Science IDEAS as an Integrated Instructional Model for K-5 Impacts Comprehension: Learn Why!

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What is Involved with Meaningful Learning in Science?

Meaningful learning in science requires

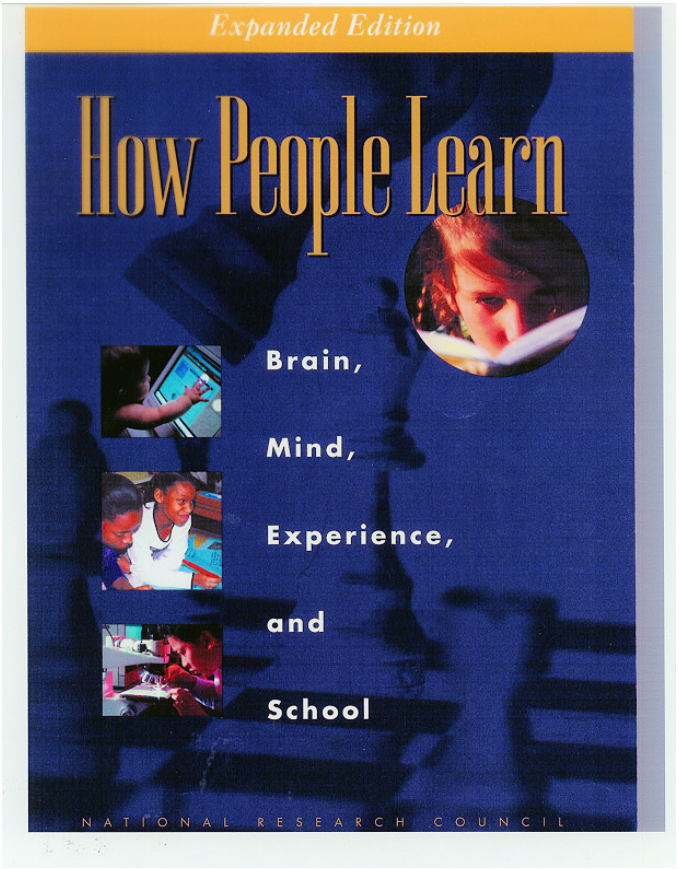
- Meaningful content to be learned
- A curricular structure with opportunities for students to be able to:
  - learn more about what is being learned
  - explicitly relate what is to be learned to what has already been learned (access prior curricular knowledge)
  - build relationships among concepts (e.g., powerful *sameness)*
  - review what has been learned

What Does Research Tells Us? Consensus Research About the Role of Knowledge in Meaningful Learning

Recent Research Related to Learning with Understanding…

3 Major Findings…

- *Prior Knowledge* is a major determinant of future learning
- Understanding involves *organizing/ re-organizing* knowledge around core concepts
- Learning involves *knowing when* to use prior knowledge and skills for future learning (*metacognition*)



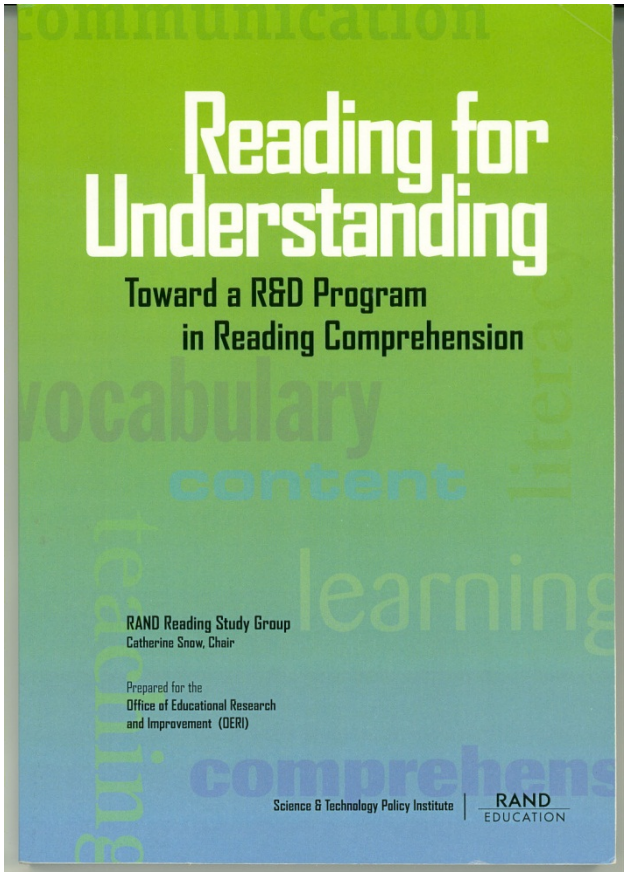
Consensus Research: Conclusions Relating to the Role of Knowledge in Reading Comprehension

