A Collaborative 21st Century Approach to Implementing the Current Science Curriculum

Meeting Agenda

8am – 8:40am: Welcome and Introductions

8:40 – 9:20am: Topic Elicitation and Exploration (Group Activity 1)

- The purpose of this activity is to develop a concept map that shows the key “concepts and skills” for each group’s assigned embedded task.

9:20 – 10:20am: Topic Synthesis (Whole Group Activity 1)

- A spokesperson from each group will report on their "E*mbedded Task Concept Map “*
- Whole Group Concept Map development showing connections (Concepts and Skills)

10:20am – 10:30am: Break

Agenda [continued]

10:30 – 11:00am: Topic Elicitation and Exploration
Group Activity 2

- The purpose of this activity is to develop an instructional strategy/model for implementing the embedded tasks infused with common core elements, such as non-fiction readings.

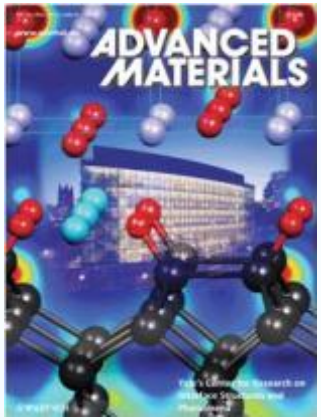
11:00am – 11:50pm Topic Synthesis and Application
Whole Group Activity 2

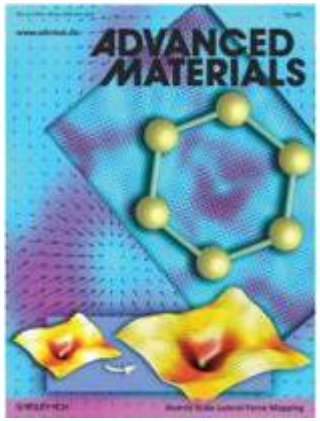
- Report out and synthesize group ideas. Discuss how to apply the instructional models. (Prof. Karen Cummings)

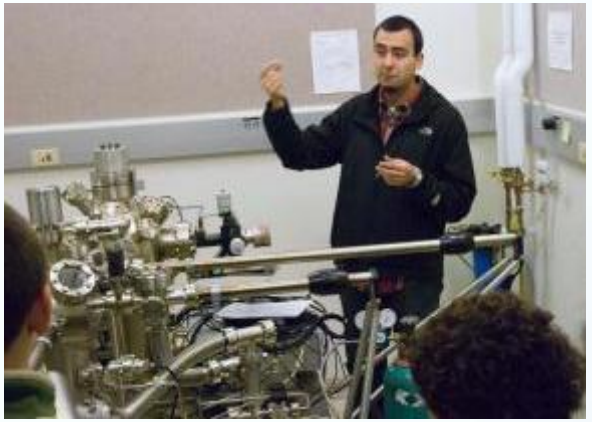
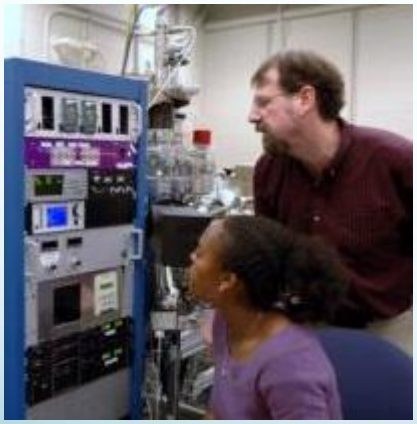
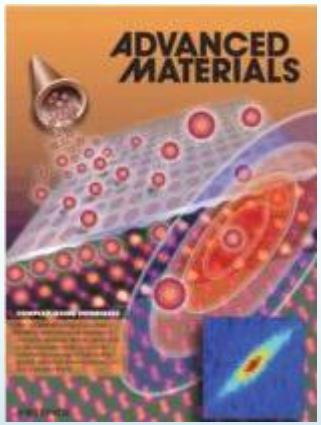
11:50am - 12:00pm Wrap up and Evaluation (post-survey)

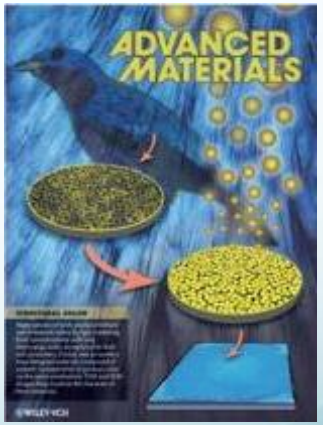
CRISP Education and Outreach [EO]

synergistic integration of research and education



A National Science Foundation Materials Research Science and Engineering Center [MRSEC]

