Using Content Area Reading to Develop Reading Comprehension Proficiency in Grades K-5

Rationale, Evidence and Policy Implications
For Increasing Student Achievement Outcomes

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New Perspectives -- Model – Framework – Evidence

Reverse Current Poor Achievement Trends

Reading Comprehension remains a systemic problem across the state and nation for students in grades K-12

Science achievement remains a systemic problem *across the* state, nation and internationally for all students across K-12

Presentation Overview

Meaningful Learning

Goal of K-12 Education

Role of K-5 Education

Meaningful Learning and Comprehension

Dynamics for Building Content-Area Reading Comprehension

Achievement Trends – After Decades of Reform Efforts

Science IDEAS – K-5 Integrated Science and Literacy Model

Description, Framework, History, Multi-Year Evidence, Implementation Requirements

Policy Implications - Improve Achievement Trends

Maximizing Student Learning Outcomes and Re-Thinking Elementary School Curricular Focus – in Reading and Science

Science IDEAS

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Presentation Overview

Meaningful Learning

Goal of K-12 Education

Role of K-5 Education

Meaningful Learning – Big Idea

What we do as adult learners:

Each and every day –

experiences add cumulatively to our learning

Life's experiences – life's journey

What differentiates humankind from other living organisms

We continually gain expertise in our domain(s) of knowledge

We organize the knowledge we have so that we can

- *Use it to solve complex problems*
- *Use it to invent, create, and formulate 'new' knowledge and knowledge-structures*
    - *Computers*
    - *Big Data*
    - *Robots*
    - *Artificial Intelligence*

Summary: Purpose of each year of schooling for 'all' children

Meaningful Learning - Education

Main Goal of Pre-K-12 Education

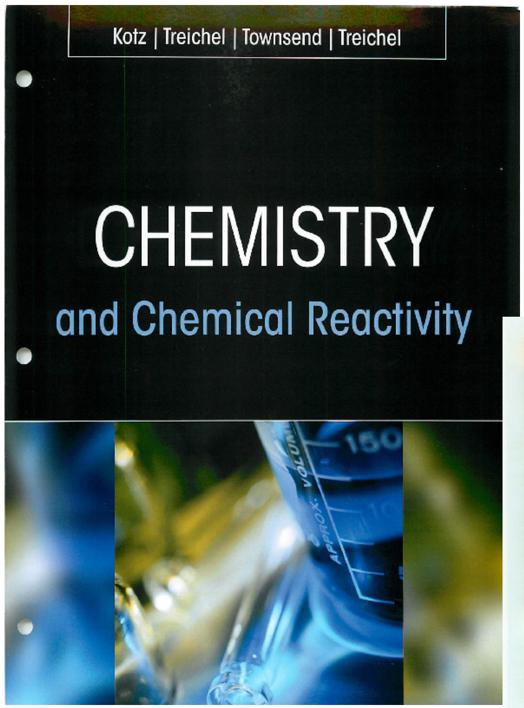
- *Provide meaningful learning experiences – across Pre-K-12 grade span that lead to*
    - *Continually building students' background knowledge –*
        - *core subjects – K-12*
        - *in-depth learning to support reading comprehension (Pre-K – 12)*
    - *Maximizing student capacity - read with understanding (comprehend) 'progressively' more sophisticated texts*
    - *Effectively use reading strategies in the service of gaining new knowledge and understanding*

How Does Pre-K-5 Education Support the Goal?

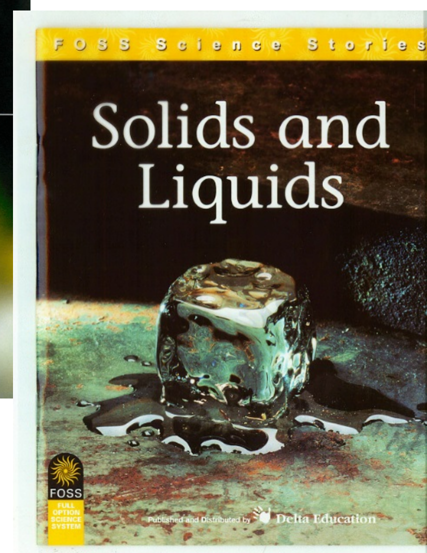
- *K-5 instruction – should provide foundational core knowledge to support subsequent learning and comprehension across grades 6-12*

Understanding Reading Comprehension – K-5

Main Goal: Preparing grades 6-12 students for the challenges of reading with understanding – comprehension - associated with the content courses that are required in school



High School Science
Grade 10-11



Grade 5 science

Middle School
Physical Science

Average speed is calculated as distance divided by time

Most objects do not move at a constant speed. The speed of an object can change from one instant to another. One way to describe the motion of an object moving at changing speeds is to use *average speed*. Average speed is simply the distance traveled by an object divided by the time the object takes to travel that distance. Average speed can also be expressed as a simple mathematical formula.

Equation for Average Speed

$$speed = \frac{distance}{time} \qquad v = \frac{d}{t}$$

Suppose a wheelchair racer, such as the one shown in **Figure 5**, finishes a 132 m race in 18 s. By inserting the time and distance measurements into the formula, you can calculate the racer's average speed.

$$v = \frac{d}{t} = \frac{132\ m}{18\ s} = 7.3\ m/s$$

The racer's average speed over the entire distance is 7.3 m/s. But the racer probably did not travel at this speed for the whole race. For instance, the racer's pace may have been faster near the start of the race and slower near the end as the racer became tired.

Figure 5
A wheelchair racer's speed can be determined by timing the racer on a set course.

Instantaneous speed is the speed at a given point in time

You could find the racer's speed at any given point in time by measuring the distance traveled in a shorter time interval. The smaller the time interval, the more accurate the measurement of speed would be. Speed measured in an infinitely small time interval is called *instantaneous speed*. Although it is impossible to measure an infinitely small time interval, some devices measure speed over very small time intervals. For practical purposes, a car's speedometer gives the instantaneous speed of the car.

Velocity describes both speed and direction

Sometimes, describing the speed of an object is not enough. You may also need to know the direction in which the object is moving. In 1997, a 200 kg (450 lb) lion escaped from a zoo in Florida. The lion was located by searchers in a helicopter. The helicopter crew was able to guide searchers on the ground by reporting the lion's **velocity**, which is its speed *and* direction of motion. The escaped lion's velocity may have been reported as 4.5 *m/s to the north* or 2.0 km/h *toward the highway*. Without knowing the direction of the lion's motion, it would have been impossible to predict the lion's position.

velocity the speed of an object in a particular direction

322 CHAPTER 10

Elementary Science – K-5 begins to build that foundation

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Curricular **Blueprint** – Building Reading Comprehension Proficiency

What we understand about learning guides our recommendations for how reading programs might be 'designed'. Such programs should enable students to:

- Develop and access *prior curricular knowledge* in cumulative meaningful learning
- engage in *continually reading* about what they are learning
- read across *multiple sources* and genres
- **apply *strategies* and skills to support *gaining knowledge and understanding***

Implications – instruction that *does not link learning* across lessons and focuses primarily on skills does little to support comprehension

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Meaningful Learning and Comprehension

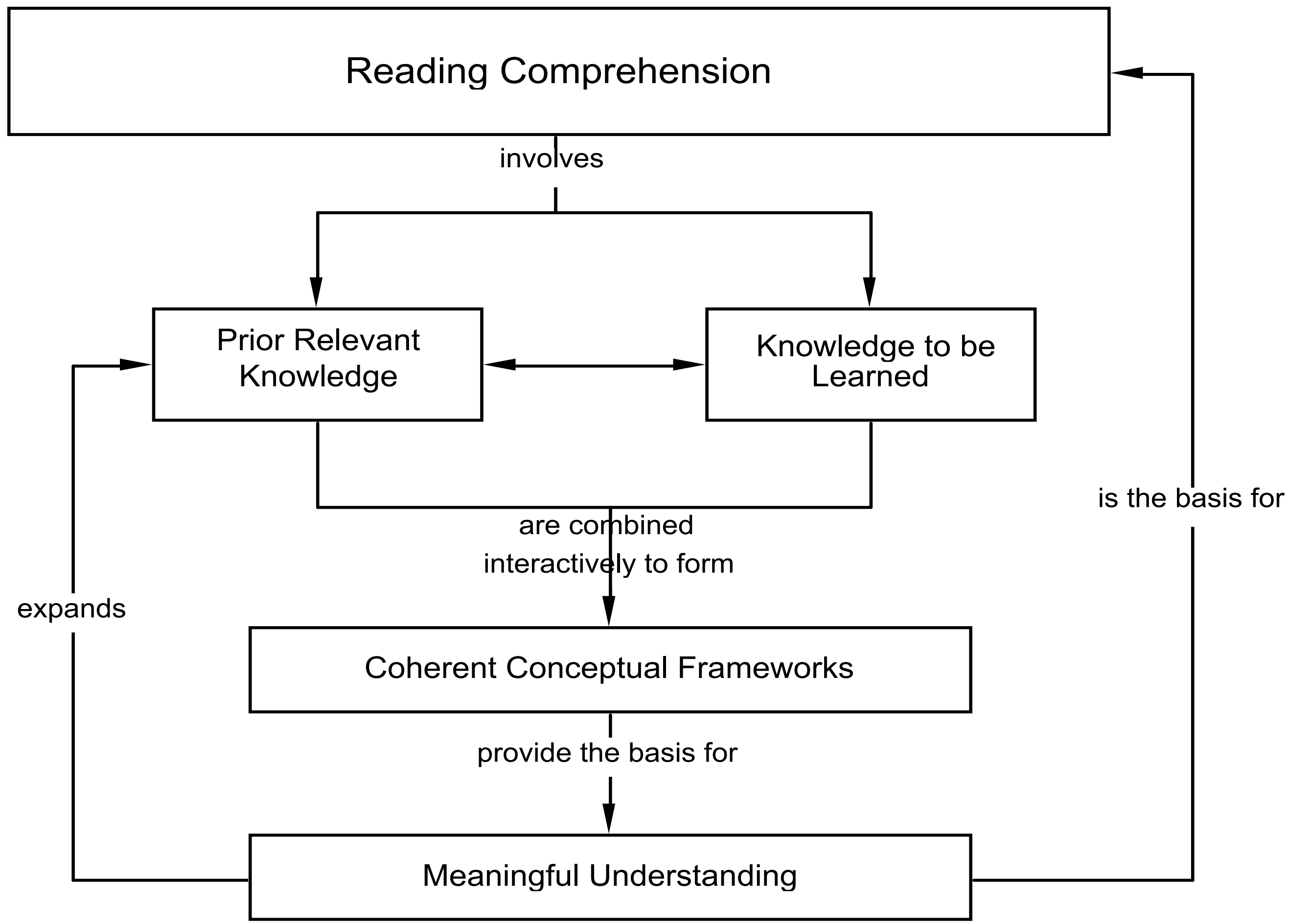
Academic Knowledge

- Learned primarily through school curriculum
- Serves as prior knowledge for subsequent learning
- More students depend on school for gaining such knowledge
- Can build upon students' everyday knowledge
- Increases when reading involves the use of knowledge-based skills and strategies

More about the Knowledge

- Cumulatively developed
- Organized around big ideas (core knowledge)
- Broadly applicable
- Facilitates deep thinking and explanations

Knowledge-based Reading Comprehension-Necessary for Meaningful Learning



Grade 5, Unit 1, Reading Jumping Into Reading Work: Fiction, Nonfiction and Poetry August 14 - September 27 September 28 - October 4 (Test Sophistication Practice)	Grade 5, Unit 1, Writing Research Based Argument Essay (Book) August 14 - September 27 September 28 - October 10 (Test Sophistication Practice)
Focus Standards: **RL.1.1** Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text. **RI.1.1** Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text. **RI.1.2** Determine two or more main ideas of a text and explain how they are supported by key details; summarize the text. **RI.2.4** Determine the meaning of general academic and domain-specific words and phrases in a text relevant to a *grade 5 topic or subject area*. **RI.2.5** Compare and contrast the overall structure (e.g., chronology, comparison, cause/effect, problem/solution) of events, ideas, concepts, or information in two or more texts. **RI.4.10** By the end of the year, read and comprehend informational texts, including history/social studies, science, and technical texts, at the high end of the grades 4–5 text complexity band independently and proficiently.	**Focus Standards:** **W.1.1** Write opinion pieces on topics or texts, supporting a point of view with reasons and information. a. Introduce a topic or text clearly, state an opinion, and create an organizational structure in which ideas are logically grouped to support the writer's purpose. b. Provide logically ordered reasons that are supported by facts and details. c. Link opinion and reasons using words, phrases, and clauses (e.g., consequently, specifically). d. Provide a concluding statement or section related to the opinion presented. **W.2.4** Produce clear and coherent writing in which the development and organization are appropriate to task, purpose, and audience. (Grade-specific expectations for writing types are defined in standards 1–3 above.) **W.2.5** With guidance and support from peers and adults, develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach. **W.3.7** Conduct short research projects that use several sources to build knowledge through investigation of different aspects of a topic.