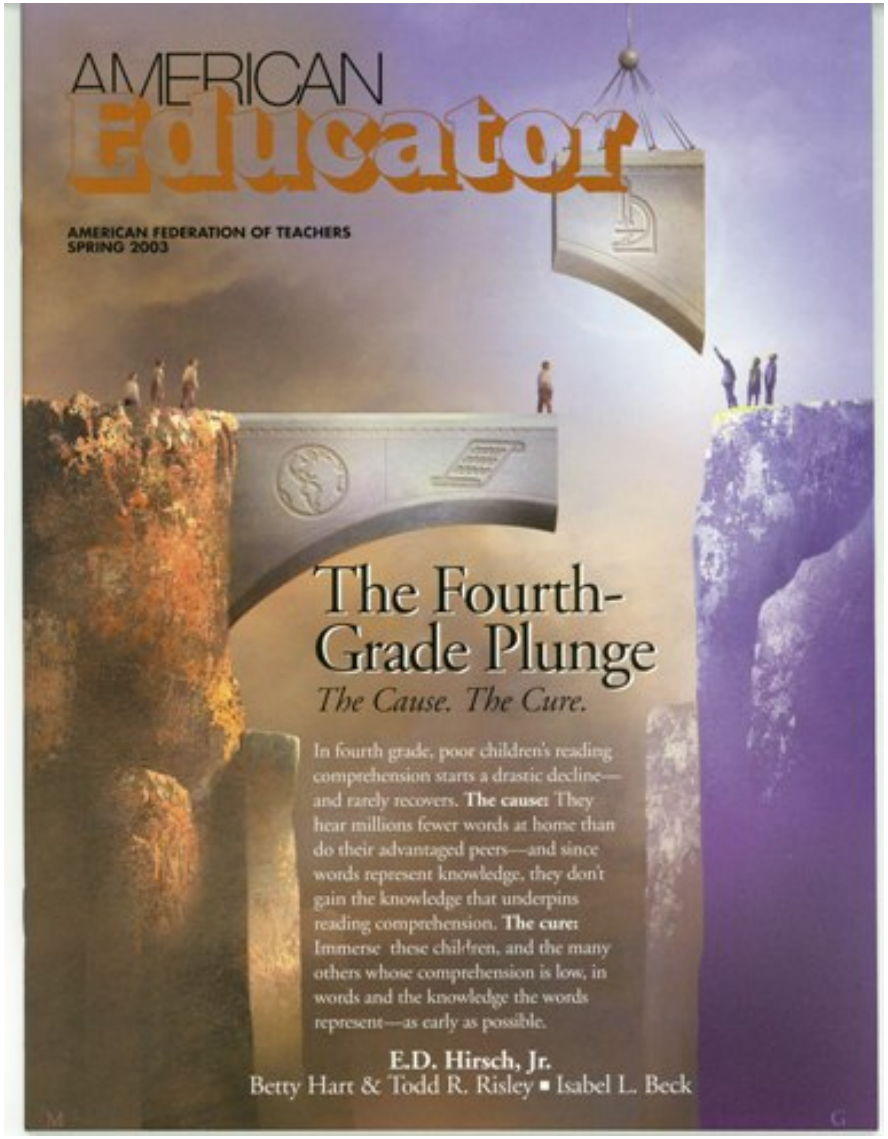
Rand Research Findings

•Recommends more content-area reading

•Defines comprehension as…

The simultaneous process of extracting and constructing meaning from print materials





American Educator

Spring 2003

Entire issue devoted to comprehension

Available from the American Federation of Teachers (AFT.org)

Basals Acknowledge the Need for Background Knowledge, But Do Little To Build It

In the early grades, the heart of a reading basal is a collection of simple stories with which children can practice their emerging decoding skills. In general, these stories don't impart much word or domain knowledge—partly because it is important not to interfere with practicing decoding skills. There are a few fabulous examples of how such simple stories can introduce tremendous world knowledge (for example, Open Court's story titled *Homes Across the World* introduces children to the world's diverse geography and cultures with houses on stilts, houses with thatch roofs, and much more)—but such stories are rare.

Therefore, a critical way to build vocabulary and world knowledge is through stories that teachers read aloud and through the discussions that follow. Most of the basals seem to recognize this and suggest devoting time to read-alouds. But the provided read-alouds rarely introduce interesting vocabulary or content; and, by second grade, they are typically not part of the daily (or even weekly) schedule. (Harcourt Trophies is a notable exception, providing almost daily teacher-read-alouds with interesting vocabulary.) In addition, teacher editions instruct teachers to "build background knowledge" about story content before reading the stories (whether basal or read-aloud stories). But most of the stories' content deals with slight topics grounded in the domestic world of the modern American child, making it unlikely that students' horizons will be broadened.

To increase students' word and world knowledge, students must be exposed to more rigorous content: Teacher read-alouds should be roughly two grade levels above the students, and students' basal stories should ideally develop the same bodies of knowledge that have been introduced in the teacher read-alouds. Moreover, significant chunks of time—say 20 minutes daily—should be devoted to discussion after each read-aloud. This allows time to ensure that all students comprehend the high-level read-alouds, explain new vocabulary, and start using the new vocabulary and new ideas and concepts.

In one typical five-week unit from a 2nd-grade basal, the teacher read-alouds were all short poems or several-paragraph stories like those above, containing very ordinary vocabulary. Only one story departed from the simple world of family and friends and themes of sharing, playing, and family celebrations. Across several 1st- and 2nd-grade basals, some topics on which teachers were asked to build background knowledge were: what teddy bears look like; what makes grandmothers special; and what could happen if everyone brought their pets to school.

Puppy for Sale!

"I'm sitting in the window of Pat's Pet Shop. It could be worse. At least I have my friend Blackie with me. Blackie has been at Pat's for a couple of months. I've been here only a couple of weeks. I miss the warmth of my mother and my three sisters and four brothers. But I try not to think about it. At least here in the window I can watch the people go by.

"There he is, that little boy who was here this afternoon with his mother. It was really nice when he held me in his arms. He smelled like that fluffy blue blanket in my old home. And he had soft hands. He knew exactly how to hold me as he put me back in the box by the window.

"Of course, Pat tried to interest him in Blackie. She told his mother that he is friendly, that he is good with children, that he's almost paper trained. But you can't blame Pat—Blackie does need a home."

Friends
Crystal Bowman

A friend is someone who listens,
A friend is someone who cares.
A friend is someone who understands,
A friend is someone who shares.

It's nice to have a special friend
To tell all your secrets to.
It's nice to know that someone you like,
Is someone who really likes you.

A friend is someone you call on the phone
To talk about nothing at all.
A friend is someone who cheers you up
And makes you feel ten feet tall.

Everyone would like to have
A special friend, it's true.
But if you want a special friend,
You need to be one, too.

Toaster Time
Eve Merriam

Tick tick tick tick tick tick tick
Toast up a sandwich quick quick quick
Hamwich
Or jamwich
Lick lick lick!

Tick tick tick tick tick tick — stop!
POP!