CRISP EO Goals

Use the **interdisciplinary** aspects of materials science for recruitment, retention, and education in STEM

Enhance the core science knowledge of K-12 teachers

➔**Improve learning** for K-12 students

Develop models for **recruitment and retention** of **diverse** STEM majors from urban K-12 districts

STEM = science, technology, engineering and math

Professional Development

RET fellowship – summer research with stipend

RET scholarship – for summer courses

Courses in MS Science Education and Nanotech MS

IDS 571: Science Laboratory Practice

PHY 511: Experiments/Demos in Physics

PHY 519: Nanotech I: Fundamentals of Nanoscience

PHY 521: Nanotech II: Characterization of Nanomaterials

www.southernct.edu/crisp

CRISP EO Resources

Professional Development - for educators, professionals and practicing scientists

Educational Resources - clearing-house for hands-on activities and demos available for loan for local educators

Library - CRISP has a collection of books & DVDs also available

Forum - register to connect with other educators and have access to additional curricular resources

List-serv - join our list-serv for science educators

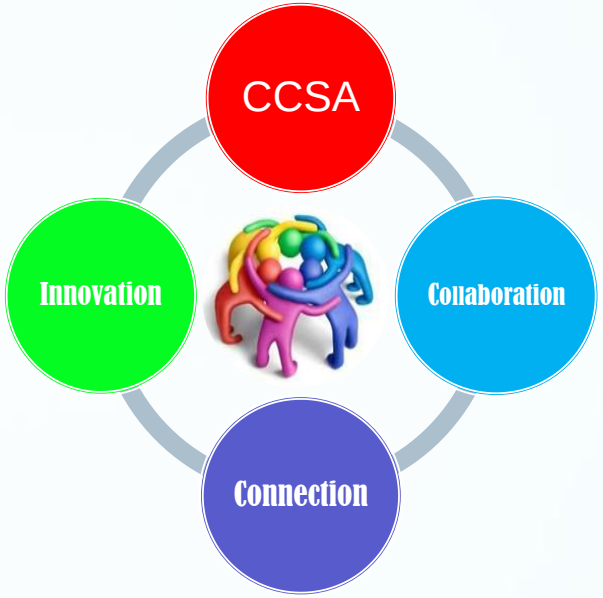
https://www.southernct.edu/crisp

The 21st Century Approach

- Next Generation Standards
- 21st Century Skills
- Common Core
  - *To be ready for college, workforce training, and life in a tech society, students need the ability to gather, comprehend, evaluate, synthesize, and report on information and ideas, to conduct original research in order to answer questions or solve problems…"*
- Interdisciplinary and collaborative: We must work together – K-12 [across grades and disciplines], university faculty, industry and the community

http://www.nextgenscience.org/next-generation-science-standards
http://www.corestandards.org/the-standards

CCSA – Who are we?
Goals for the meeting



CCSA - Who are we?
A team of collaborative, innovative and interdisciplinary educators who wish to enhance the educational opportunities for students by facilitating professional development for teachers

CCSA - Goals for the meeting
Develop models around current embedded tasks to promote deeper learning and engage students by looking at common content from different disciplinary perspectives.

We need you…

To share in a collaborative innovative way to help teachers help students learn!

Our Mission

To empower teachers by providing opportunities to create interdisciplinary teams and research-based educational activities that makes science accessible to all students.

Why are you here?

You are the teachers who will facilitate the change.

Your experience, expertise and knowledge of your students are the vehicles that will develop the innovative ways to develop our craft and move instruction into a new era of teaching and learning!

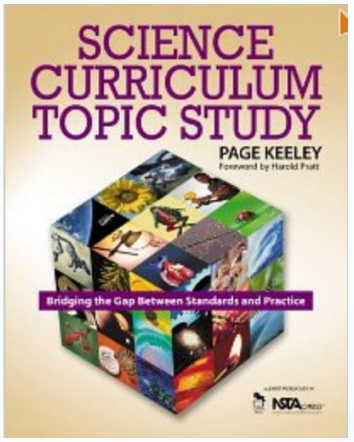
Your are the future !

Never doubt that a small group of thoughtful, committed citizens can change the world; indeed, it's the only thing that ever has.