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Meaningful Learning -
Conceptual Understanding - NRC 2000

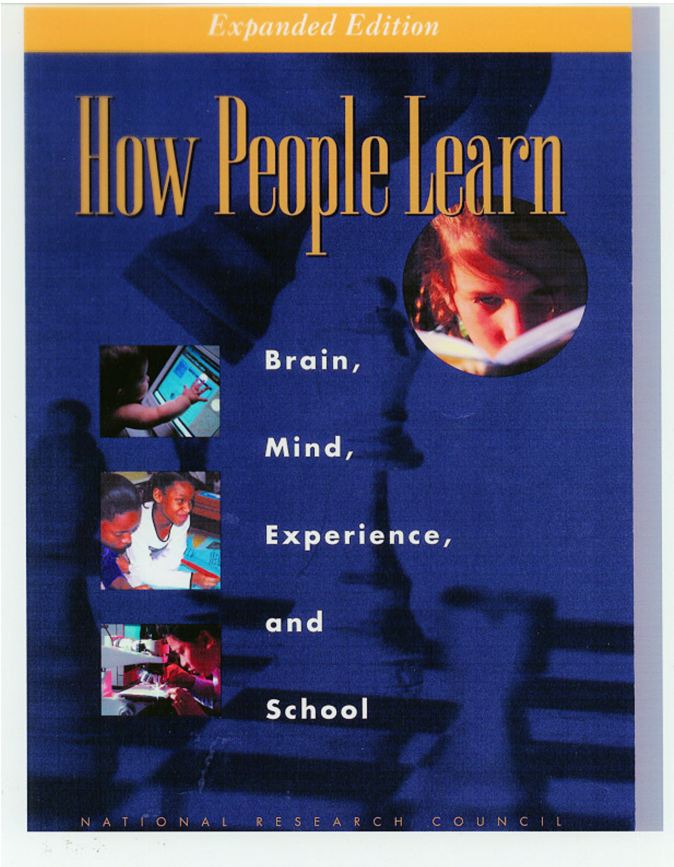
Learning with Understanding…

<u>3 Major Findings</u>…

Prior Knowledge is a major determinant of future learning

Understanding (learning) involves **cumulatively organizing knowledge around core ideas of the discipline**, making it accessible for later use

Learning involves ability to know how to **use one's knowledge for future learning** (metacognition, reflection)



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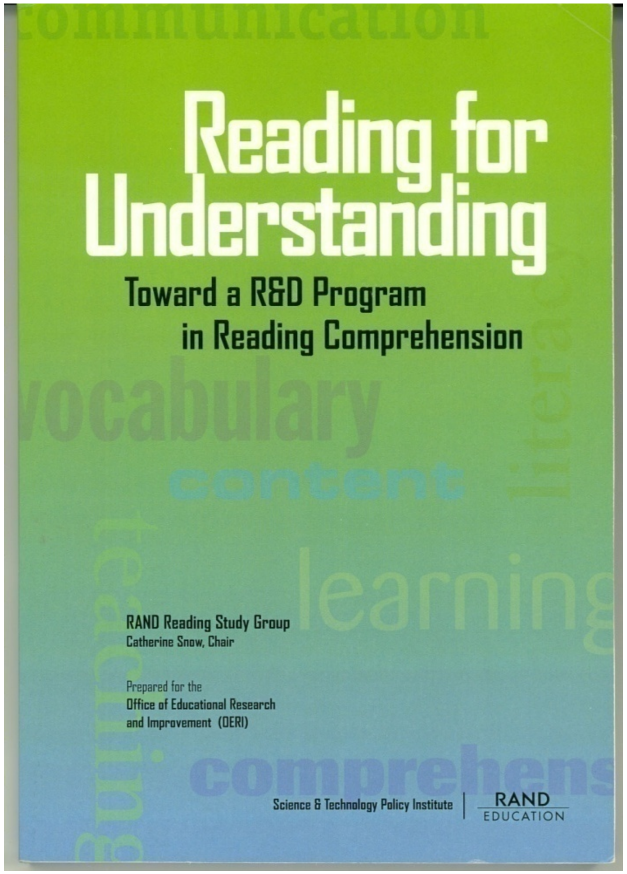
Meaningful Learning – Necessary for Reading Comprehension -

•Recommends more focus on content-area reading comprehension (CCSS and NAEP)

•Defines comprehension as … *the simultaneous process of extracting and constructing meaning from what is read*

•*Implies that understanding what is spoken and what can be observed is also interpreted simultaneously*



Meaningful Learning and Comprehension

American Educator – 2003

- Hart & Risely -10 million word gap
- J Chall - Fourth grade plunge
- E D Hirsch – Domain knowledge
- Steven Stahl – Vocabulary
- Kate Walsh – Basal readers
- Nell Duke – Time for non-fiction
- Margaret McGowan, Linda Kucan and Isabel Beck - Vocabulary

Review – Key Points

Meaningful Learning – Understanding and Comprehension

Importance of Prior Knowledge

Organized-Easily Accessed- Changed as Needed when New Learning Occurs

Knowledge-Based Strategies

Definition

Activity

Responses Required

Sentence # 1

Graham Woods was knocked out of his crease on the first over after lunch.

Sentence #2

Roberto Clementi sacrificed and knocked in a run.

Sentence # 3

Besides spending a lot of time in the trenches, Claire will make a good assistant principal because she can keep her eye on the ball.

Sentence # 4

Methods of nutrition serves as a core idea in distinguishing among categories of eurkaroyta.

Reflection - Summary

Quote

E. D. Hirsch

"Comprehension includes everything the sentence (or speaker) does NOT say."

Overview

State and National Achievement Trends

Reading Comprehension

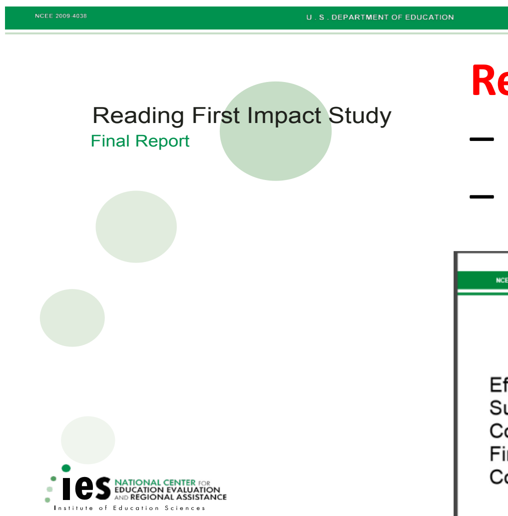
Science

State

National

International

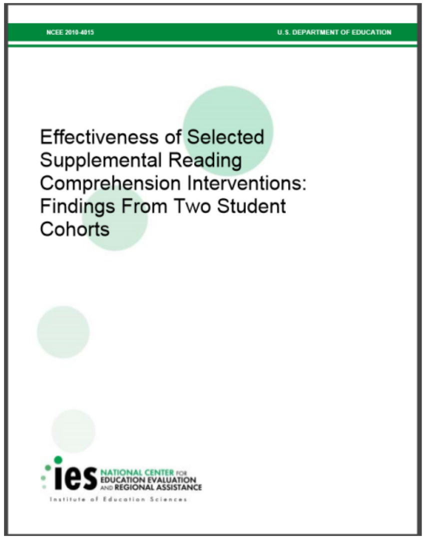
Reading Comprehension Achievement Results of 3 National Studies


U. S. DEPARTMENT OF EDUCATION

Reading First Impact Study
Final Report

ies NATIONAL CENTER FOR EDUCATION EVALUATION AND REGIONAL ASSISTANCE
Institute of Education Sciences

Reading First – NCLB $4 billion
– No gains in comprehension
– Increased time for literacy


U.S. DEPARTMENT OF EDUCATION

Effectiveness of Selected Supplemental Reading Comprehension Interventions: Findings From Two Student Cohorts

ies NATIONAL CENTER FOR EDUCATION EVALUATION AND REGIONAL ASSISTANCE
Institute of Education Sciences

Study – 5th Grade Supplemental Reading Programs –
– Minor gain in reading comprehension for one program
– No gains for other programs

The Enhanced Reading Opportunities Study – 2008 – Grade 9 Study - Findings – Year 1: Minimal effect on comprehension; Year 2: No Carryover Impact in Grade 10

Achievement Trends
Reading Comprehension and Science

NAEP 2017 - Reading –

65% of 8th graders are not proficient

NAEP 2015 – Reading

63% of 12th graders not prepared for college reading

75% (Hispanic) not proficient in reading
64% - grade 4 – not proficient
66% - grade 8 – not proficient

NAEP – 2015 – Science

62% - grade 4 - not proficient

66% - grade 8 - not proficient

78% - grade 12 - not proficient

2009 NAEP 12 Grade Reading Achievement

- 38% of High School students performed at the proficient level in 2009
- Scores were higher that 2005 but not 1992

Florida and Other Achievement Trends

Florida Standards Assessment (FSA) 2017

- Reading –
  - Grade 8 - 48% not proficient
  - Grade 5 – 54% not proficient
- Science
  - Grade 8 – 59% not proficient
  - Grade 5 – 60% not proficient

ACT - Only 36% of ACT-tested students met the Science - College Readiness Benchmarks (ACT, 2016)

Community College

- 2/3 of entering students were underprepared for college level work (Bailey, et al., 2010)

Linking Learning and Science

- **Morgan et al**., (2016), *Educational Researcher* – Predicting Achievement
  - Longitudinal sample of 7,757 children
  - Kindergarten general knowledge - strongest predictor of 1^{st} grade general knowledge
  - 1^{st} grade general knowledge - strongest predictor of children's science achievement from grade 3 to 8^{th} grade
  - May have a long term impact on employment and prosperity
- **Banilower et al., 2013; Dillon 2013; Duke, 2000** – Allocated Instructional Time
  - Time allocation for elementary science has declined rapidly (e.g., 19 minutes per day)
- **K-12 Framework for Science Education and the Next Generation of Science Standards (NGSS)** - Science learning should begin early as children are very capable

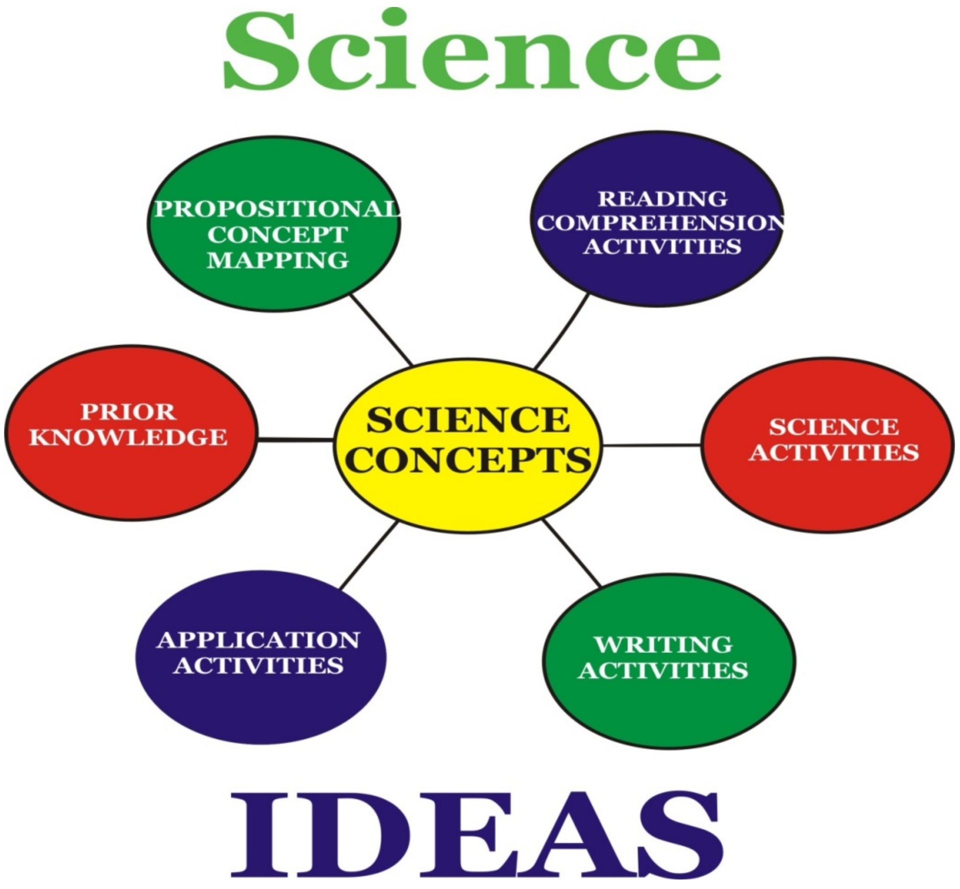
Presentation Overview

Learning in Science

Science IDEAS – K-5

Instructional Model

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



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Curriculum Planning Teams – Begin with Concept Maps

