A Framework for Using Science to Enhance Instruction on Common Core State Standards (CCSS) in Reading and Writing in Grades K-5

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Presentation Overview

- *Highlights* of our NSF Grant Projects
  - Architecture of the Interdisciplinary Model (Science IDEAS)
  - Cumulative Pattern of Research Results (Grades 3-5 and Grades 1-2)
  - Description of the Elements of the Interdisciplinary Model
- Representation of our Model of Comprehension
- Representation of our Model of the NGSS in Science
- Description of how our Model Addresses CCSS – Comprehension in Science
- Practice example

Science IDEAS Model

Integrating Literacy within K-5 Science

Science IDEAS Model
Overview of Research Findings

Year(s)	Grade(s)	Duration	N[a]	Science	Reading
Early grade 3-5 Studies					
1992	4	1 year	3 classes	MAT: +.93 GE	ITBS: +.33 GE
1993	4	1 year	3 classes	MAT: +1.5 GE	ITBS: +.41 GE
1996	4-5	5 months	15 classes	MAT: +2.3 GE	ITBS: +.51 GE
1998	4-5	1 year	45 classes	MAT: +1.11GE	ITBS: +.37 GE
Recent Grade 3-8 Longitudinal Studies					
2002-2007	3-5	multi-year	12 schools	ITBS: +.38 GE	ITBS: +.32 GE
				(Note- Includes transfer: grades 6-8)	
Recent Grade 1-2 Studies					
2005	1-2	8 weeks	2 schools	ITBS: +.42 GE	ITBS: +.72 GE
				Note (No grade 1 science effect)	
2007	1-2	1 year	2 schools	ITBS: +.16 GE	ITBS: +.58 GE

Note. Comparable number of demographically-comparable classes/schools used as controls.
All GE data are adjusted mean differences (E vs. C)

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HLM Analysis - Multi-Year Evidence of Student Achievement in Reading Comprehension and Science in Grades 3-5 and Transfer Effects to Grades 6-8

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Discovery Research – K12

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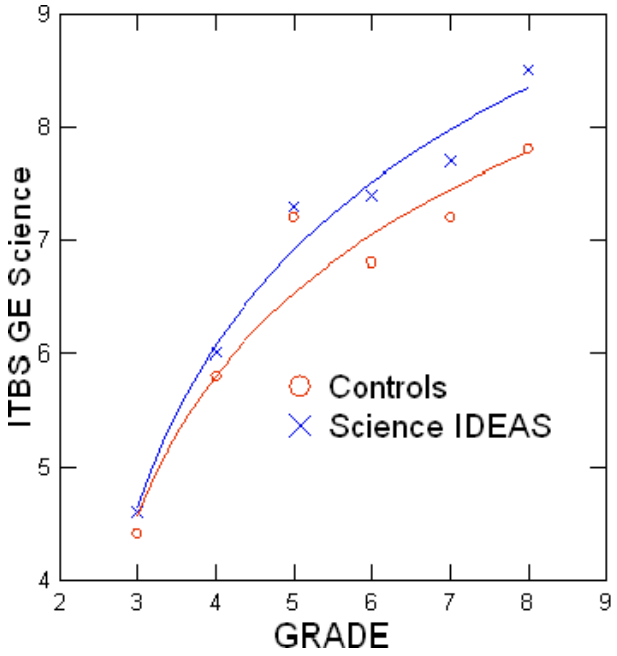