-Margaret Mead

Workshop Approach

Science Curriculum Topic Study



- An approach designed to help science educators deeply examine a curricular topic.
- A guide for using standards as the starting point to improve the quality of science education.
  - 147 CTS Guides: Energy Transformations; Cells; Properties of Matter; Forces; Motion; Scale; Experimental Design; Data Analysis...
- A collaborative PD experience where teachers come together to share knowledge, increase understanding, and gain a K-12 (across grades) “big picture” of the topic
  - Our goal is to make connections among the ideas in the topic to promote a coherent flow ideas from one embedded task to another
    - Concept Maps

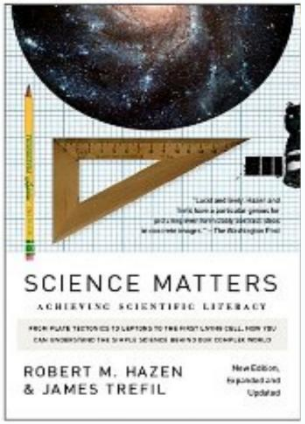
CTS Guides and Resources

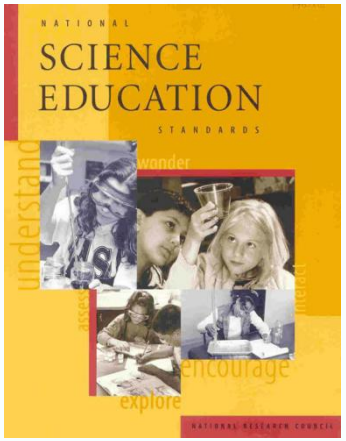
Standards- and Research-Based Study of a Curricular Topic

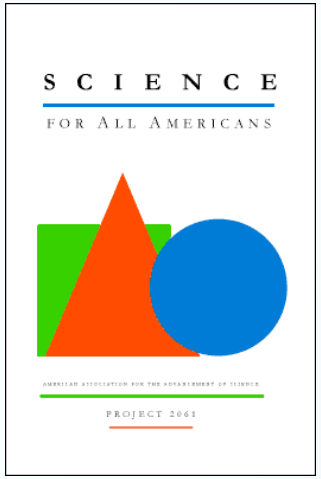
PROPERTIES OF MATTER

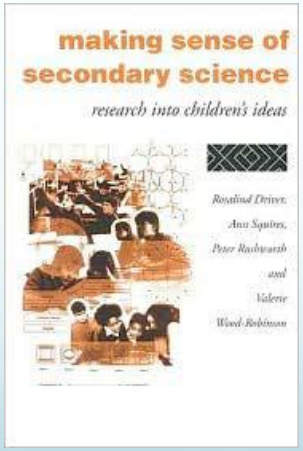
Section and Outcome	Selected Sources and Readings for Study and Reflection Read and examine *related parts* of:
I. Identify Adult Content Knowledge	IA: ***Science for All Americans*** ▸ Chapter 4, *Structure of Matter,* pages 46–48 IB: ***Science Matters: Achieving Scientific Literacy*** ▸ Chapter 7, *Atomic Architecture,* pages 94–109
II. Consider Instructional Implications	IIA: ***Benchmarks for Science Literacy*** ▸ 4D, *Structure of Matter* general essay, page 75; grade span essays, pages 76–79 IIB: ***National Science Education Standards*** ▸ Grades K–4, Standard B essay, pages 123, 126 ▸ Grades 5–8, Standard B essay, page 149; Vignette *Funny Water,* pages 150–153 ▸ Grades 9–12, Standard B essay, page 177
III. Identify Concepts and Specific Ideas	IIIA: ***Benchmarks for Science Literacy*** ▸ 4D, *Structure of Matter,* pages 76–80 IIIB: ***National Science Education Standards*** ▸ Grades K–4, Standard B, *Properties of Objects and Materials,* page 127 ▸ Grades 5–8, Standard B, *Properties and Changes of Properties in Matter,* page 154 ▸ Grades 9–12, Standard B, *Structure and Properties of Matter,* pages 178–179
IV. Examine Research on Student Learning	IVA: ***Benchmarks for Science Literacy*** ▸ 4D, *Structure of Matter,* pages 336–337 IVB: ***Making Sense of Secondary Science: Research Into Children's Ideas*** ▸ Chapter 8, *Materials,* pages 73–78 ▸ Chapter 9, *Solids, Liquids, and Gases,* pages 79–84 ▸ Chapter 12, *Water,* pages 98–103 ▸ Chapter 13, *Summary of Ideas About the Physical Properties of Air,* pages 107–110
V. Examine Coherency and Articulation	V: ***Atlas of Science Literacy*** ▸ *Conservation of Matter,* pages 56–57; note the conceptual strand *Changing vs. Constant Properties* ▸ *States of Matter,* pages 58–59 ▸ *Chemical Reactions,* pages 60–61; note the conceptual strand *Changing Properties.*
VI. Clarify State Standards and District Curriculum	VIA: ***State Standards:*** Link Sections I–V to learning goals and information from your state standards or frameworks that are informed by the results of the topic study. VIB: ***District Curriculum Guide:*** Link Sections I–V to learning goals and information from your district curriculum guide that are informed by the results of the topic study.