Unit Planning – Step 1: construct concept map; use available resources especially above grade level

Step 2: Negotiate understanding

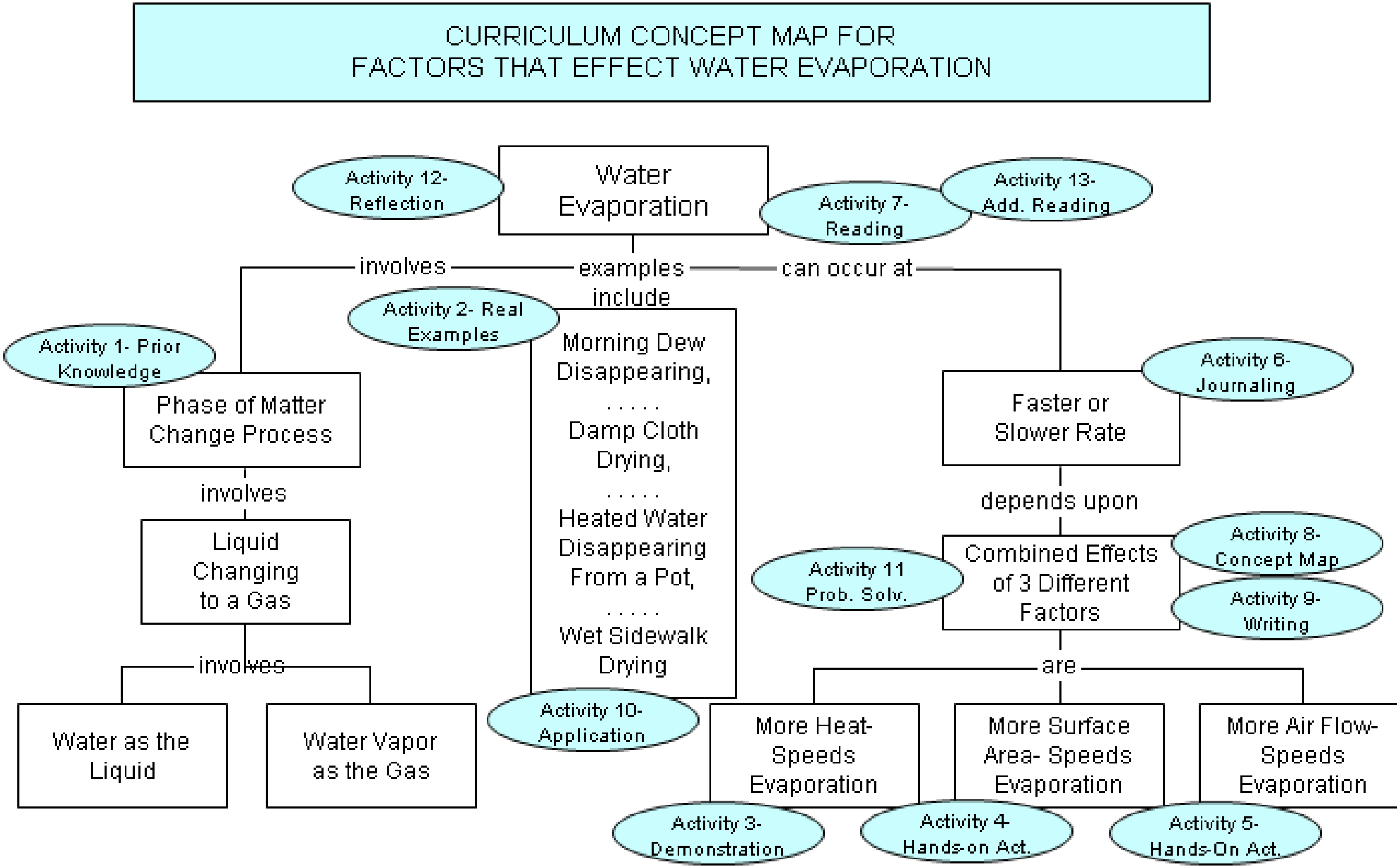
Step 3: Determine needed resources

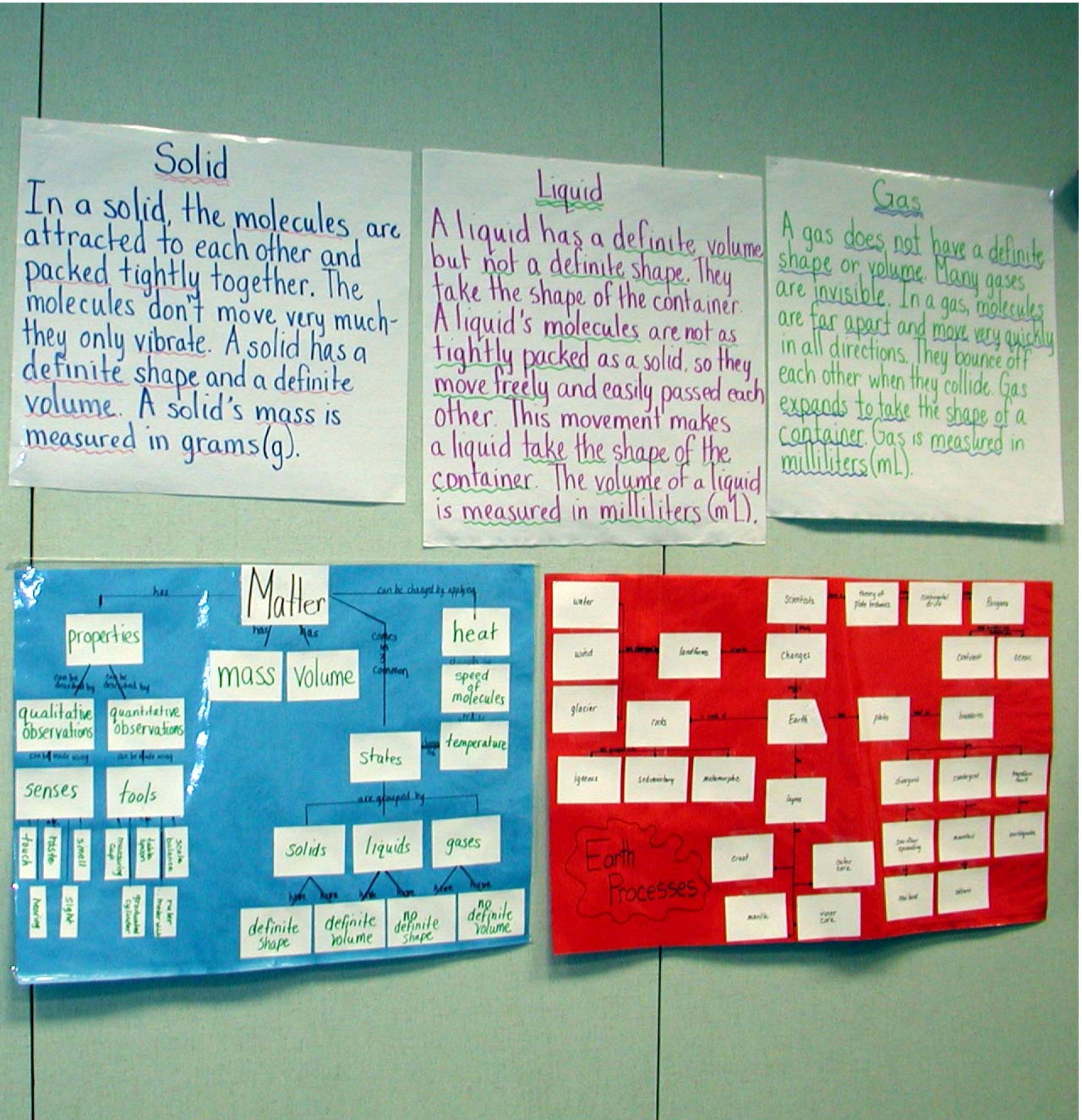
Step 4: Maps are displayed for teaching and planning

Large room – lots of wall space – plenty of postit notes – plenty of resource materials

Propositional Concept Maps:

The Starting Point for All Curriculum Units





Concept maps have many purposes:

<u>Teacher</u>

1. Planning a unit of study
2. Blueprint for instruction
3. Assessment

<u>Student</u>

1. Studying
2. Writing
3. Comprehension

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Propositional Concept Maps

2nd grade teacher explains how she used student suggestions to organize the class map on the rain forest (2013-16)

2nd grade teacher builds map with students as lesson evolves (2003-2008)

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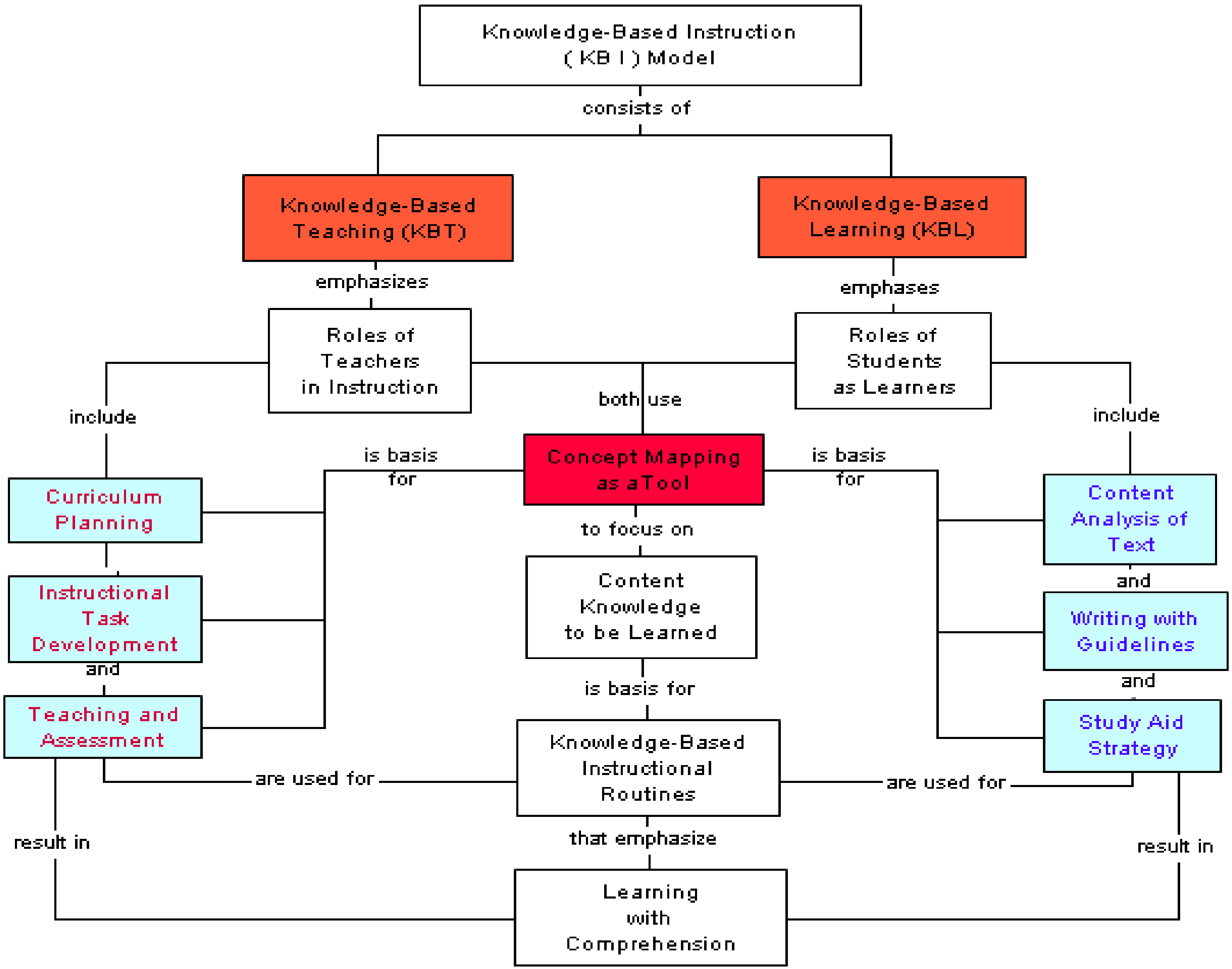