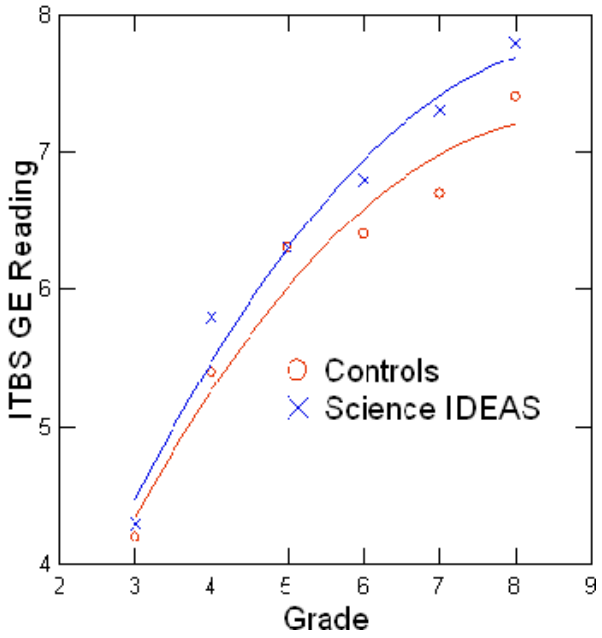

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Year 1 Results

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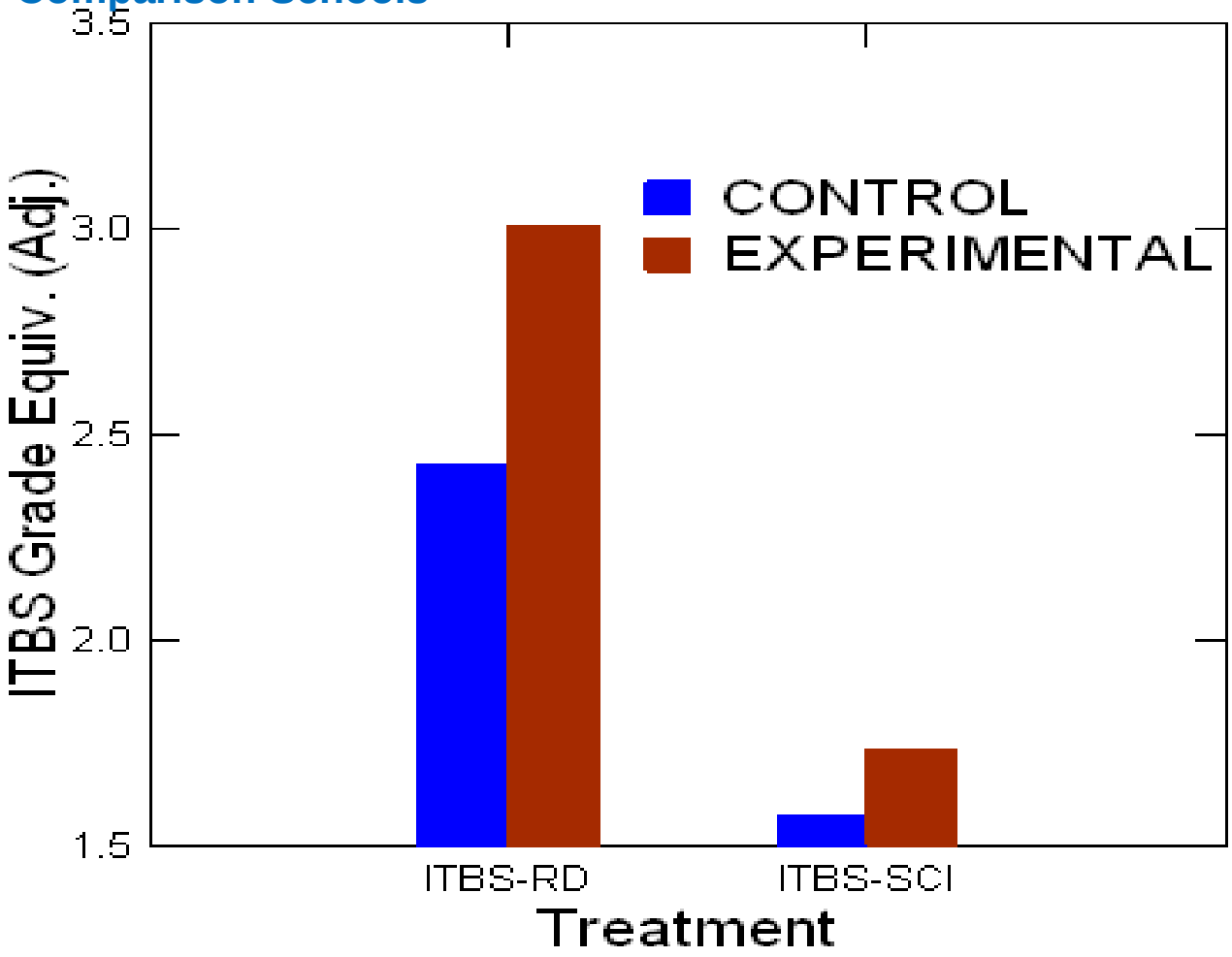
Grade 1-2 Adjusted Mean Differences: Primary Science IDEAS vs. Comparison Schools