Build Background

Teddy Takes a Vacation

BEFORE READING

Build Background

LARRY'S BABY BOA

BEFORE READING

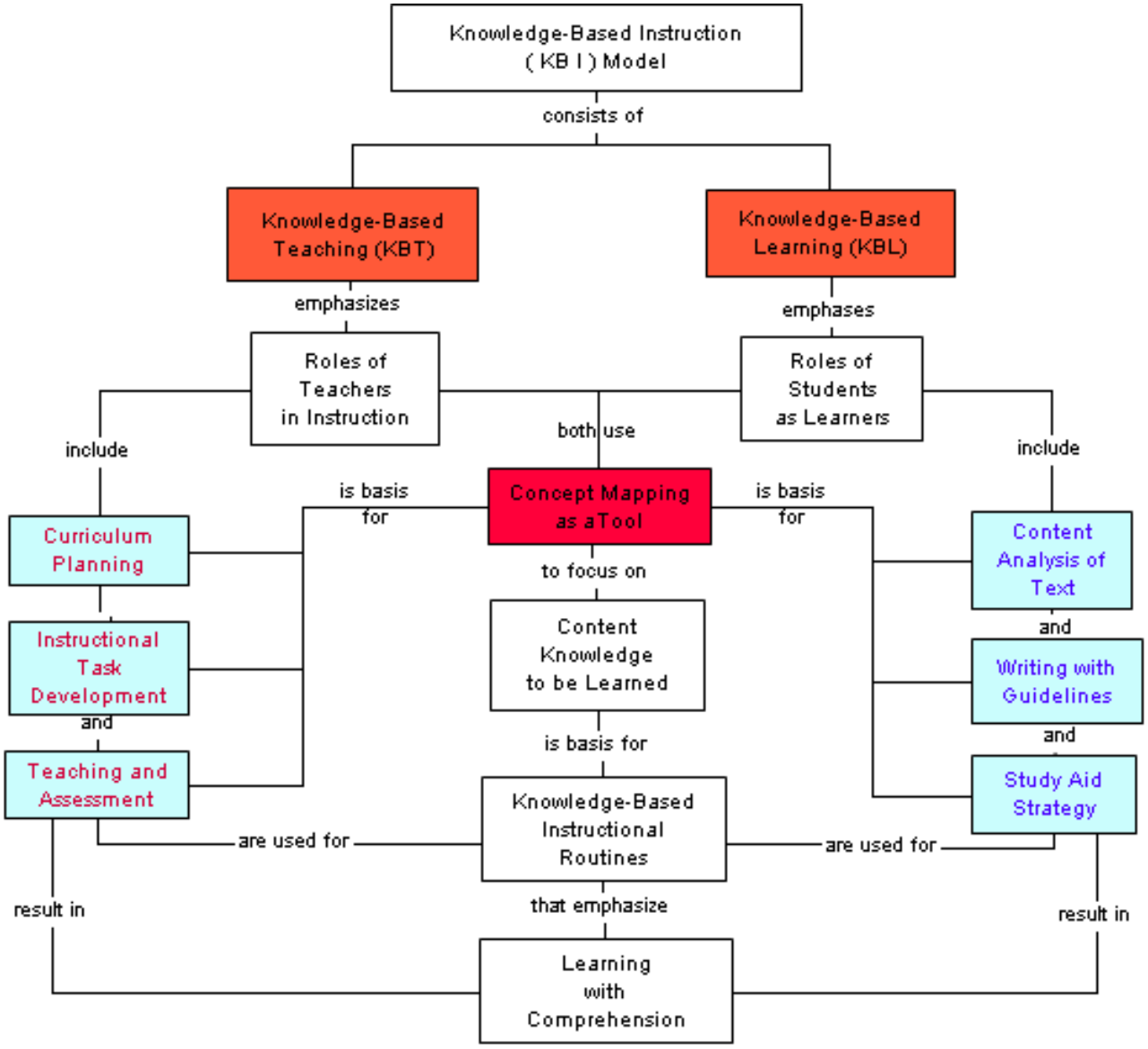
Build Background

Basal Readers: The Lost Opportunity to Build Background Knowledge to Propel Comprehension