Note- For Content Analysis of Text- a knowlege-focused reading comprehension strategy is a key process that complements concept mapping (i.e., to read with comprehension: apply reading comprehension strategy, then concept map content)

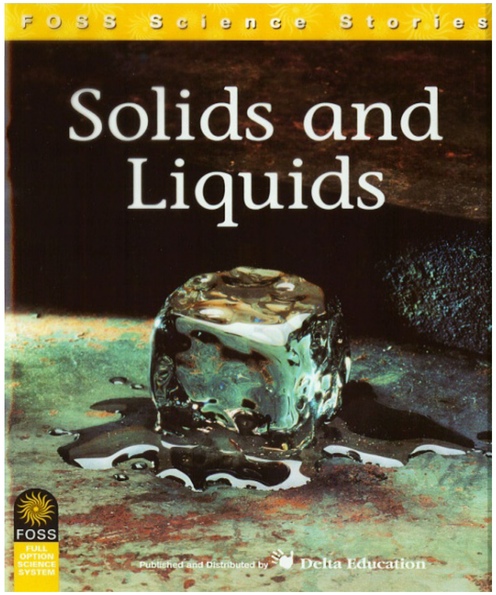
Investigating Science Phenomena

Science inquiry/investigations provide rich opportunities for all students to gain science knowledge – as they can observe, question, manipulate phenomena and gather evidence

All activities and investigations are linked to both reading and writing more about the science topic

Reading Comprehension

Reading Comprehension: Guided reading using non-fiction books **related** to the science concepts being investigated (District Literacy Standards and CCSS)



Goal: Students are learning more about what they already know!
Students have opportunities to read about and write their own non-fiction books related to the core disciplinary science concepts being learned. Recommended is reading up to 10 non-fiction books for a unit of study.

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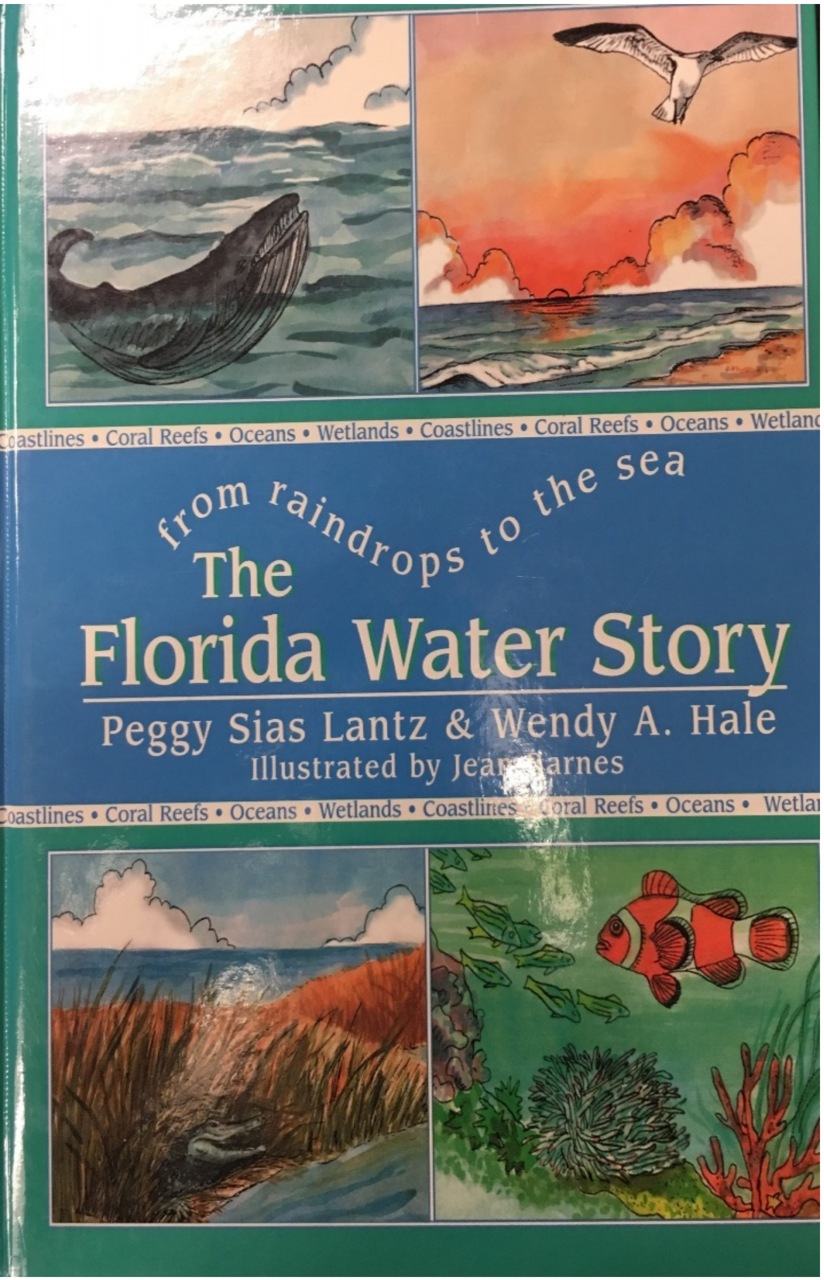
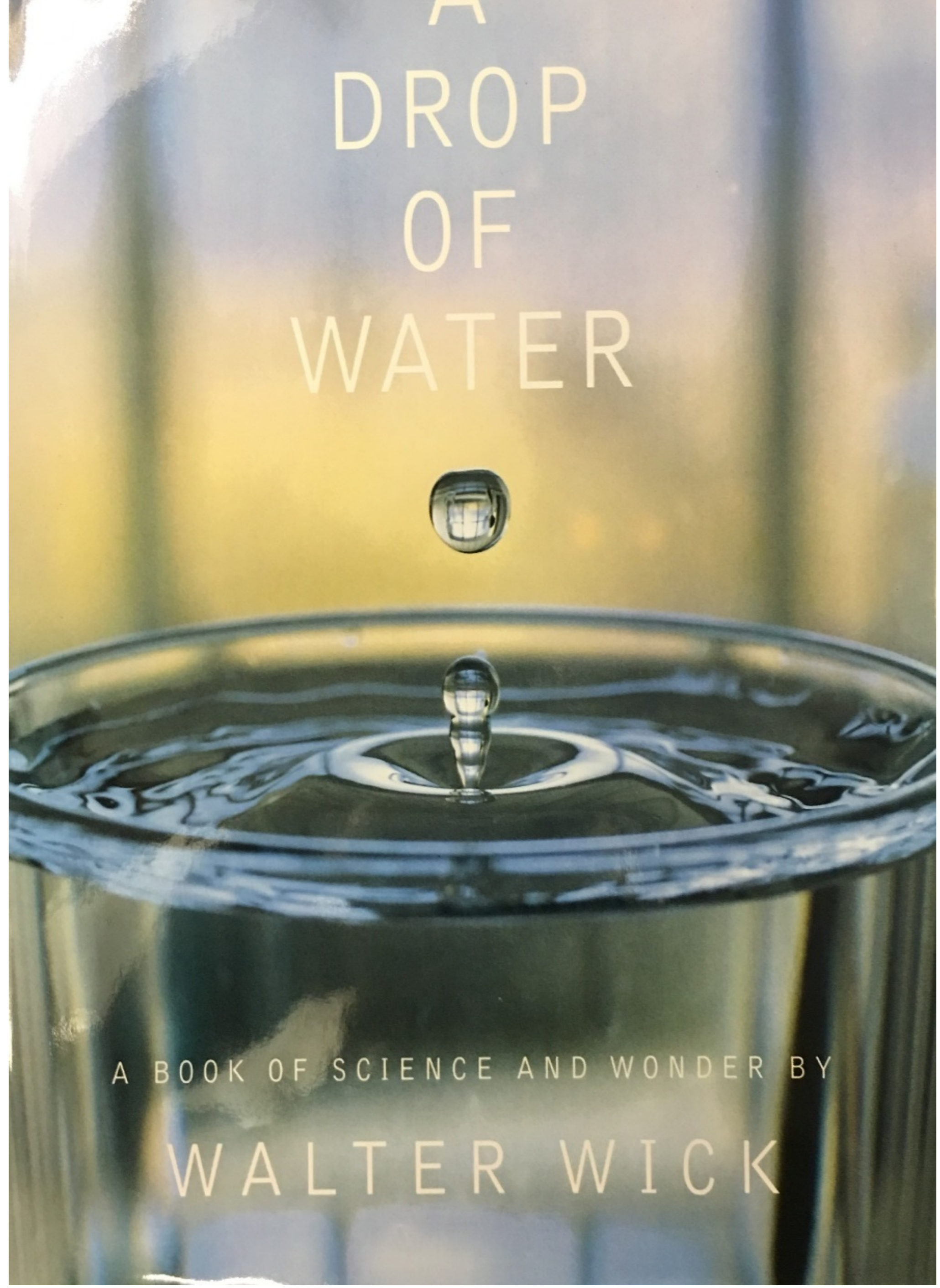
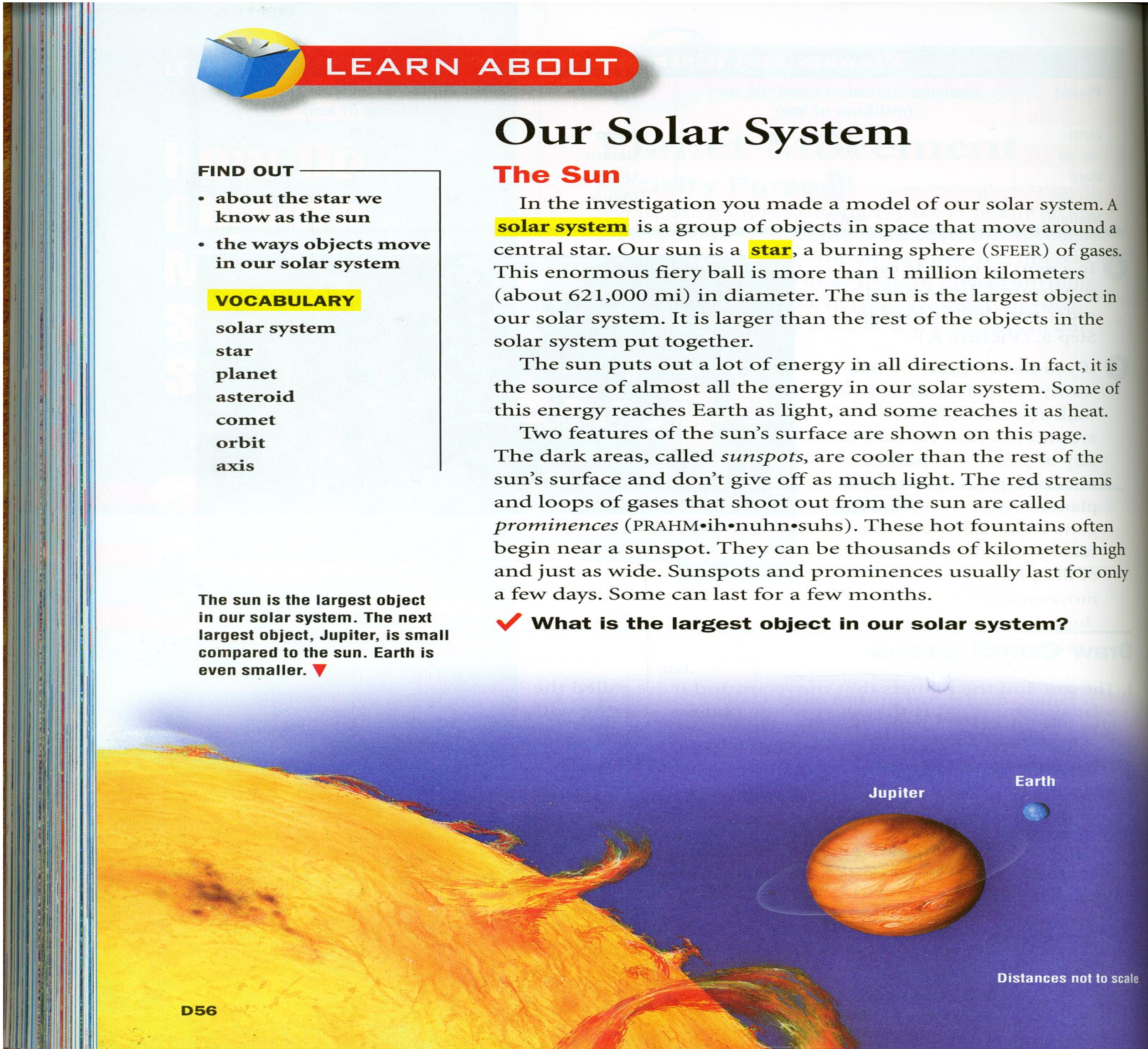