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Element # 1
Science Investigations

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- **Science inquiry (first-hand investigations)are aligned with Practices of Science (POS) and the Disciplinary Core Ideas (DCI's)**

- All first-hand investigations are linked with reading and writing more about the topic (CCSS)

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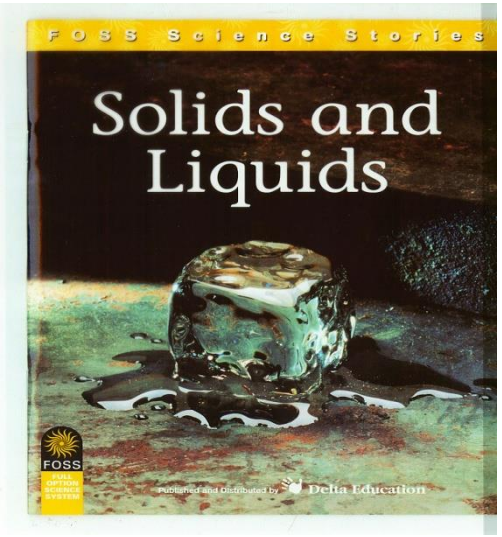
Element # 2

Reading Comprehension

- **Reading (second-hand investigations) -** students are first guided in reading about the topic, then they are able to read additional non-fiction books related to the science concepts being learned (District Literacy Standards and CCSS)



Students are learning more about what they already know! This has a major impact on comprehension and writing. Recommended is the reading of up to 10 books related to the lesson topic/concepts. Strategies used include our KBC model, guided reading, close reading, paired reading, and independent reading.

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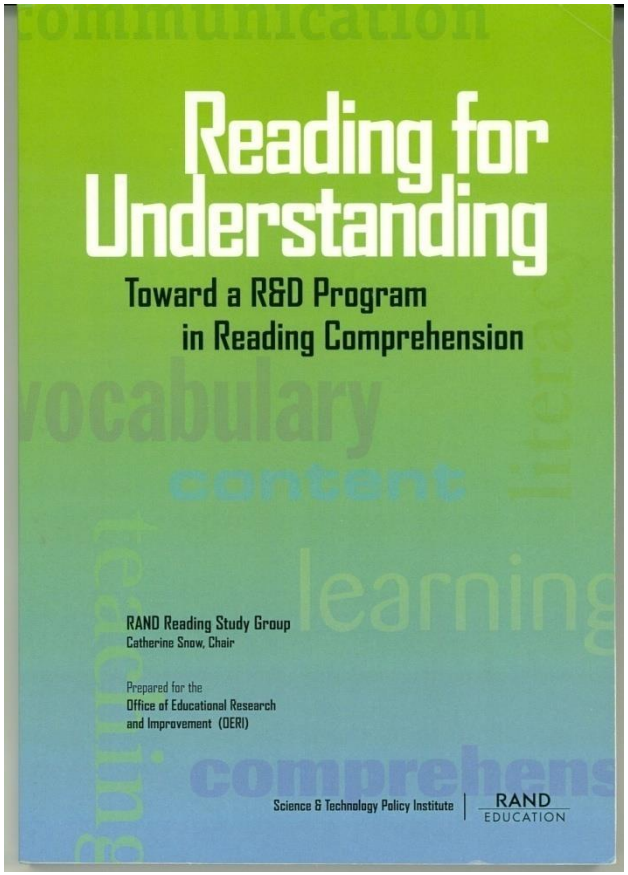
Element # 2 Reading Comprehension