Author: Kate Walsh

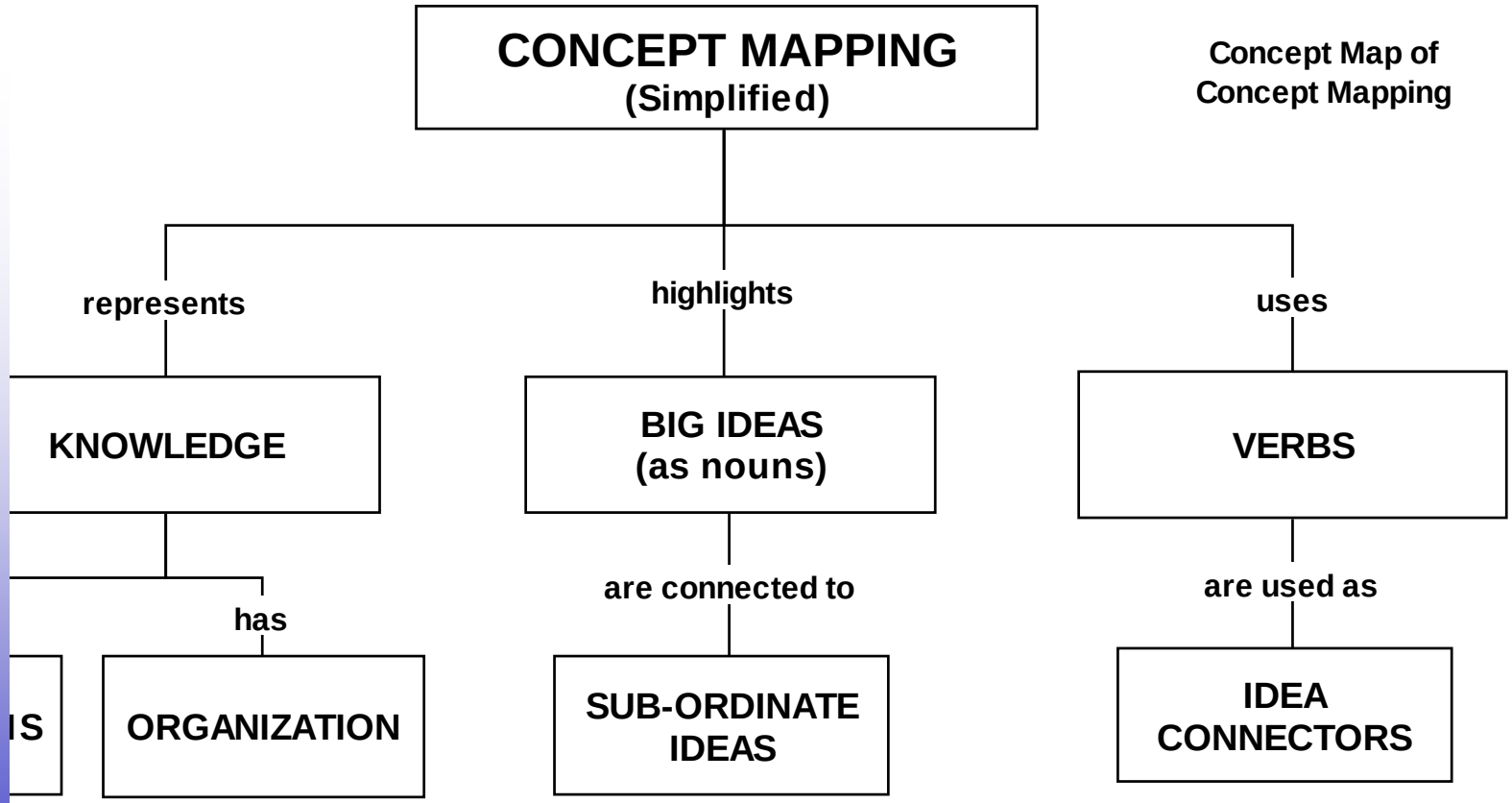
American Educator Spring 2003

An Instructional Model
Building Reading Comprehension by Integrating Reading within Science - Grades K-5



Note- For Content Analysis of Text- a knowlege-focused reading comprehension strategy is a key process that complements concept mapping (i.e., to read with comprehension: apply reading comprehension strategy, then concept map content)

Concept Mapping as a Graphic Organizer



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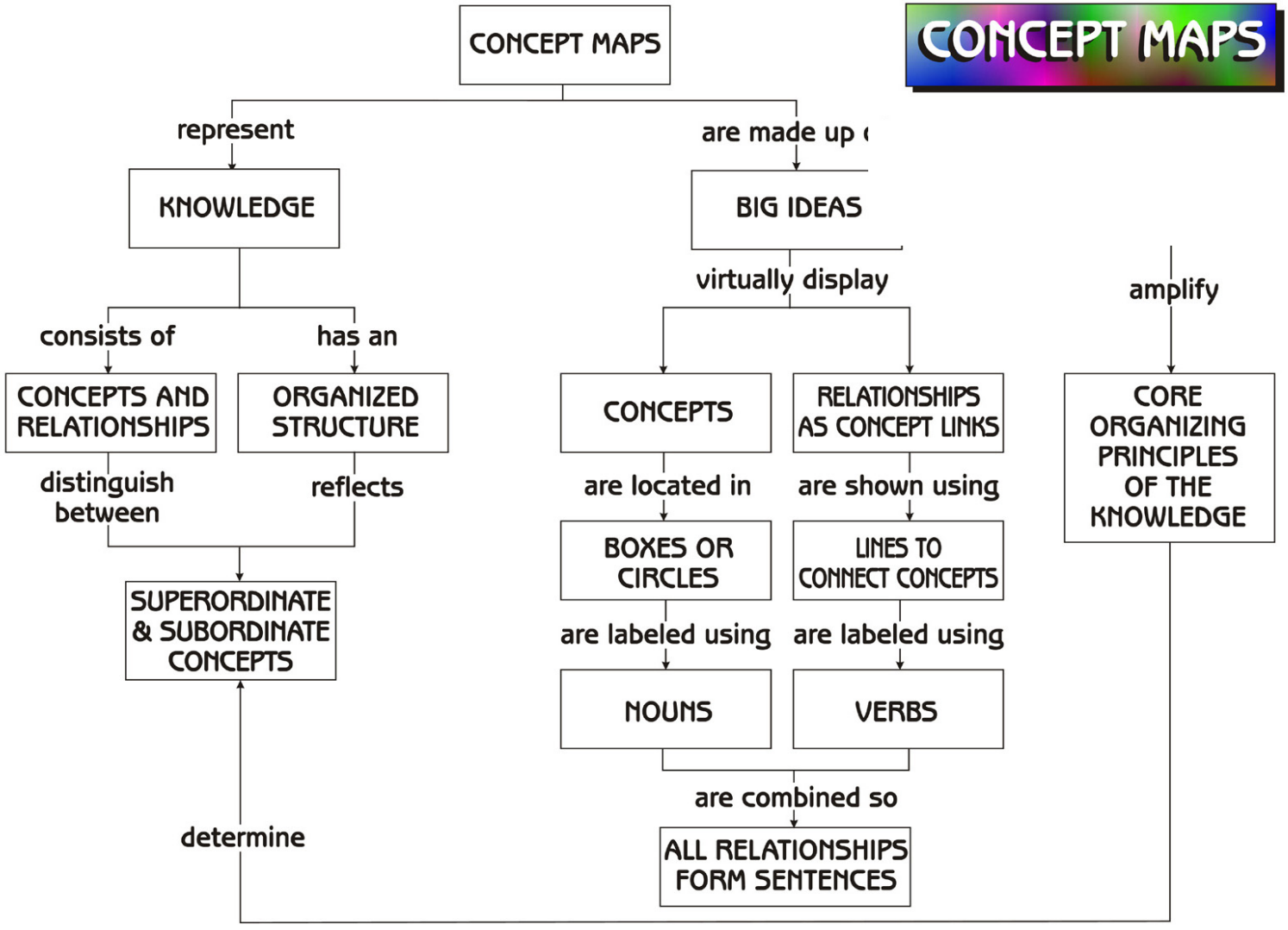
Project #0228353

Constructing Propositional Concept Maps



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Propositional Concept Maps: A Curriculum Planning Tool

- Concept maps -
  - are useful in representing the organization or structure of the content knowledge *prior to* and *resulting from* instruction.
  - are powerful because they inform the teacher about:
    - Prior knowledge that is needed by students
    - New knowledge students attend to
    - How new knowledge is perceived by students
    - What learners judge to be important
    - What they actually learn

Propositional Concept Maps: A Curriculum Planning Tool

- Curriculum Concept Maps help to-
  - Organize the school curriculum
  - Highlight ‘big’ ideas in the curriculum as organizing concepts for learners
  - Prioritize concepts to be taught (less is more)
  - Identify ‘gaps’ in the curriculum
  - Identify concepts which can be used to connect other disciplines
  - Establish consistency among the curriculum units being taught at a grade level or for a course

Propositional Concept Maps: A Curriculum Planning Tool

- Curriculum Concept Maps help to-
  - Identify a plan for instruction including daily lessons (See Evaporation Map)
  - Serve as a framework to evaluate texts and other instructional materials
  - Organize curriculum across grade levels or courses as well as provide for vertical articulation
  - Integrate FLSSS in science with literacy