Coral Reefs • Oceans • Wetlands • Coastlines • Coral Reefs • Oceans
from raindrops to the sea
The Florida Water Story
Peggy Sias Lantz & Wendy A. Hale
Illustrated by
Coral Reefs • Oceans • Wetlands


DROP
OF
WATER
A BOOK OF SCIENCE AND WONDER BY
WALTER WICK

Knowing how the concepts are organized within a text is important for teaching and for learning



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

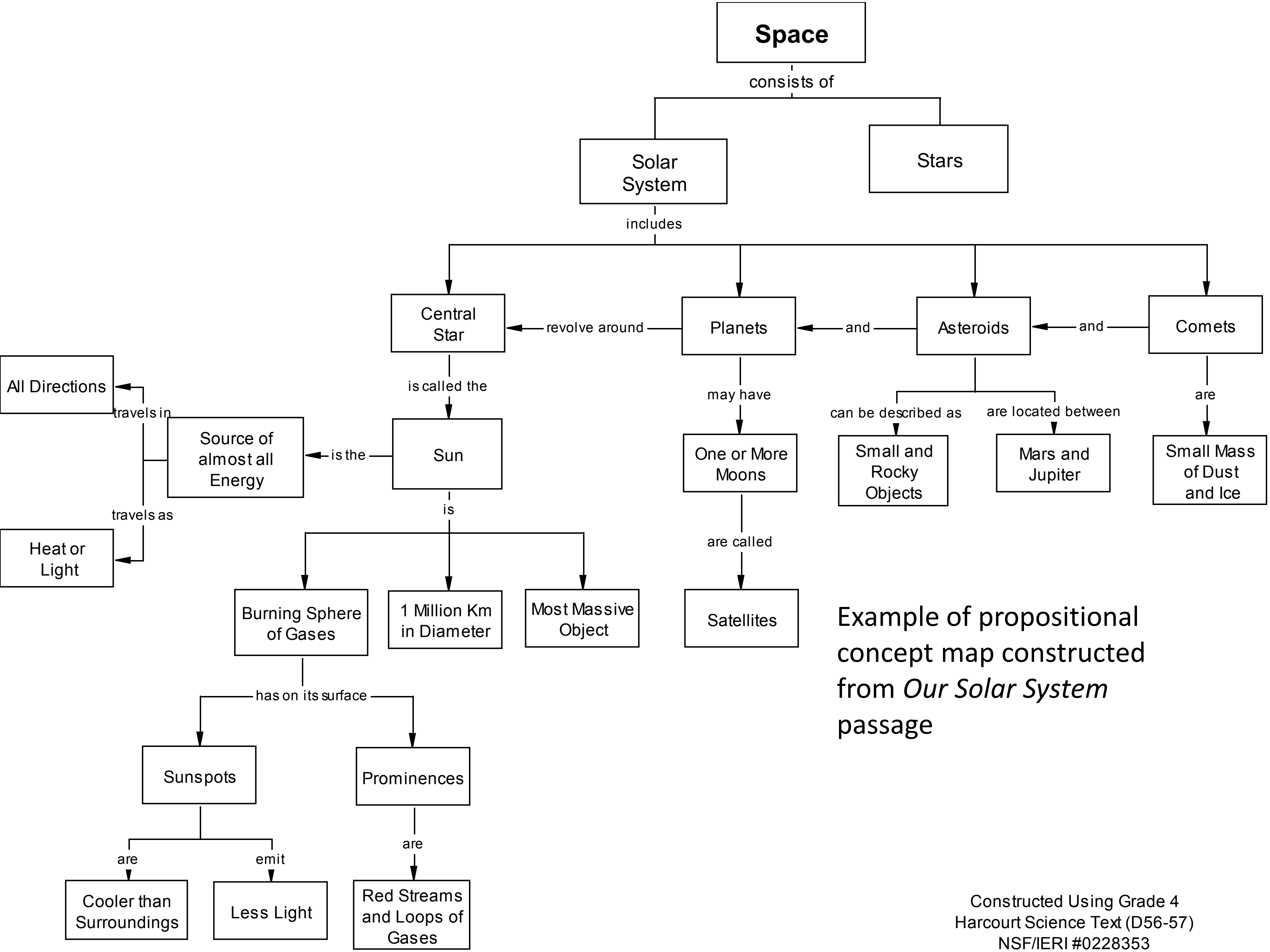
In the investigation you made a model of our solar system. A **solar system** is a group of objects in space that move around a central star. Our sun is a **star**, a burning sphere (SFEER) of gases. This enormous fiery ball is more than 1 million kilometers (about 621,000 mi) in diameter. The sun is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

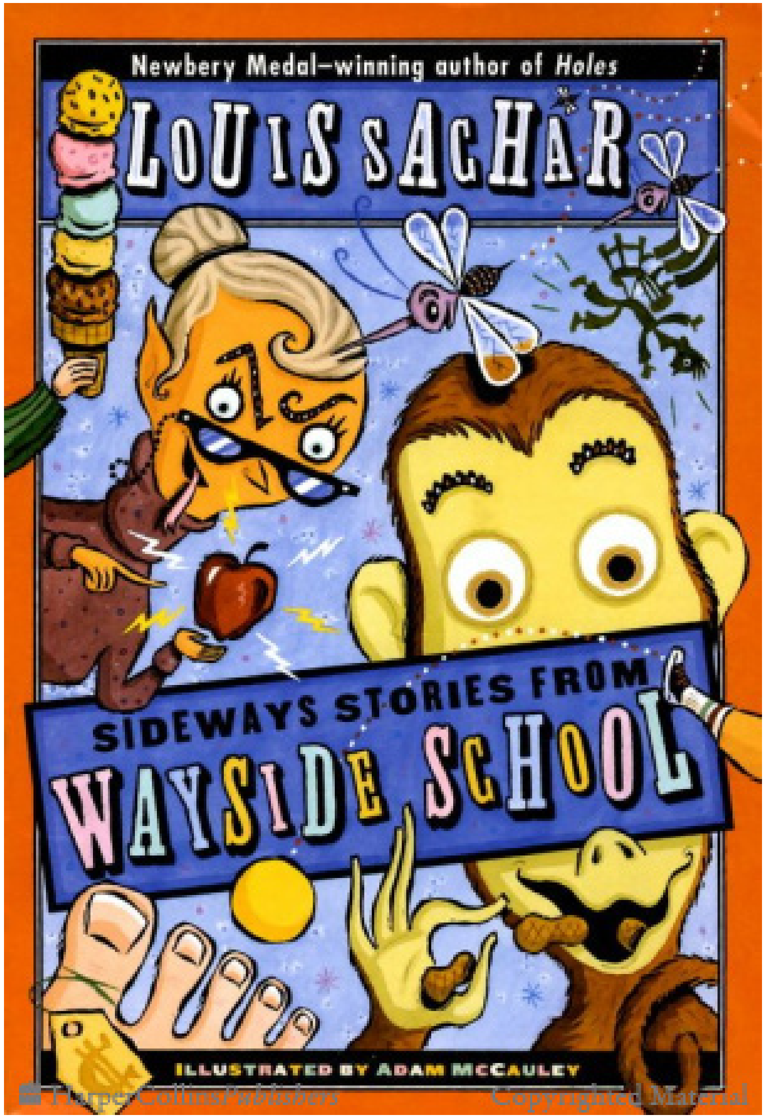


Example of propositional concept map constructed from *Our Solar System* passage

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

Struggling Readers – low level – high interest

Books like these are often used for struggling readers…
What must be considered is "if" every moment of instruction counts, then …..



Science IDEAS: A Model for Integrating Literacy with In-Depth Science Learning

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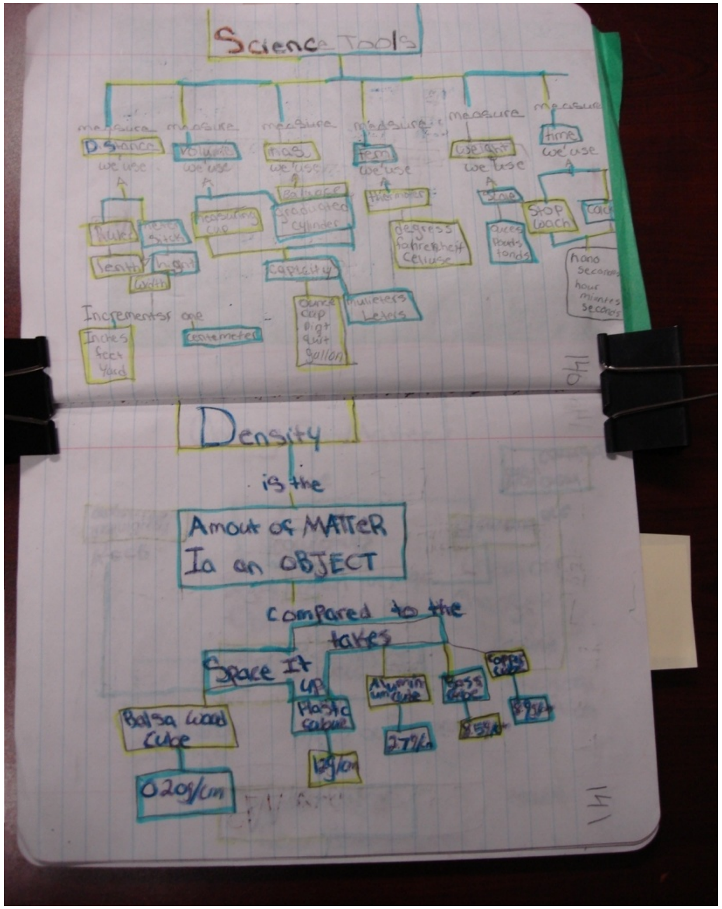
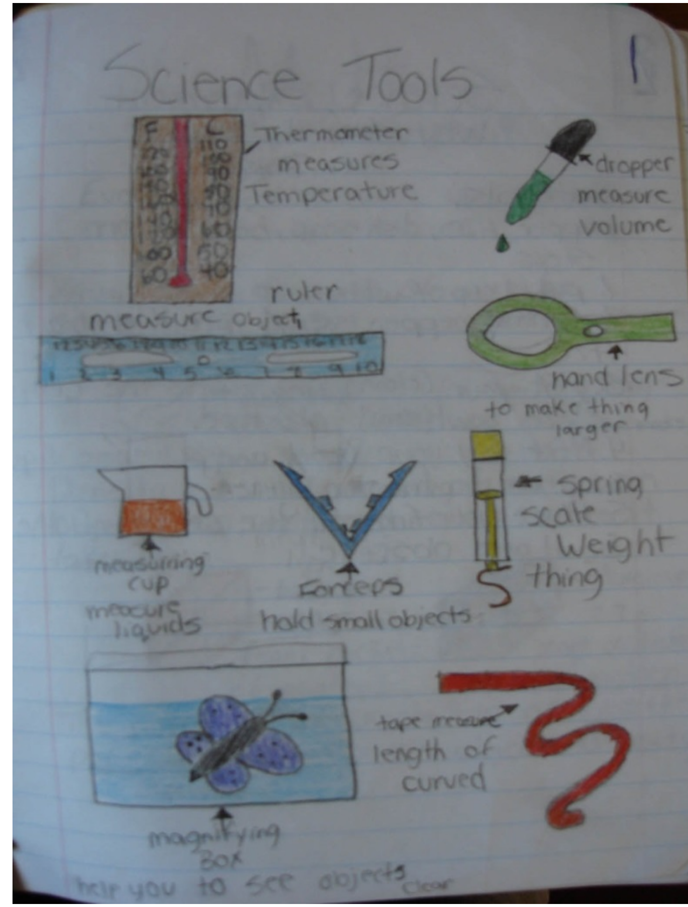
•Writing and Journaling are specifically aligned with the science concepts being learned.