[What we can Learn from the Rand Report]

Research Findings

- Recommends the need for much more focus on content-area reading comprehension (as does the CCSS and NAEP)
- Provides an excellent definition of comprehension, namely that… *comprehension is the simultaneous process of extracting and constructing meaning from text*



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Element # 3
Writing and Journaling

- 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 can write their own informational books, posters and other literary exhibits (District Literacy Standards and CCSS)

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Element # 3 Writing and Journaling

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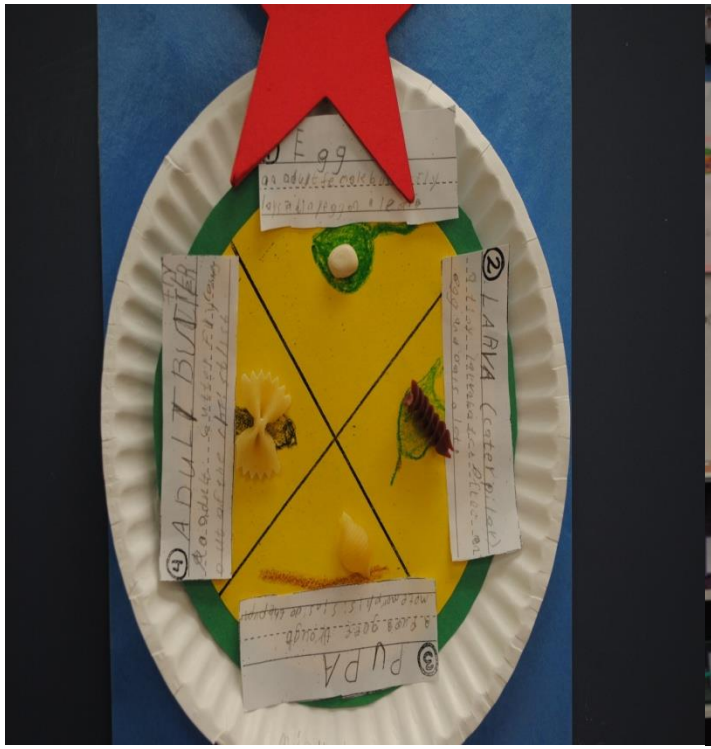

Students labeled and described the life cycle of a butterfly (Grade 1)

Student created her own informational book and a diorama that include the panda bear (Grade 1)

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Element # 3 Writing and Journaling