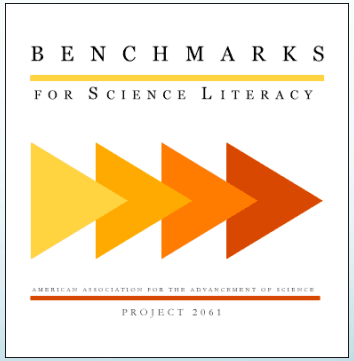
Visit www.curriculumtopicstudy.org for updates or supplementary readings, Web sites, and videos.











www.currriculumtopicstudy.org

First Step

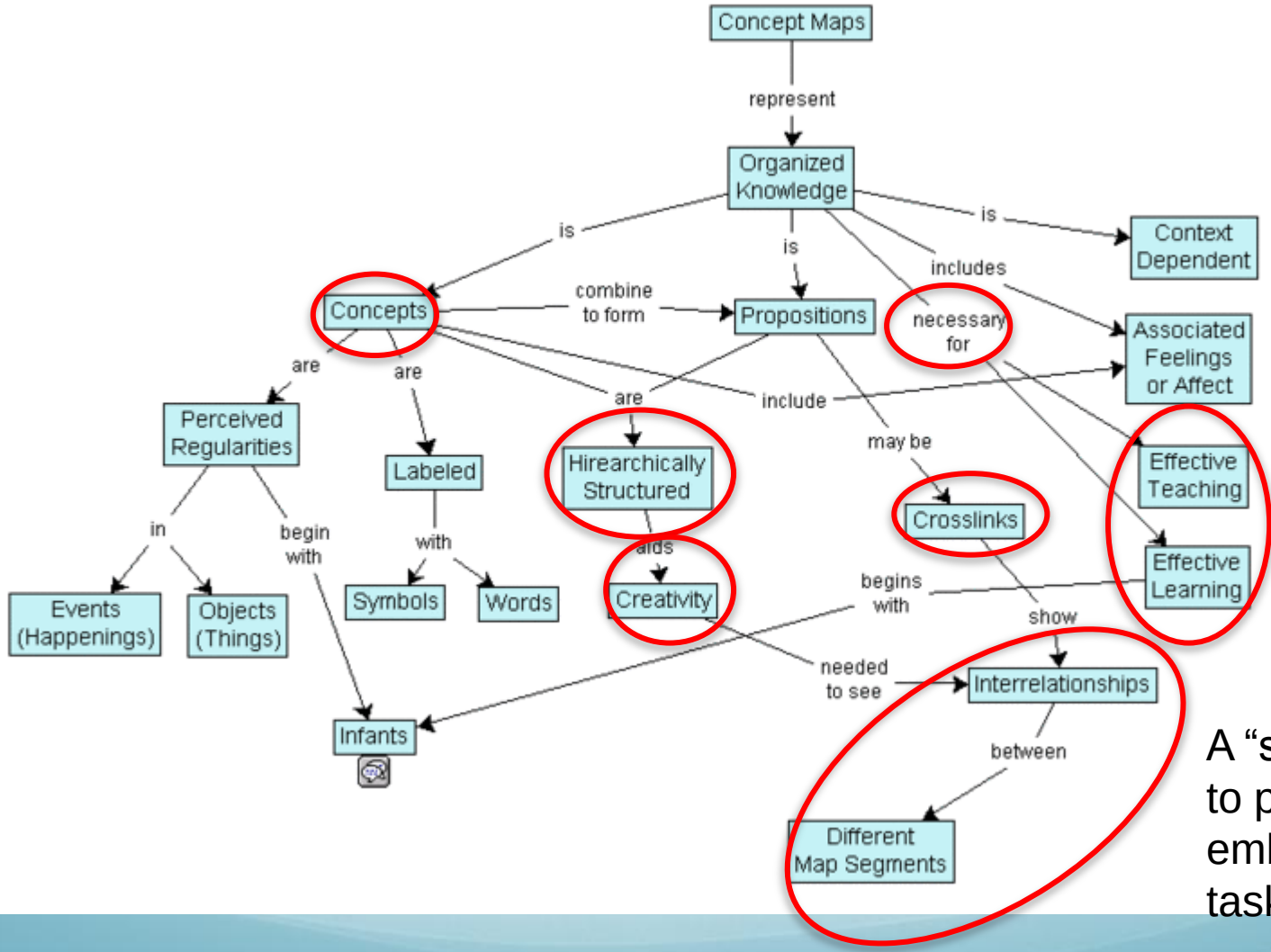
8:40 – 9:20am: Topic Elicitation and Exploration (Group Activity 1)