•Students can use a wide variety of writing genres (e.g., describe steps followed in their investigations, make claims, gather and record evidence, and draw conclusions).

•Students write their own informational books, posters and other literary exhibits

Student Science Journals

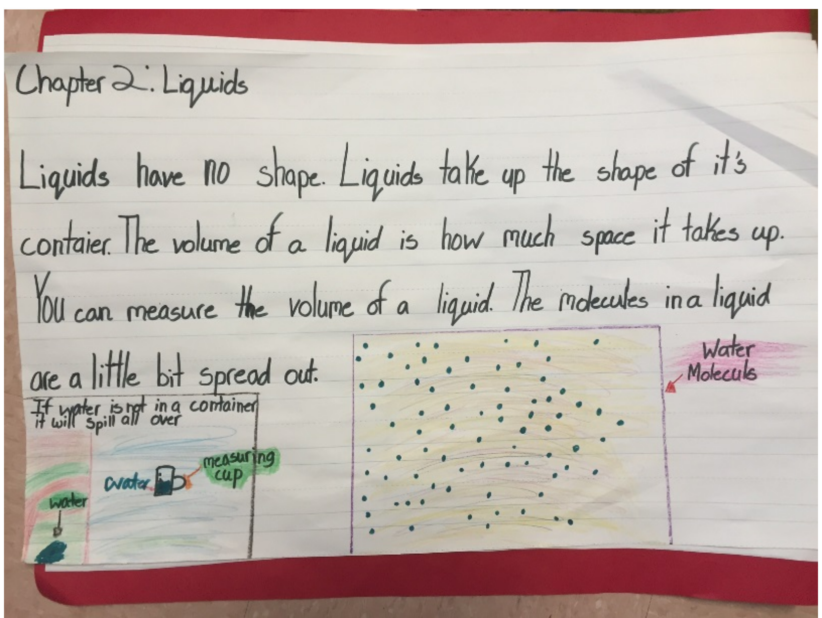




Journals provide a chronology of what is being taught and learned

Science IDEAS: A Model for Integrating Literacy with In-Depth Science Learning

Students created models of phenomena – Life Cycle and then labeled and described the life cycle of a butterfly (Grade 1)



Group Project – Big Book on States of Matter – multi-page book

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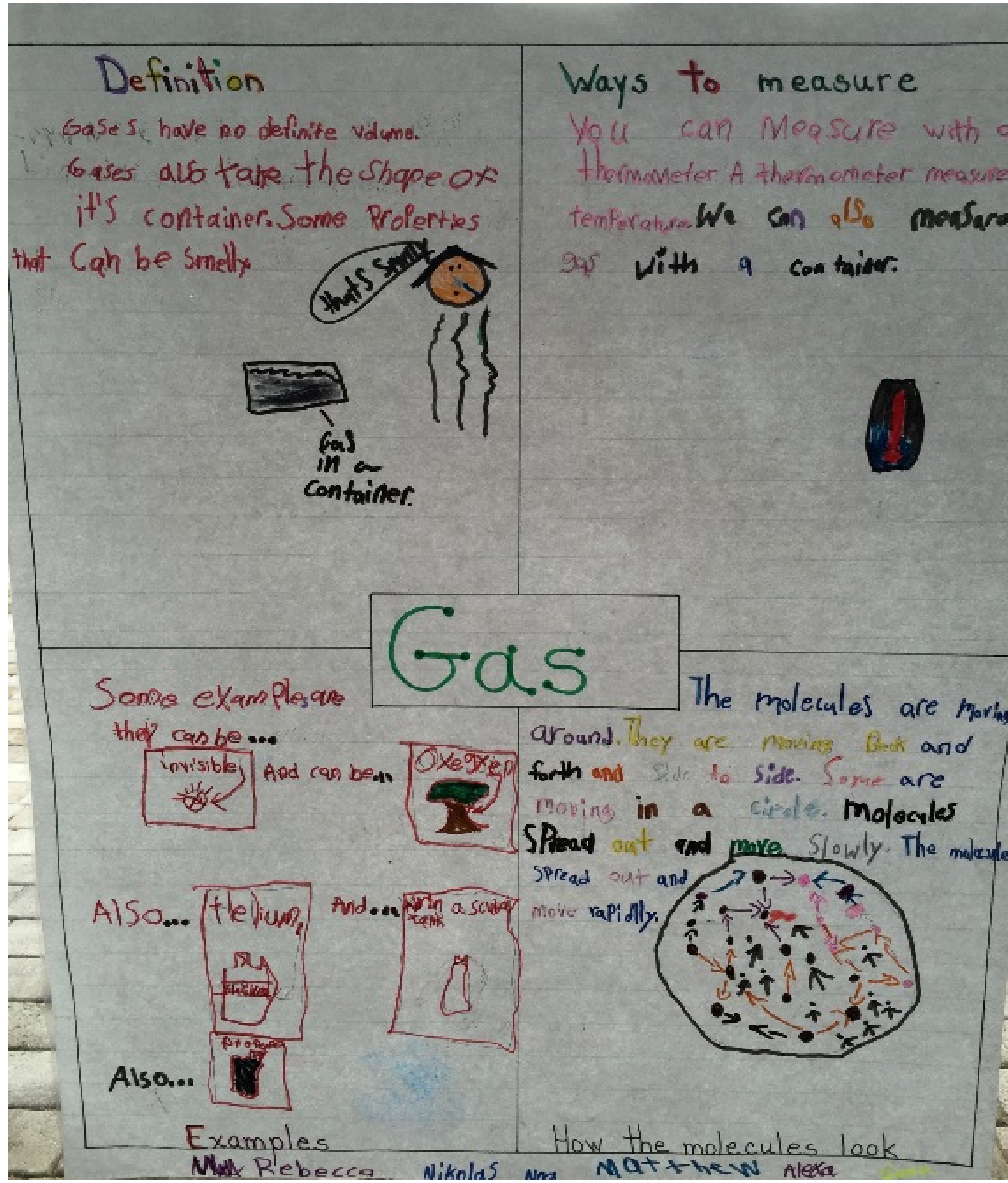
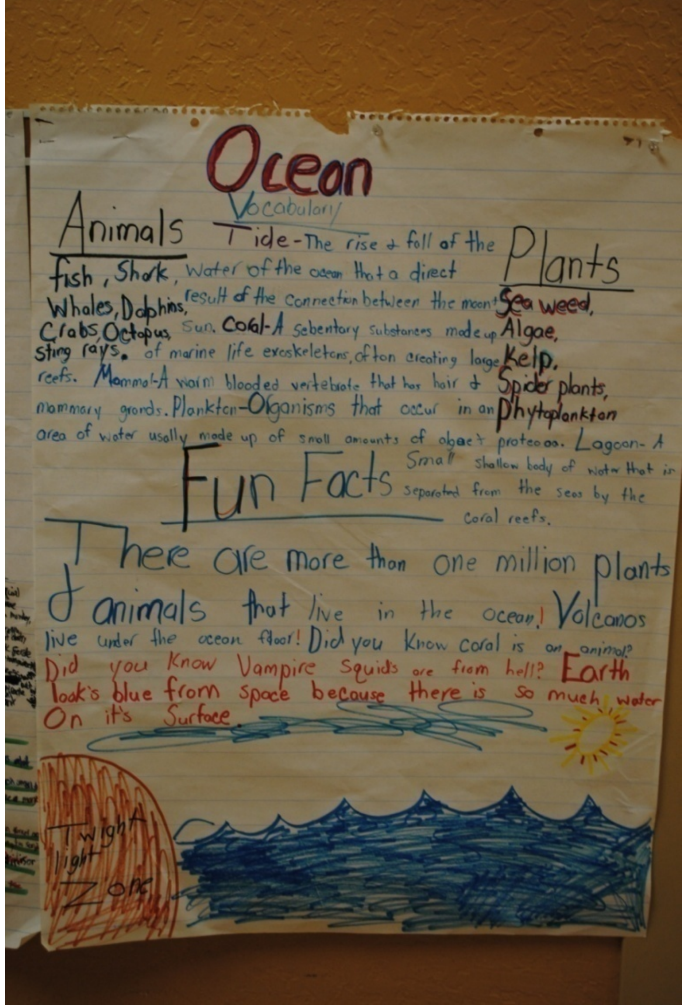
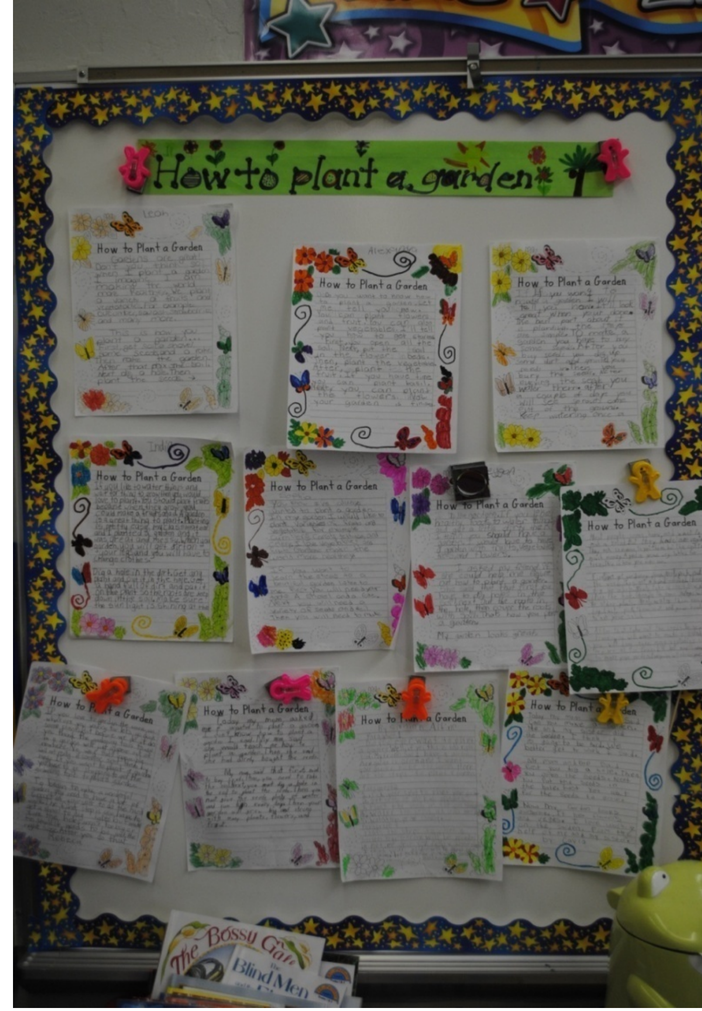

Definition
Gases have no definite volume.
Gases also take the shape of it's container. Some Properties that Can be smelly.
that's smelly
Gas in a container.
Ways to measure
You can Measure with a thermometer A thermometer measures temperature. We can also measure gas with a container.
Gas
Some examples are they can be...
invisible
And can be an
Oxegxen
Also...
Helium
And...
Also...
The molecules are moving around. They are moving Back and forth and Side to side. Some are moving in a circle. molecules Spread out and move Slowly. The molecules Spread out and move rapidly.
Examples
How the molecules look
Rebecca
Nikolas
Matthew
Alexa

Science IDEAS



Students created informational posters highlighting key science concept words (vocabulary), examples of living organisms, fun facts (Do you know why the Earth looks blue from space? Grade 2)



Upon completion of a hands-on gardening experience, each student wrote suggestions for How to Plant a Garden? Grade 2

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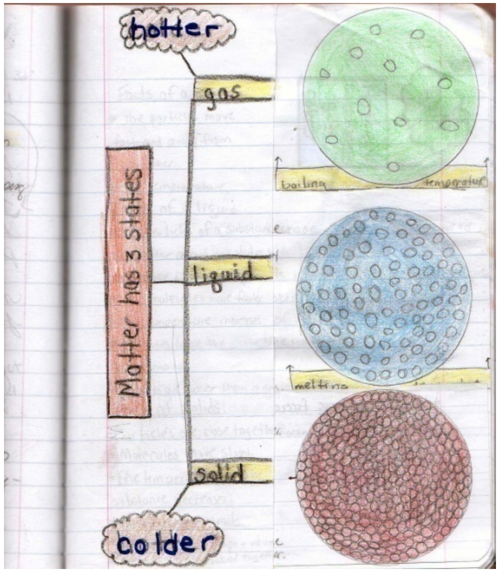
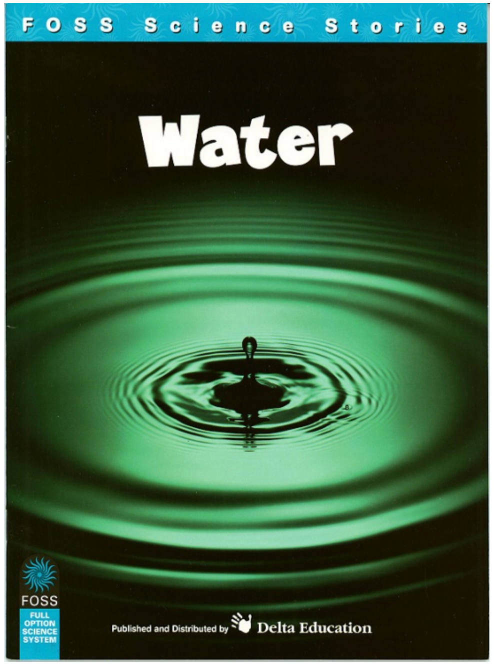
Application Activities

