics		No comparison of any characteristics	Incomplete comparison of one characteristic	Comparison of one characteristic	Comparison of multiple characteristics
Completeness of comparisons		No attempt of comparing any characteristics	One or more characteristics are listed for only one item being compared	Comprehensive comparison of one characteristic	Comprehensive comparison of multiple characteristics
Contrasting of multiple characteristics		No contrast of any characteristics	Incomplete contrast of only one characteristic	Contrast of only one characteristic	Contrast of multiple characteristics
Completeness of contrasts		No attempt of contrasting any characteristics	One or more characteristics are listed for only one item being contrasted	Comprehensive contrast of one characteristic	Comprehensive contrast of multiple characteristics
Organization		No apparent organization	Comparisons done as a list in no particular order	Organized by characteristics or item but not consistent	Organized consistently by characteristics or items

# **Colleague's Comments**

**Q.:** What was the most beneficial part of the training?

**> The insight gained as far as incorporating science related activities coupled with reading skills.**

**Q.:** What was the most beneficial part of the support you received during the time you spent designing your activities?

**> [Literacy Coach] around to answer questions, provide ideas.**

# **Colleague's Comments**

**Q.:** What was the most challenging part of implementing the activities in your classroom?

**> Time**

**Q.:** What was most beneficial about reflecting on the activities?

**> Time to reflect – also time to discuss with colleagues.**

# **Colleague's Comments**

**Q.:** What advice would you have for developing the training for other departments in the future?

**> Have a common set of strategies ( with the same terminology ) so students can transfer techniques from class to class when a teacher says, “We are now going to . . .”**

# **So What's Next?**

- **Baseline assessments**
- **'Control' and 'Experimental' groups**
- **Continued coaching**
- **Common assessments**
- **Reflection**
- **Celebration**

# **SUGGESTED RESOURCES**

**Buehl, Doug.**

# *Your Turn -*

➤ *Questions:* \_\_\_\_\_

➤ *Comments:* \_\_\_\_\_

➤ *Observations:* \_\_\_\_\_

*Thank you!*

## **Contact Information**

**Dr. David Greenwood**  
**Science Chair**  
**Mundelein High School**

**[dgreenwood@mhs.k12.il.us](mailto:dgreenwood@mhs.k12.il.us)**  
**847-949-2200 ext. 1087**

**Dennis Szymkowiak**  
**Reading Specialist /**  
**Literacy Coach**  
**Mundelein High School**

**[denszym@mhs.k12.il.us](mailto:denszym@mhs.k12.il.us)**  
**847-949-2200 ext. 1095**