- The purpose of this activity is to develop a concept map that shows the key “concepts and skills” for each group’s assigned embedded task.

What is a concept map?

- A concept map is a diagram showing the relationships among concepts (and skills).
- It is a graphical tool for organizing and representing knowledge.

What is a concept map?



A “story line” to pull the embedded tasks together

Our Goal

A common use for concept maps is the creation of new knowledge

by transforming the tacit knowledge of individuals into an organizational resource…

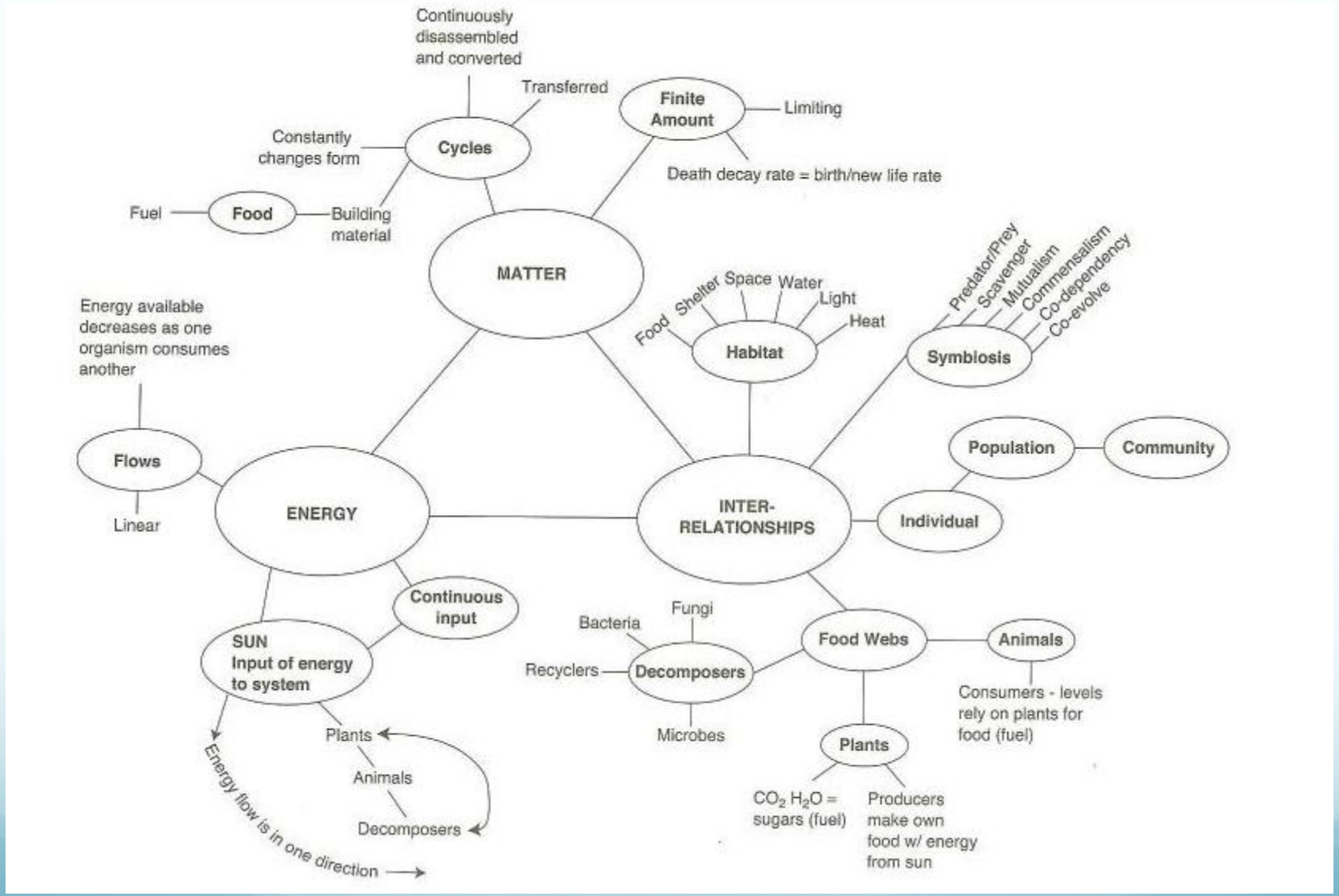
mapping team knowledge for use by others