Application activities may include any combination of:

- Hands-on investigations
- Writing and Journaling
- Reading additional non- fiction
- Revising concept maps
- Projects and field trips





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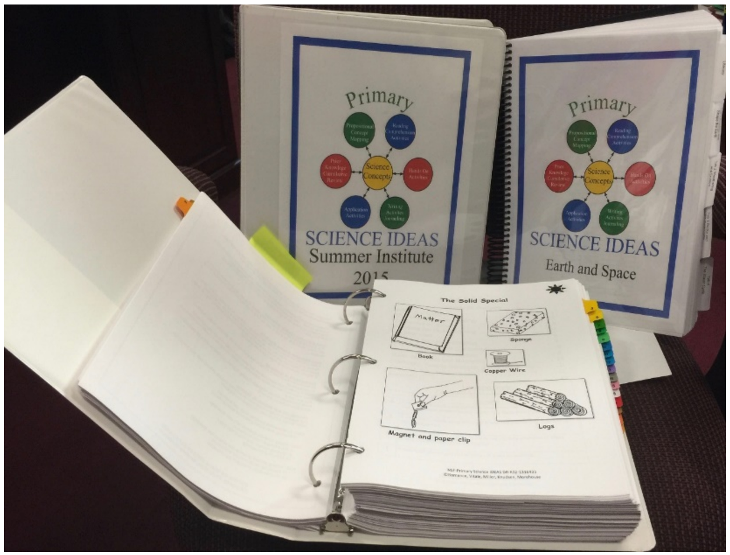
Framework - Literacy in Science IDEAS

Science IDEAS: An Instructional Model

- applies a *disciplinary core concept framework* to identify, organize and sequence all instructional activities
- framework means that "*what is being taught*" and "*how it is organized and sequenced*" are the first steps in planning for instruction in which literacy can be integrated into science
- Development focuses on student meaningful understanding (comprehension) of the science core concepts and concept relationships to be learned
- Literacy means having students read with 'understanding' across multiple print/digital sources and writing to learn and demonstrate understanding

Science IDEAS – Curriculum Materials



Matter, Force and Motion
Earth/Space Science
Life/Environmental Science

Served as a supplemental support for grade level planning and teacher science learning

Instructional Materials – Topic/Grade-Level Specific Curriculum Binders – Main Focus on Conceptual Coherence

- Provided an extensive range of supports including
  - Background knowledge
  - Propositional concept maps – as instructional blueprints
  - Multiple activities/investigations for each major concept/cluster
  - Reading and journaling suggestions/ examples
  - Grades 1-2 has student science readers
  - Grades 3-5 – www.scienceideas.org

What We Observed – Multi-Year Visits to Many Classrooms and Schools

Multiple Classroom Visits…
Found that all children were…

- actively engaged in the science lesson
- eager to ask and answer questions
- excited about reading more and more books on the topic being learned
- able to read books higher than their lexile status
- engaged and supported each other in group projects
  - assembling materials for activities
  - creating posters and charts showing what they learned
  - building a group concept map
  - creating big books

What We Observed – Multi-Year Sites Visits to Many Classrooms

Teachers reported that

- concepts maps facilitated being able to identify concepts and organize them for instruction
- concept maps facilitated lesson planning
    - identifying hands-on activities
    - selecting appropriate reading materials
    - selecting topics for writing
    - selecting reading skills to support science
- the SI model was flexible and easy to implement
- integrating science and literacy improved student achievement levels

Science IDEAS

Using Content Area Reading to Develop Reading Comprehension Proficiency in Grades K-5
Rationale, Evidence and Policy Implications For Increasing Student Achievement Outcomes

Multi-Year Research Findings

1992 – 2016

Research funded in part by two National Science Foundation grants as well as DD Eisenhower Funds

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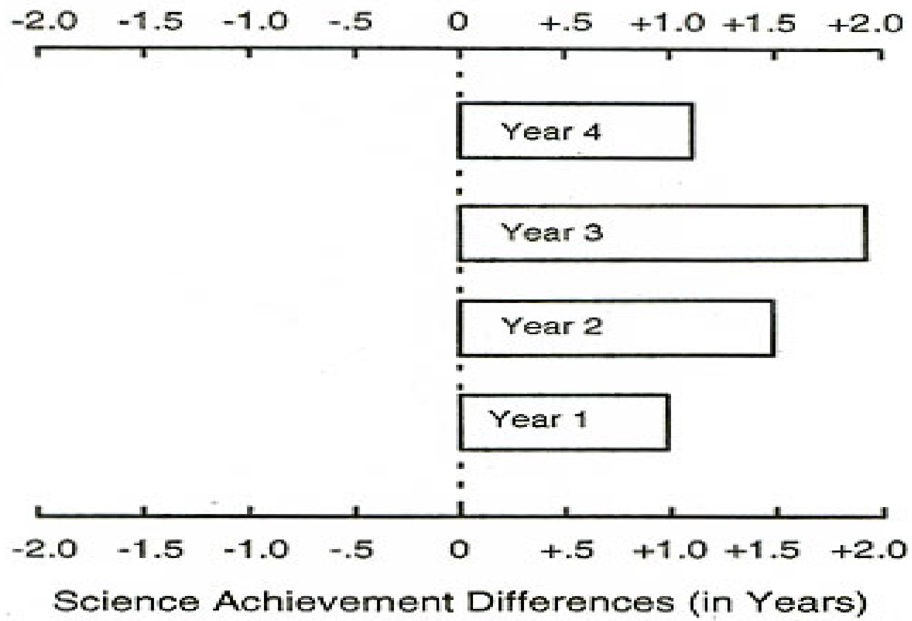
Science IDEAS: Patterns of Research Evidence

- **Research Findings: 1992-2001**

Science IDEAS: Multi-Year Findings (MAT Science)

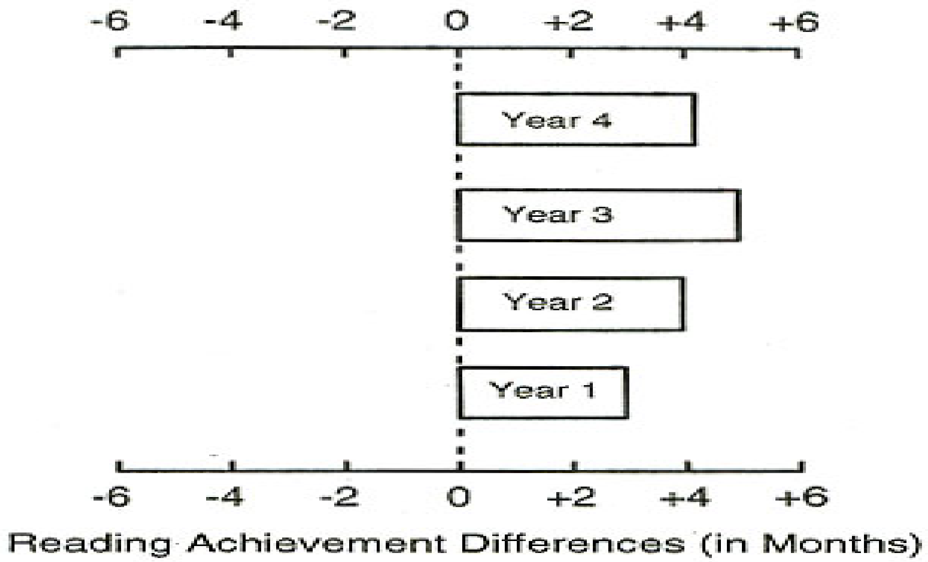


Note-- Year 1 students = grade 4; average/above average
Year 2 students = grade 4; average/above average
Year 3 students = grades 4,5; at-risk
Year 4 students = grades 4,5; average/above average/at-risk

Science IDEAS: Patterns of Research Evidence

- **Research Findings: 1992-2001**

Science IDEAS: Multi-Year Findings (ITBS/SAT Reading)

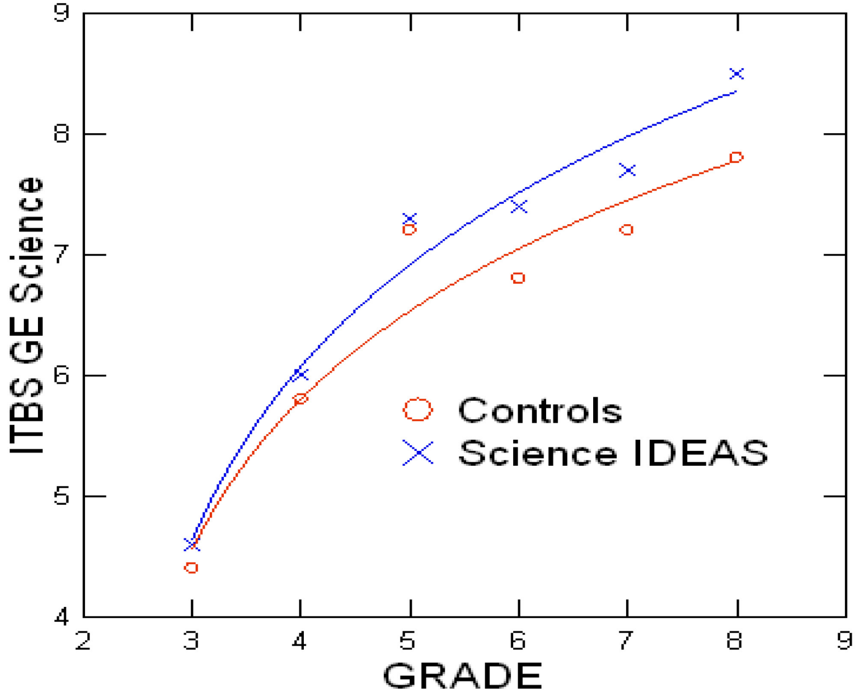


Note-- Year 1 students = grade 4; average/above average
Year 2 students = grade 4; average/above average
Year 3 students = grades 4,5; at-risk
Year 4 students = grades 4,5; average/above average/at-risk

Science IDEAS: Patterns of Research Evidence – Grades 3-8

- **NSF/IERI Project Research Findings: 2002-2007**
  - **Grades 3 - 8: Student achievement in Science**

2006-2007 ITBS Achievement Trajectories

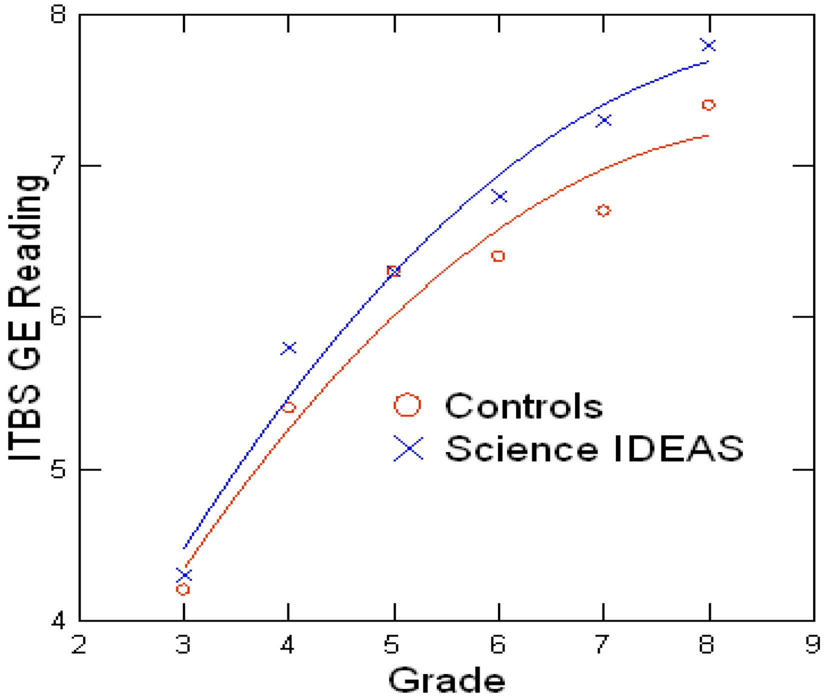


Note- Figure shows adjusted GE means on the ITBS Science subtest for the Science IDEAS and Control students by Grade Level. Covariates were Gender and At-Risk status. Difference between Science IDEAS and Control students was significant, $F(1, 6457) = 18.8$, $p < .001$, as was the Treatment x Grade Interaction, $F(5, 6457) = 4.81$, $p < .001$ supporting the increasing differences in performance with Grade Level.