Propositional Concept Maps: A Curriculum Tool for Teachers

Propositional Concept Maps help to –

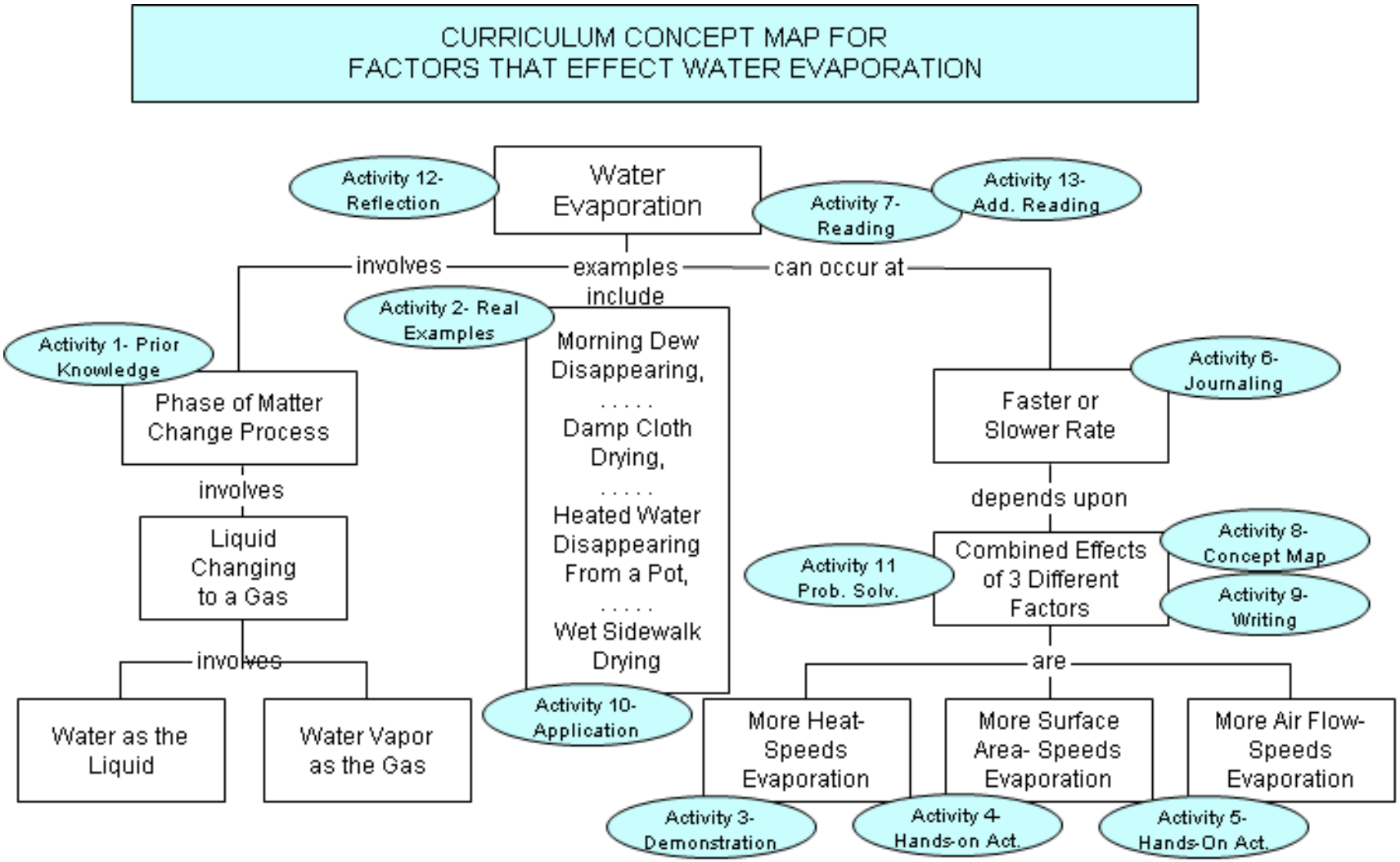
- **Organize the school curriculum.**
  - **Construct a single lesson**
  - **Construct a map representing multiple lessons**
  - **Construct a map for an entire Unit of study**
    - **Notes and Considerations are important**
  - **Map out the curriculum across a grade level**
  - **Map out the curriculum vertically (K-12)**
  - **Identify gaps and overlaps in terms of what is being taught**

Easy Start-Up for Concept Maps

- Initial Use:
  - Grade level planning – all teachers – with some guidance (if possible)
  - Create large poster-size maps as teacher guides in the classroom
  - Reference them often while teaching (students like to know where they are)
  - Illustrate large map with indicators showing activities, reading, writing ideas
  - Teacher plan unit/lesson assessments using maps
  - Use maps with students for review
  - Add samples of student work to illustrate what has been learned