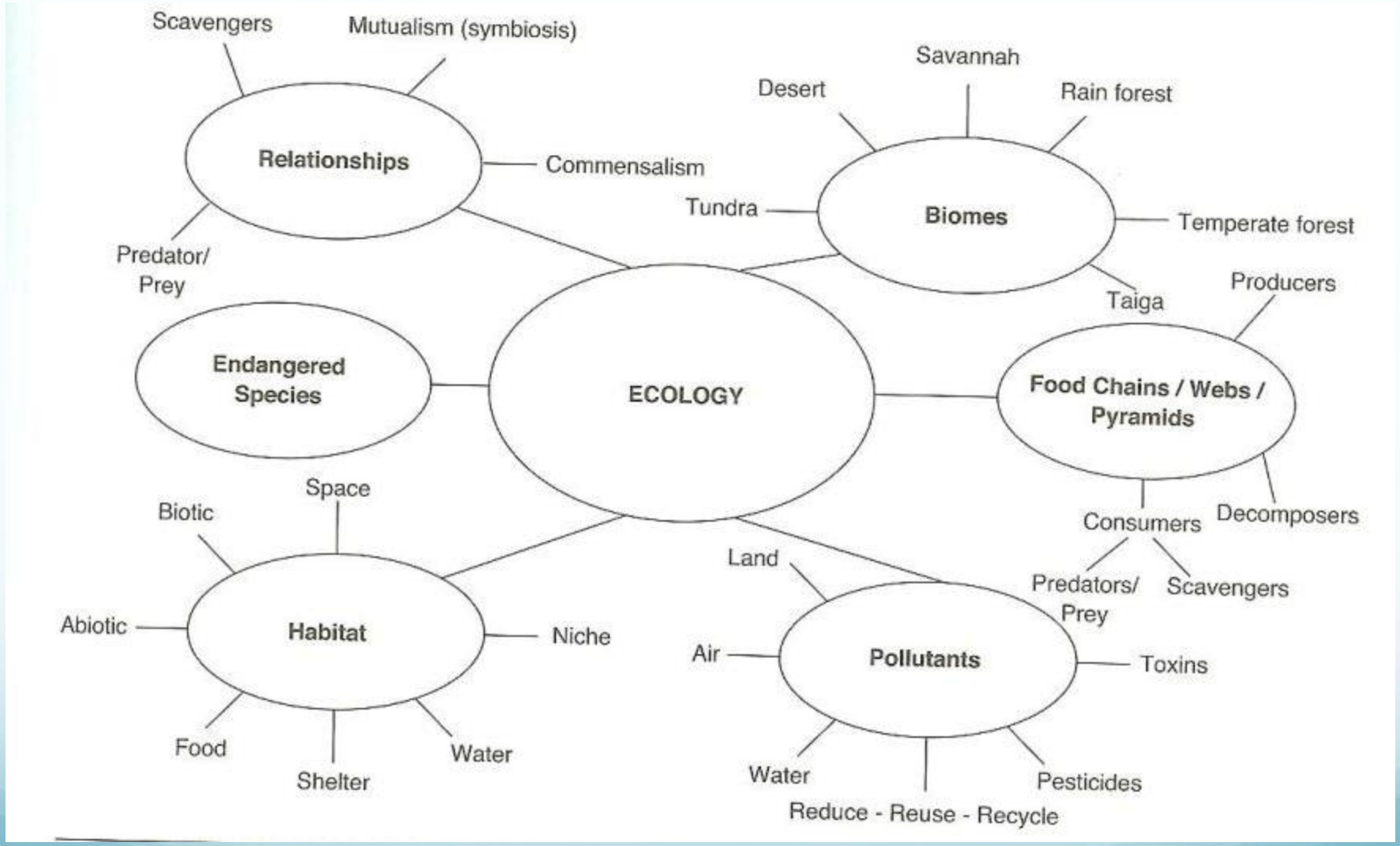
Our First Task

We will be mapping what students need to know (concepts)

and what they need to be able to do (skills)

to have success with a few of the grade 9 embedded tasks.