Science IDEAS: Patterns of Research Evidence – Grades 3-8

- **NSF/IERI Project Research Findings: 2002-2007**
  - **Grades 3 - 8: Student achievement in Reading**

2006-2007 ITBS Achievement Trajectories



Note- Figure shows adjusted GE means on the ITBS Reading subtest for the Science IDEAS and Control students by Grade Level. Covariates were Gender and At-Risk status. Difference between Science IDEAS and Control students was significant, F(1, 7145) = 22.53, p < .001. The Treatment x Grade Interaction, was not significant. Girls out-performed Boys in Reading, F(5, 7145) = 24.14, p < .001.

School Accountability Grades 2002-2010

Elementary Schools Implementing Science IDEAS in Grades 3-5 Across Project Years 2001-02 Through 2007-08: School Accountability Grades

District	School Name	Grades	Avg. Minority	Avg. Free Lunch	PLANNING YR01-02	YR 1 YR02-03	YR 2 YR03-04	YR 3 YR04-05	YR 4 YR05-06	YR 5 YR06-07	YR 6 YR07-08	YR 7 YR08-09	YR 8 YR09-10
B	Challenger	3-5	37	72	B1	A	A	A	A	A	A	A	A
B	Silver Ridge	3-5	14	25	B2	A	A	A	A	A	A	A	A
A	Discovery Key	3-5	16	30	A1	A	A	A	A	A	A	A	A
A	Pointciana	3-5	48	62	A2	B	A	A	C	A	A	A	A
B	Nova Blanche	3-5	40	68	B3	A	A	B	A	A	A	A	A
B	Nova Eisenhowrer	3-5	39	68	B4	B	A	A	A	A	A	A	A
B	Oakland Park	3-5	72	78	B5	B	A	A	C	A	A	A	B
A	Boca Raton	3-5	64	61	A3	A	A	A	A	A	A	A	A
A	Lantana	3-5	70	63	A4	A	A	C	C	B	B	A	A
A	Sandpiper	3-5	20	36	A5	A	A	A	A	A	A	A	A
A	Heritage	3-5	72	69	A6	B	A	A	A	A	A	A	A
A	Elbridge Gale	3-5	32	50	A7					A	A	A	A

Note 1- The project began through an NSF Planning Grant in 2001-02. The NSF/IERI Project was implemented from 2002-03 through 2007-08. Year 6 (2007-08) and Year 7 (2008-09) were funded through no-cost project extensions.

Note 2- Shaded areas show years Science IDEAS was implemented. Grades were assigned by the Florida Statewide Accountability System

Representative Achievement Results: Grades 1-2 and Grades 3-5

Year	Grade	Exp. Duration	Participants	Effects of Science IDEAS on Student Achievement: Science	Effects of Science IDEAS on Student Achievement: Reading
1992	4	1 Yr.	3 Classes	+.93 GE (MAT)	+.35 GE (ITBS)
1998	4-5	1 Yr.	45 Classes	+1.11 GE (MAT)	+.37 GE (ITBS)
2002 – 2007*	3-5	Multi-Year	12 Schools	+.38 GE (ITBS)	+.32 GE (ITBS)
2003 – 2008**	3-5	Multi-	6 Schools	+1.08 GE (ITBS)	+.57 GE (ITBS)
2005	1-2	8 Wks.	2 Schools	+.42 GE (ITBS)	+.72 GE (ITBS)
2007	1-2	1 Yr.	2 Schools	+.16 GE (ITBS)	+.58 GE (ITBS)
2011-2013***	1-2	Multi-	7 Schools	+.29 GE (ITBS)	+.32 GE (ITBS)

*Note- Results include direct effects for grades 3-5 and transfer effects to grades 6-8
**Note- Results include direct effects for grades 3-5 and transfer effects to grades 6-7
***Note- Results include direct effects for grades 1-2 and transfer effects to grade 3

Direct and Transfer Effects of a Model Integrating Reading and Science in Grades 1-2-3 2013-2016

Direct Effects

Grade 1 Year 3	Science	Reading
ITBS GE Difference	+.31	+.07

Grade 2 Year 3	Science	Reading
ITBS GE Difference	+.42	+.20

Transfer Effects

Grade 3 Year 3	Science	Reading
ITBS GE Difference	+.42	+.51

Note 1. HLM analysis results for ITBS Reading found the effects of treatment significant ($t(16) = 2.34$, $p < .05$, Hedges g Effect = .1..67

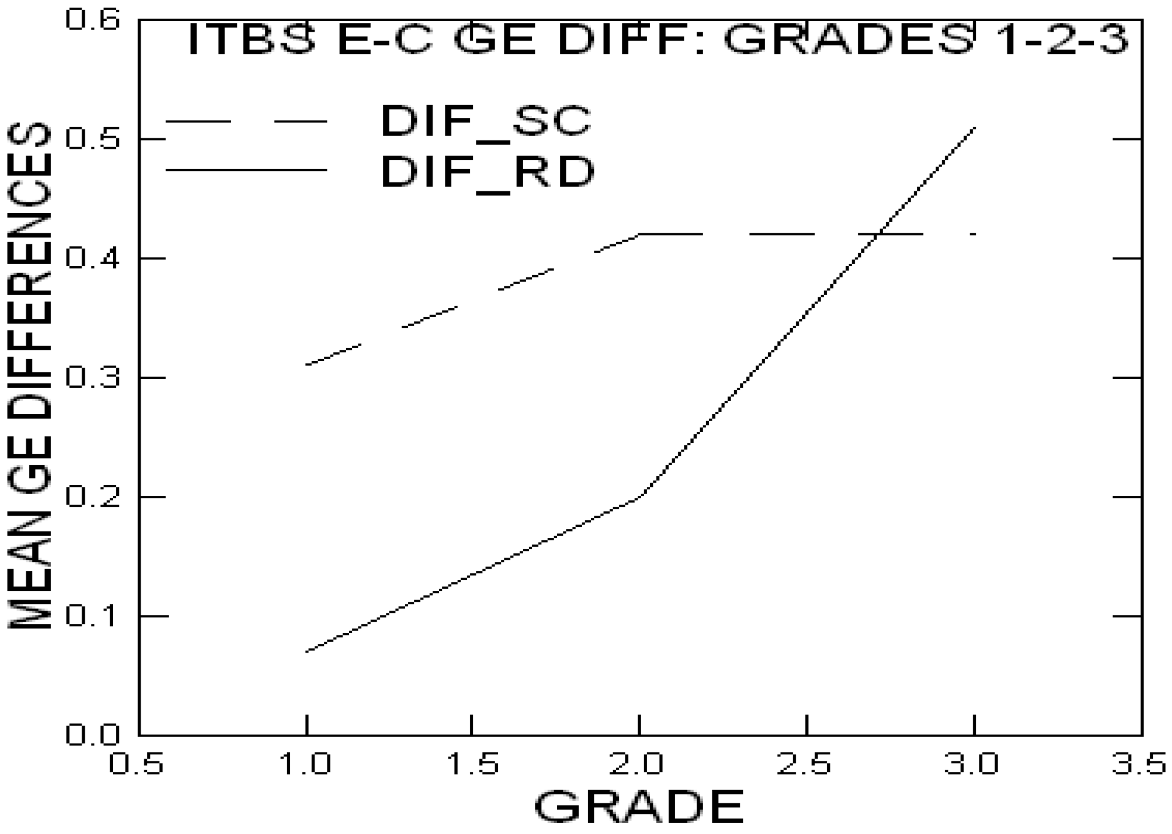
Note 2. HLM analysis results for ITBS Science found the effects of treatment significant ($t(16) = 2.38$, $p < .01$, Hedges g Effect = 1.34. In addition, the HLM analysis found a significant Treatment x Grade interaction ($t(15) = 2.47$, $p < .05$).

Note 3. Grade, Title 1 status, Minority status, and Gender were significant for both analyses.

Grade 3 results reflect 2 full years of content area reading and writing in science plus regular yr 3 instruction.

Primary Science IDEAS: Direct and Transfer Effects on ITBS Science and Reading in Grades 1-2-3

Note- Grades 1-2 show direct effects of intervention. Grade 3 shows transfer effects. Figure shows Adjusted Mean GE Exp. vs. Cont. Differences.



Science IDEAS: A Grade 1-5 Integrated Instructional Model Evidence of its Effectiveness as Cited by Others

- 1992 – **Journal of Research in Science Teaching** – Research article of the Year
- **National Reading Panel** – 2001 (cited under reading comprehension)
- Slavin, R. E., Lake, C., Hanley, P., & Thurston, A. (2014). **Experimental Evaluations of Elementary Science Programs: A Best Evidence Synthesis**. *Journal of Research in Science Teaching*. 51(7). 870-901.
- Rhodes, H. and Feder, M. (2014***). Literacy for Science: Exploring the Intersection of the Next Generation Science Standards and Common Core for ELA Standards***. Washington, DC: National Research Council. The National Academies Press.
- **National Academy of Science & National Research Council Invitational Workshop** - (December 9-10, 2013). (Washington, DC). Agenda - Note: Session 2/Page 2 - Literacy for Science in Principle and Practice. Organized for the Academy by Dr. P. David Pearson, University of California, Berkeley

Summary Thoughts:
Developing Science and Reading Literacy Using Informational Text

Benefits to students derived from using "science-based informational text" as part of the literacy development…..

- Inherently interesting to most students (even preferred by some)
- Motivates further reading
- Builds background knowledge (concept understanding and vocabulary) for future learning because it helps children learn about the world around them
- Basis for success throughout later years in school

Summary Thoughts – Making the Case for Linking Science and Literacy across Pre-K-5 Classrooms

- Strong evidentiary base - demonstrating powerful outcomes in support of linking reading comprehension (and writing) and science (Romance & Vitale, Pearson, Hiebert, French, Gelman, Greenfield, Hirsch)
- Early engagement in science (pre-K-K) determines student success in science in grade 3 and grade 8 science as well as serving as a factor in subsequent economic well-being and career growth (Morgan, et al., 2016)
- Early science builds fluency, vocabulary, and critical thinking,
- Lack of early science learning manifests itself in the continuing decline in student achievement from grades 5-12 in both science and reading (Morgan et al., 2016; NAEP, 2015)
- Generally, enhancements and increases in dosage of reading (including high dosages of non-content-rich materials for struggling readers) does not hold up in terms of improvement on state accountability and nationally-normed measures – NAEP (especially above basic and proficient) (NCLB, Reading First, Executive Summary, 2006)

Summary Thoughts - Making the Case for Linking Science and Literacy across Pre-K-5 Classrooms - 30 Yrs

- **Science IDEAS - Grades 1-5**
  - Model was feasible for regular classroom teachers to implement with fidelity
  - Effect of model on achievement was consistent across gender, ethnicity, and grade levels (no treatment interactions)
  - Science IDEAS instruction resulted in significant "added value" to desired achievement outcomes
  - Transfer effects were noted in grade 3 and grades 6-7
  - Significant findings for both reading and science were obtained
  - Increased achievement in reading at the elementary level will impact middle and high school content-area reading comprehension achievement

Summary Thoughts
Policy Implications that Address Science Learning with Reading Comprehension and Writing

- *Consider revamping elementary curriculum in a manner that is truly 'transformative'*
    - *content-area subjects should be front and center*
    - *remove instructional barriers that deny struggling learners the opportunity to build the background knowledge that propels comprehension*
    - *Consider grade level planning organized around teacher creation of concept maps to address what content students will be learning*
- *Consider increasing instructional time for integrated science and literacy – per day*
    - *Primary – 45 minutes daily*

      30 minutes science + 15 minutes from reading block
    - *Intermediate – 90 minutes daily*

      45 science + 45 minutes from the reading/writing block

Thank you!

Sharing a multi-year journey designed to improve student learning in science and reading has been awesome!

Science IDEAS

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