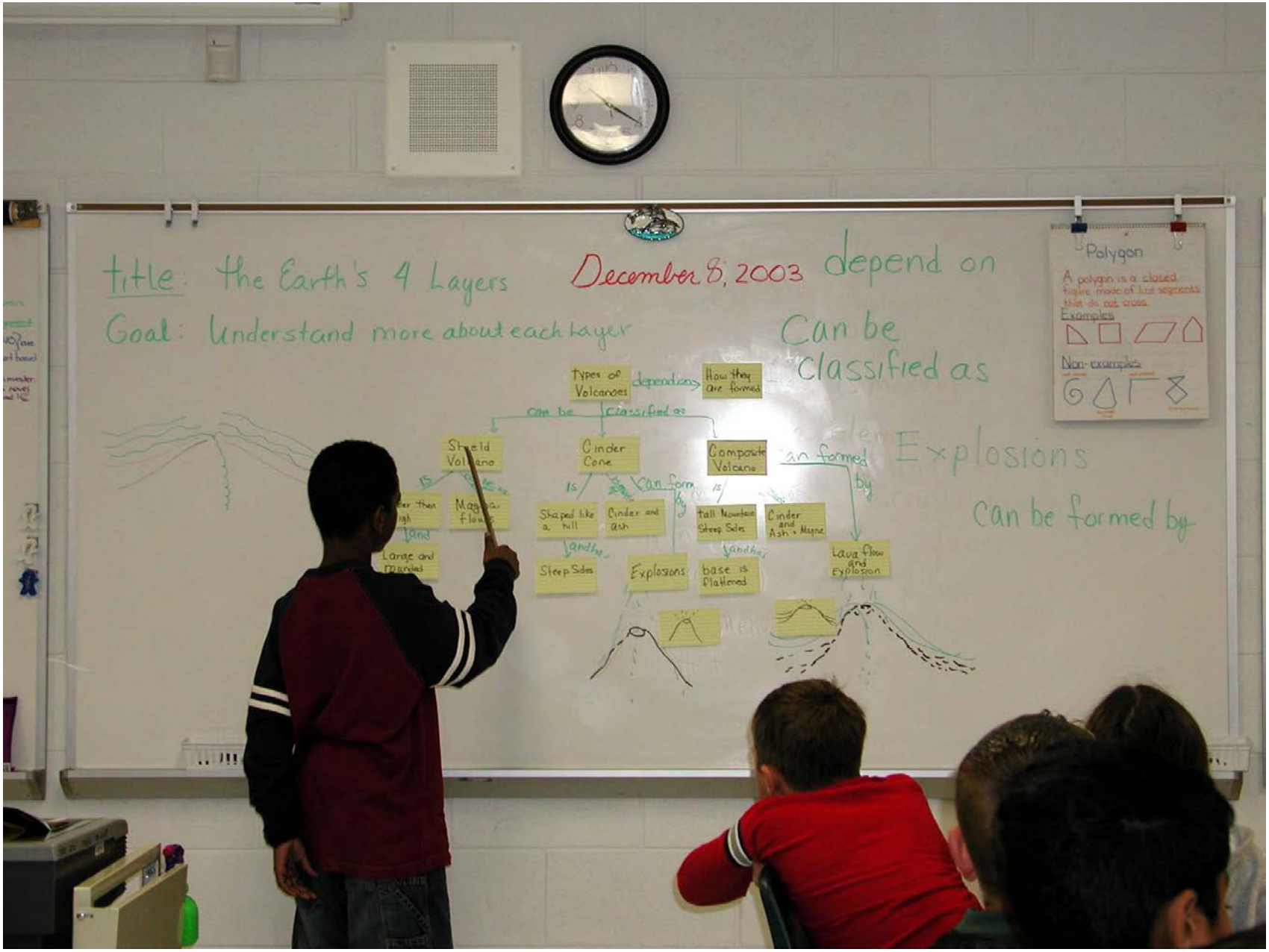
Propositional Concept Maps:

The Starting Point for All Curriculum Units



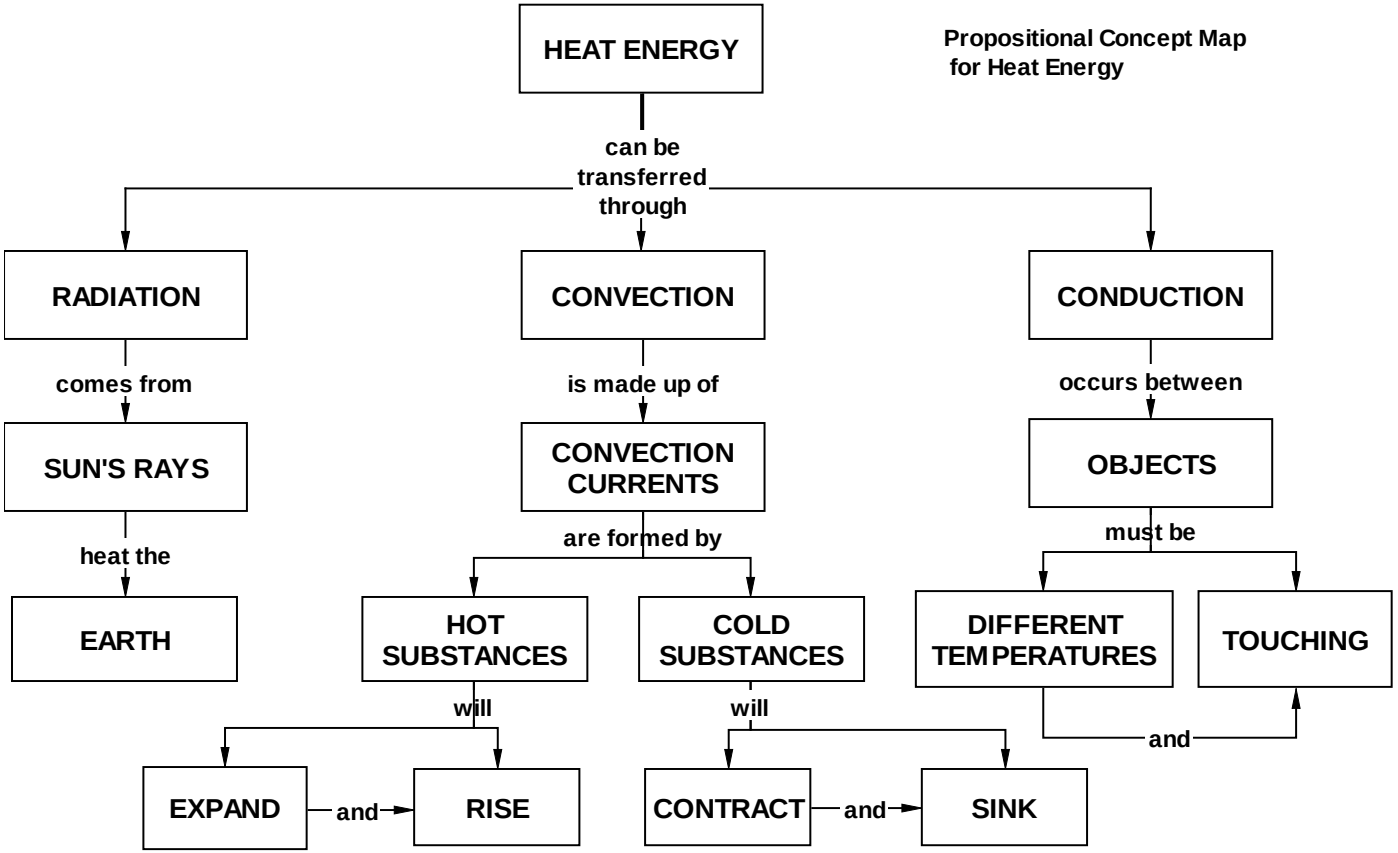
Teachers realized the potential of using multiple sources