Continuously disassembled and converted
Transferred
Finite Amount
Limiting
Constantly changes form
Cycles
Death decay rate = birth/new life rate
Fuel
Food
Building material
MATTER
Energy available decreases as one organism consumes another
Food
Shelter
Space
Water
Light
Heat
Habitat
Predator/Prey
Scavenger
Mutualism
Commensalism
Co-dependency
Co-evolve
Symbiosis
Flows
Linear
ENERGY
INTER-RELATIONSHIPS
Population
Community
Individual
Continuous input
SUN Input of energy to system
Bacteria
Fungi
Recyclers
Decomposers
Microbes
Food Webs
Animals
Consumers - levels rely on plants for food (fuel)
Plants
Animals
Decomposers
Energy flow is in one direction
Plants
CO_2 H_2O = sugars (fuel)
Producers make own food w/ energy from sun


ECOLOGY
Relationships
Scavengers
Mutualism (symbiosis)
Commensalism
Predator/
Prey
Biomes
Savannah
Desert
Rain forest
Tundra
Temperate forest
Taiga
Endangered
Species
Food Chains / Webs /
Pyramids
Producers
Consumers
Decomposers
Predators/
Prey
Scavengers
Habitat
Space
Biotic
Abiotic
Niche
Food
Shelter
Water
Pollutants
Land
Air
Toxins
Water
Pesticides
Reduce - Reuse - Recycle

Our First Task

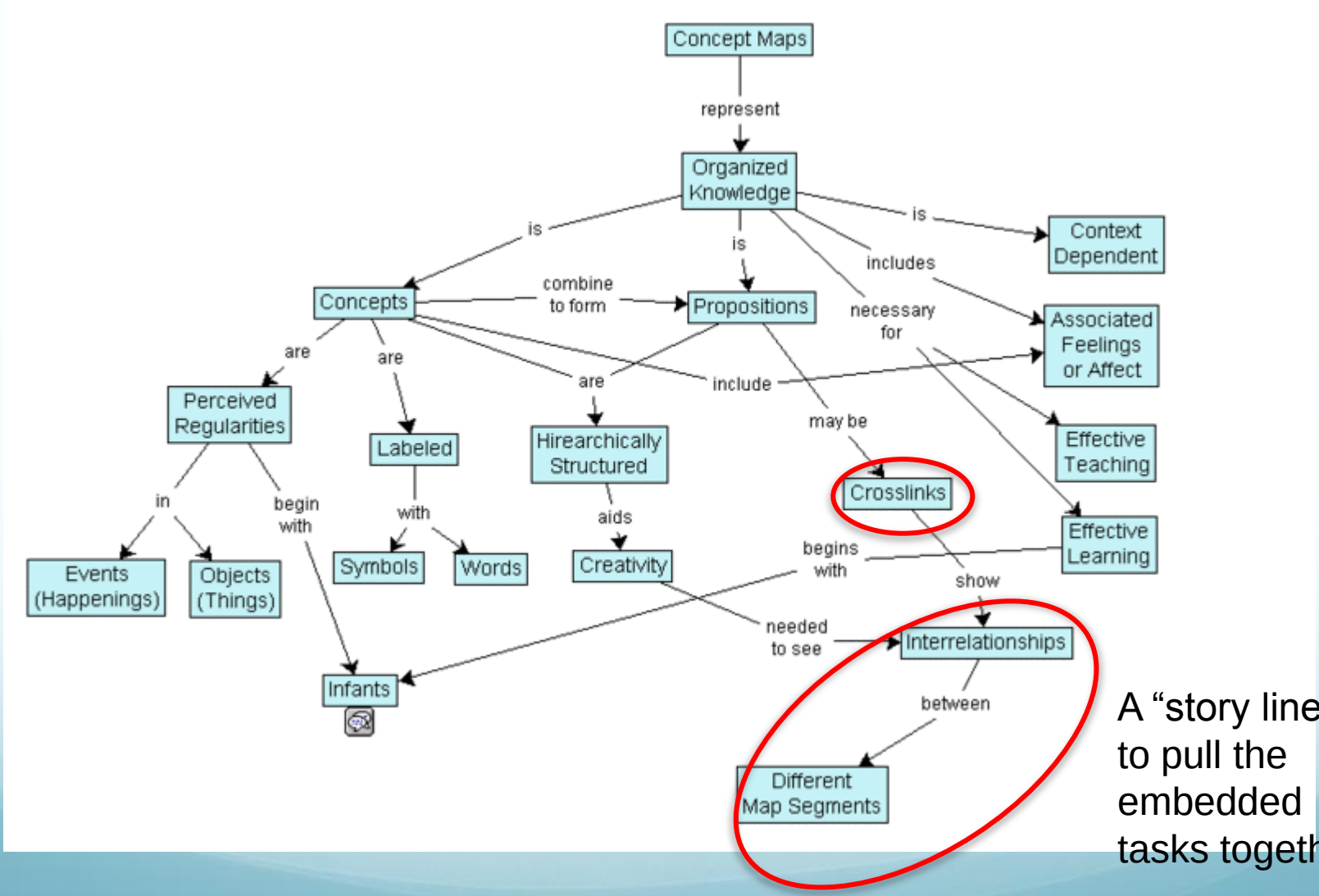
We will be mapping what students need to know (concepts)