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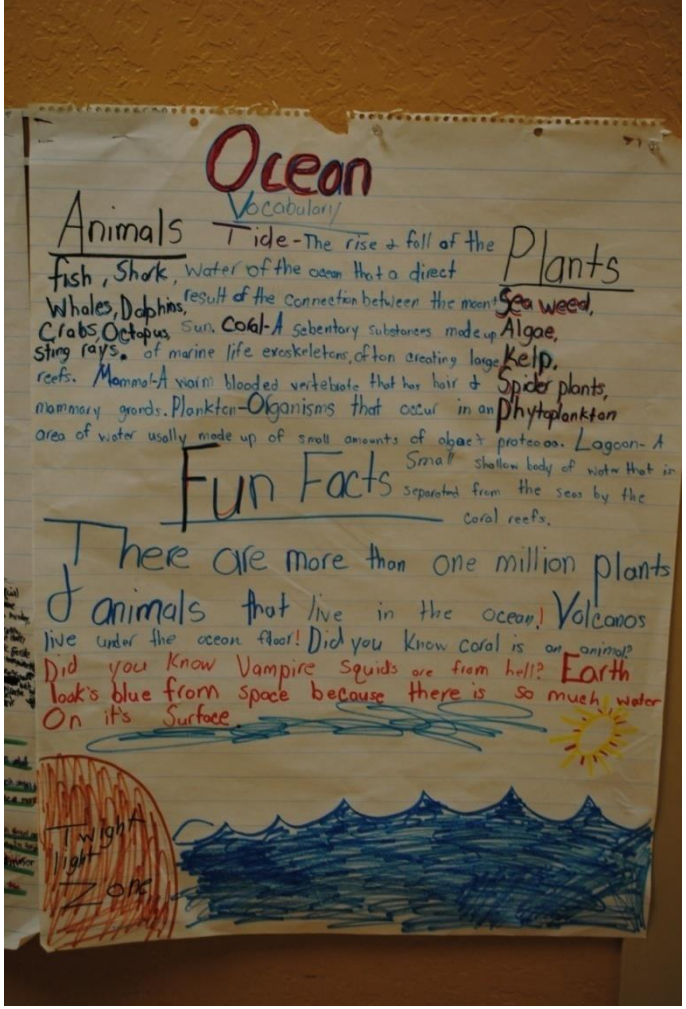
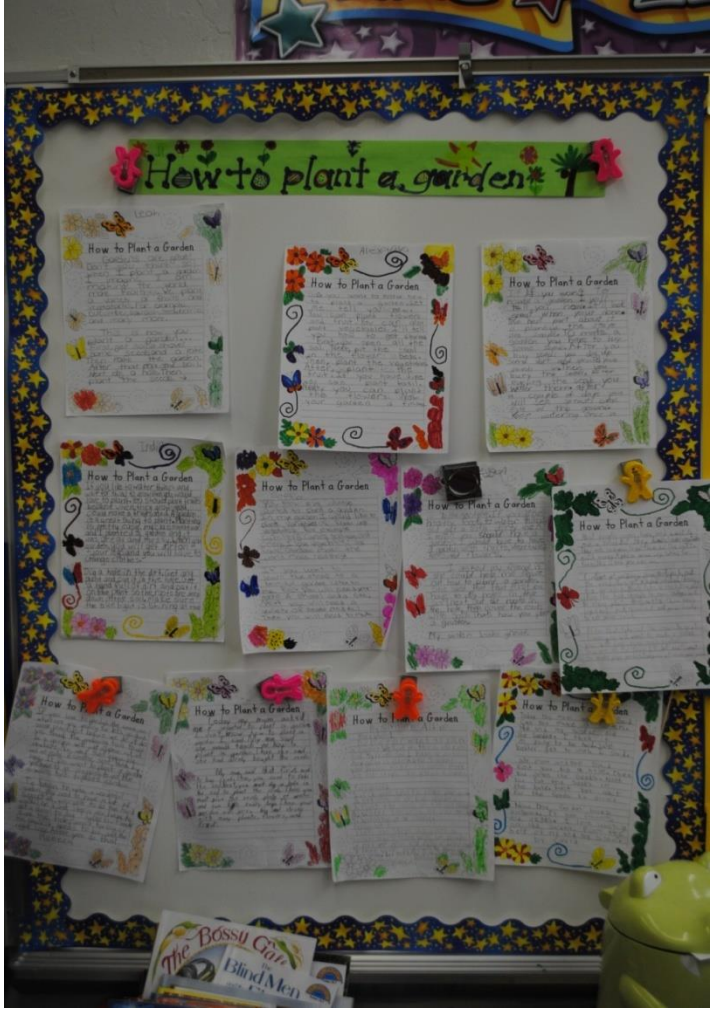