Teachers spent many weeks researching science concepts to construct concept maps representing units of study

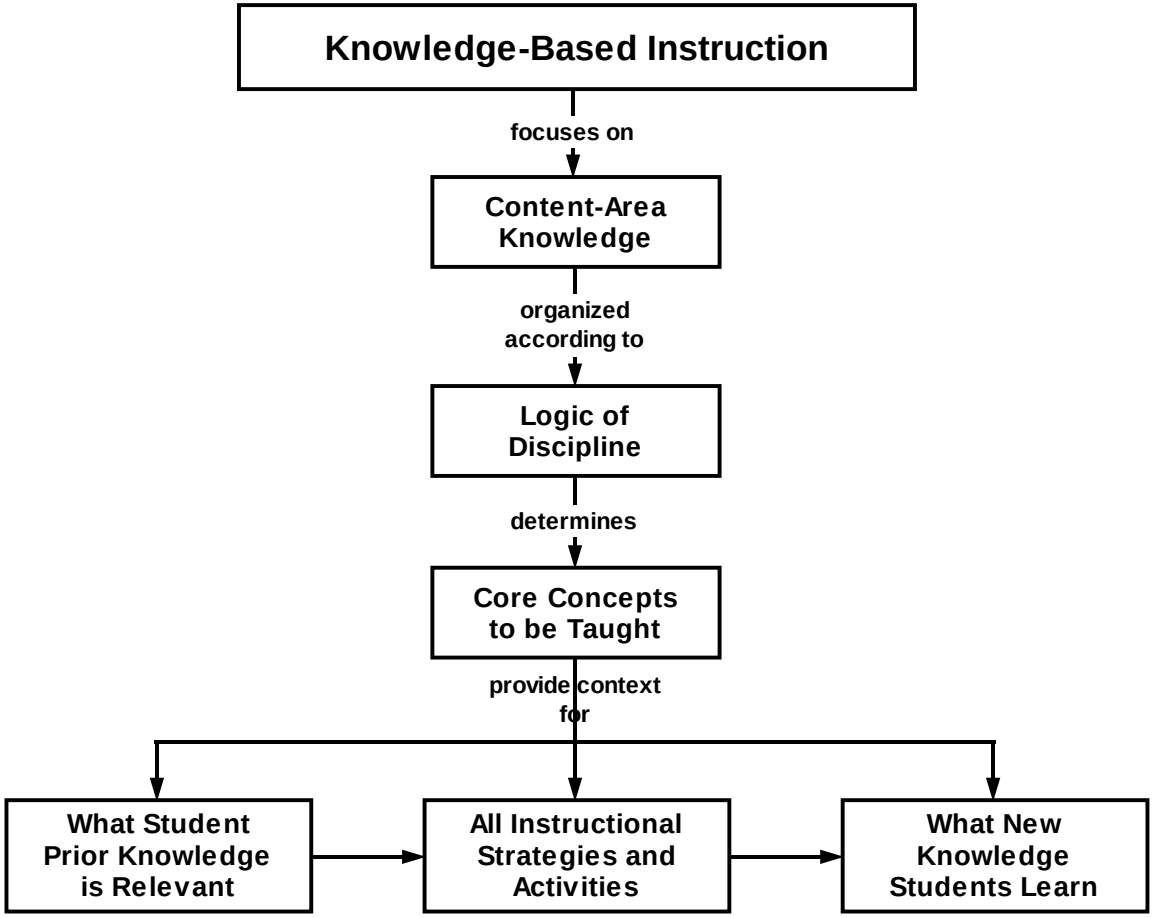

title: the Earth's 4 Layers
December 8, 2003
Goal: Understand more about each layer
depend on
Can be
classified as
Explosions
can be formed by
Types of Volcanoes
dependent
How they are formed
can be
classified as
Shield Volcano
Cinder Cone
Composite Volcano
Magma flows
Large and
Shaped like a hill
Cinder and ash
Steep Sides
Explosions
tall Mountain
Steep Sides
base is Flattened
Cinder and Ash + Magma
Lava flow and Explosion
Polygon
A polygon is a closed figure made of line segments that do not cross.
Examples
Non-examples

Focusing on Content Knowledge

Concept Map Example: Heat Energy



Science IDEAS Model as a Cognitive-Science Exemplar



Combining In-Depth Content-Area Reading with Propositional Concept Mapping to Impact Reading Comprehension
An Activity

Group Activity: Applying the Science IDEAS Reading Comprehension Routine

1. Read over Solar System (Harcourt Science)
2. Generate “Knowledge Notes”
3. Transform into questions
4. Re-Read and discuss line-by-line
5. Summarize first paragraph
6. Re-read and place key ideas on post-it notes
7. Arrange postit notes on paper, draw lines between related concepts, place verbs on the lines (See completed sample for page)