and what they need to be able to do (skills)

to have success with a few of the grade 9 embedded tasks.

We will be on the lookout for opportunities to link to the reading strands of the common core.

We will then come together to look for links between our maps



A “story line” to pull the embedded tasks together

In our second break-out session

- We will look more carefully and specifically for opportunities to leverage the non-fiction reading strands and/or multimedia requirements of the common core while …
- We (each group) develop one viable pedagogical model for teaching the concepts and skills presented on our concept map.

Second Session Slides…

In our second break-out session

- We will all look more carefully and specifically for opportunities to leverage the non-fiction reading strands and/or multimedia requirements of the common core.

Common Core-Reading

Reading Standards for Literacy in Science and Technical Subjects 6–12

RST

Grades 6–8 students:	Grades 9–10 students:	Grades 11–12 students:
Key Ideas and Details		
1. Cite specific textual evidence to support analysis of science and technical texts.	1. Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.	1. Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.
2. Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions.	2. Determine the central ideas or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.	2. Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.
3. Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.	3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.	3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.
Craft and Structure		
4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 6–8 texts and topics*.	4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 9–10 texts and topics*.	4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 11–12 texts and topics*.
5. Analyze the structure an author uses to organize a text, including how the major sections contribute to the whole and to an understanding of the topic.	5. Analyze the structure of the relationships among concepts in a text, including relationships among key terms (*e.g., force, friction, reaction force, energy*).	5. Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas.
6. Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text.	6. Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, defining the question the author seeks to address.	6. Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, identifying important issues that remain unresolved.
Integration of Knowledge and Ideas		
7. Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (*e.g.*, in a flowchart, diagram, model, graph, or table).	7. Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.	7. Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.
8. Distinguish among facts, reasoned judgment based on research findings, and speculation in a text.	8. Assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem.	8. Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.
9. Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.	9. Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts.	9. Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.
Range of Reading and Level of Text Complexity		
10. By the end of grade 8, read and comprehend science/technical texts in the grades 6–8 text complexity band independently and proficiently.	10. By the end of grade 10, read and comprehend science/technical texts in the grades 9–10 text complexity band independently and proficiently.	10. By the end of grade 12, read and comprehend science/technical texts in the grades 11–CCR text complexity band independently and proficiently.

1. Cite specific textual evidence to support an analysis of science and technical texts.
2. Determine the central ideas or conclusions of a text; trace an explanation of a complex process; provide an accurate summary of the text.
3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.
4. Determine the meaning of symbols, key terms, and other domain-specific words.
5. Analyze the structure of the relationships among concepts in a text, including relationships among key terms

6. Analyze the author's purpose, define the question the author seeks to address.
7. Translate information expressed in words into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.
8. Assess the extent to which the reasoning and evidence in a text support the author's claim.
9. Compare and contrast findings presented in a text to those from other sources (including their own experiments).
10. By the end of grade 10, read and comprehend science/technical texts in the grades 9–10 text complexity band independently and proficiently.

BTW

#7 (11th and 12th grades)

Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.

In our second break-out session

- We will all look more carefully and specifically for opportunities to leverage the non-fiction reading strands and/or multimedia requirements of the common core.
- 7th and 8th grade teachers will consider the implications and viability of the requested “prerequisite knowledge and skills”.
- Each 9th grade group will develop one viable pedagogical model for teaching the concepts and skills presented on their concept map.

What is a "pedagogical model"?

- By "pedagogical model" we mean a general description of a suggested instructional process.
- e.g. types of actives, sequence of activities, emphasis
- The goal is an outline of instruction that can be used by group members and/or others to prepare students for success with your specific embedded task.
- Ideally, the model would be general enough that it could be mapped on to other similar instructional situations.