LEARN ABOUT

Our Solar System

FIND OUT

- about the star we know as the sun
- the ways objects move in our solar system

VOCABULARY

solar system
star
planet
asteroid
comet
orbit
axis

The Sun

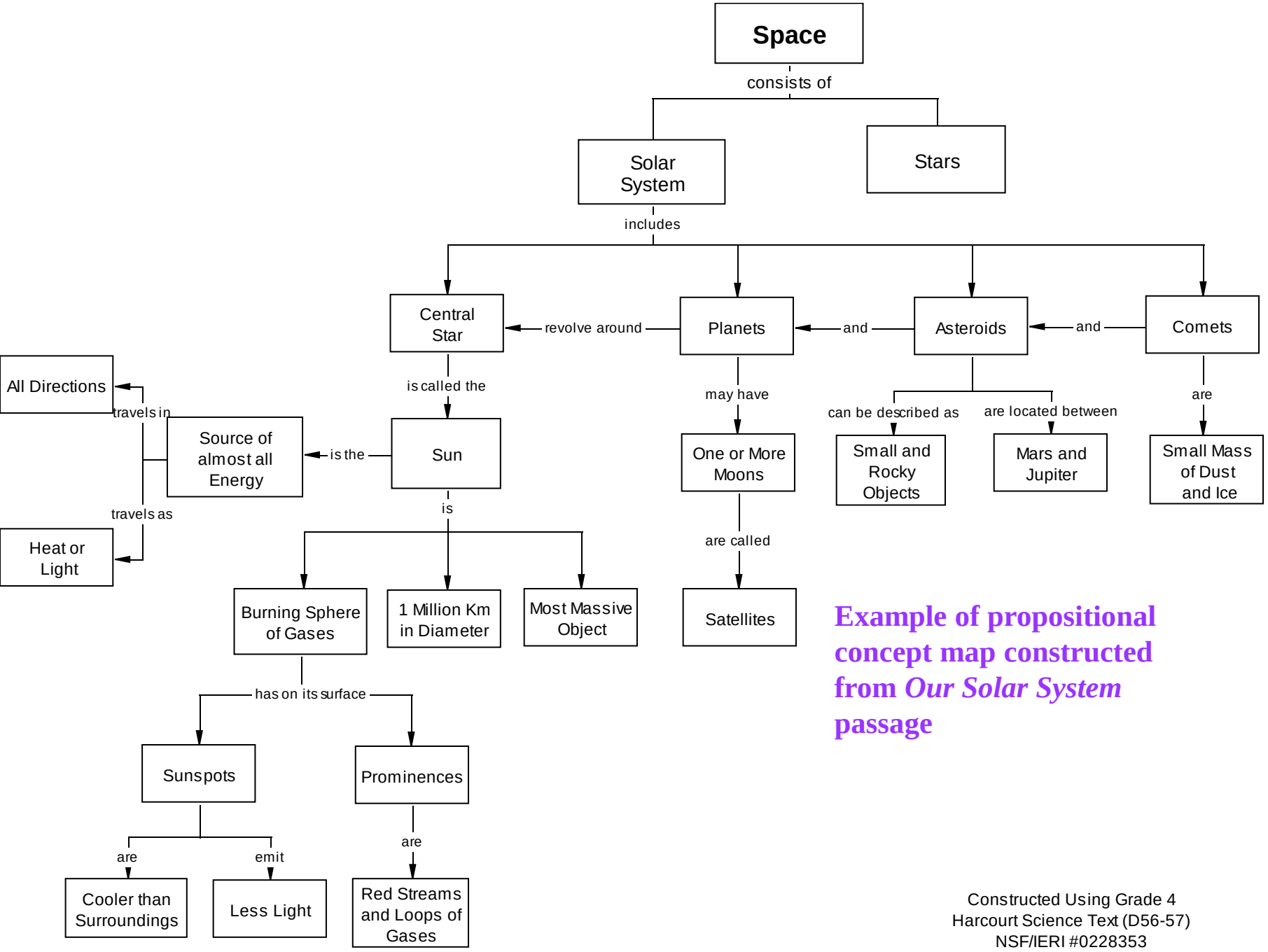
In the investigation you made a model of our solar system. A **solar system** is a group of objects in space that move around a central star. Our sun is a **star**, a burning sphere (SFEER) of gases. This enormous fiery ball is more than 1 million kilometers (about 621,000 mi) in diameter. The sun is the largest object in our solar system. It is larger than the rest of the objects in the solar system put together.

The sun puts out a lot of energy in all directions. In fact, it is the source of almost all the energy in our solar system. Some of this energy reaches Earth as light, and some reaches it as heat.

Two features of the sun's surface are shown on this page. The dark areas, called *sunspots*, are cooler than the rest of the sun's surface and don't give off as much light. The red streams and loops of gases that shoot out from the sun are called *prominences* (PRAHM•ih•nuhn•suhs). These hot fountains often begin near a sunspot. They can be thousands of kilometers high and just as wide. Sunspots and prominences usually last for only a few days. Some can last for a few months.

✔ **What is the largest object in our solar system?**

The sun is the largest object in our solar system. The next largest object, Jupiter, is small compared to the sun. Earth is even smaller. ▼



Example of propositional concept map constructed from *Our Solar System* passage

Constructed Using Grade 4
Harcourt Science Text (D56-57)
NSF/IERI #0228353

Linking Science IDEAS & Reading Comprehension through Concept Mapping

Guiding student creation of concept maps following in-depth reading and/or review:

- Re-read passages/pages
- Identify key concepts as nouns (place on post-it notes)
- Place all postit notes off to the side of a sheet of paper
- Guide organization of key concepts (arrange post-it notes in hierarchical/top-down structure)
- Guide student identification of linking verbs to connect concepts
- Edit/revise as necessary

Teacher Guidelines for Construction of Propositional Concept Maps

- Identify major concepts and sub concepts and place on individual postit notes
- Concepts are represented as nouns and are placed in boxes or on postit notes
- Keep the number of concept words on each postit note to a minimum (e.g., one or two)
- Use a variety of sources to select ideas

Teacher Guidelines for Construction of Propositional Concept Maps

- Don’t try to organize concepts while simultaneously brainstorming all the ideas you consider important
- Ask: What is the general organizing concept or most subsuming concept that can serve to organize the topic? Place it on top of map
- Next: Select the next layer of major concepts that organize (or categorize) the topic into broad subtopics,

Teacher Guidelines for Construction of Propositional Concept Maps

- Arrange organizing major concepts on map, and rehearse the links (e.g., verbs or verb phrases) that would be helpful to create a complete proposition or thought
- Note: Initially all links (e.g. verbs) should be written in pencil to allow for changes
- Maintain focus on relatedness among concepts as the key for organizing the concepts
- A single map cannot represent everything you know about a topic (use submaps for elaborations)

Teacher Guidelines for Construction of Propositional Concept Maps

- Don’t hesitate to add or delete concepts as needed
- Arrows positioned at end of links are helpful in showing flow of concept relationships
- Specific examples and small details are usually placed at the bottom of maps
- Continue: Use the same process for each concept on a map, arranging and linking as appropriate. Read map aloud to yourself. Ask: Does it make sense? Edit and rearrange: As necessary...

Summary Thoughts

- Covering topics/benchmarks and moving rapidly from one to the next does not support conceptual understanding
- Lists of state standards seem to encourage this; hence, the importance of mapping the curriculum
- Reading and answering questions has been confused with comprehension (meaningful understanding)
- Skills emphasis in the absence of meaningful content to be learned does not support comprehension
- Maps show concept links; replace memorizing vocabulary terms
- Use maps for all curricular events – the benefit is continually supporting teacher science understanding and student meaningful learning in science and reading comprehension