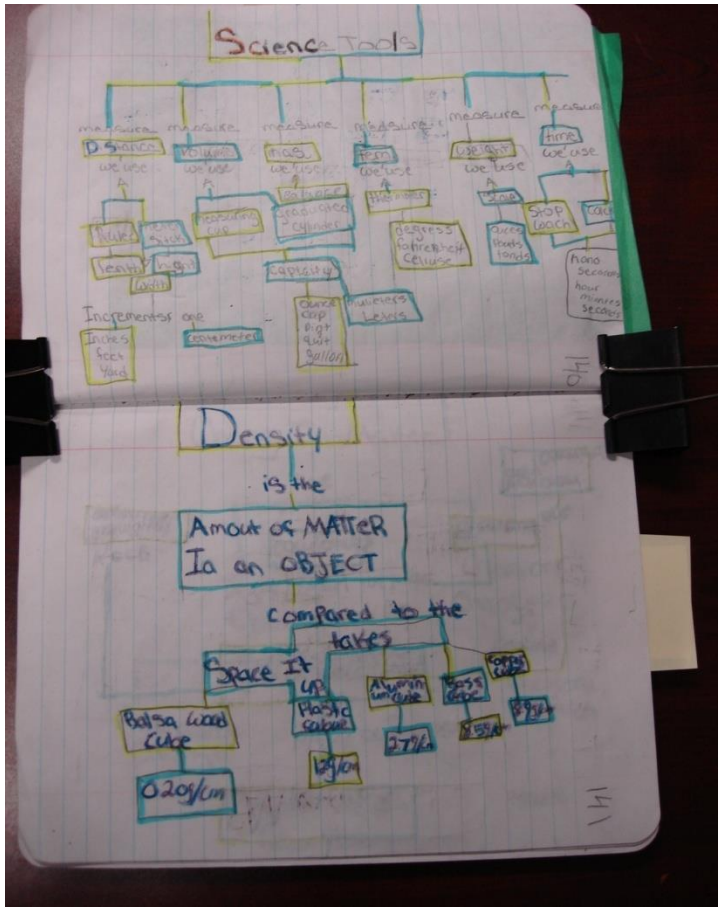
Students created informational posters highlighting key science concept words (vocabulary), examples of living organisms, fun facts (Do you know why the Earth looks blue from space? Grade 2

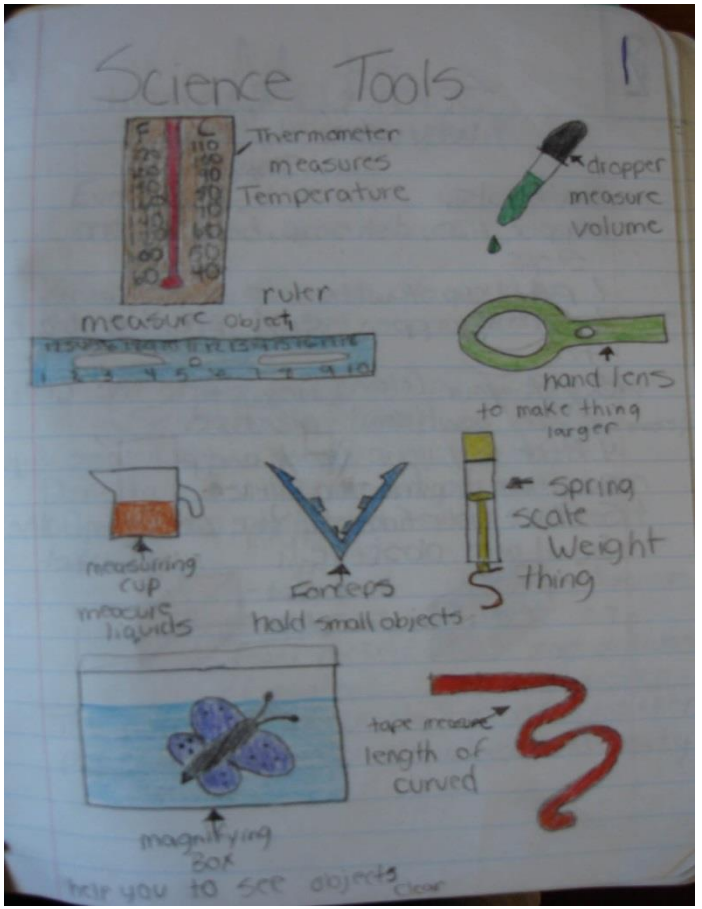


Upon completion of a hands-on gardening experience, each student wrote suggestions for How to Plant a Garden? Grade 2

Scientist's Journal

Element # 3 Writing and Journaling





Propositional Concept Maps:
The Starting Point for All Curriculum Units

Element # 4
Propositional Concept Mapping

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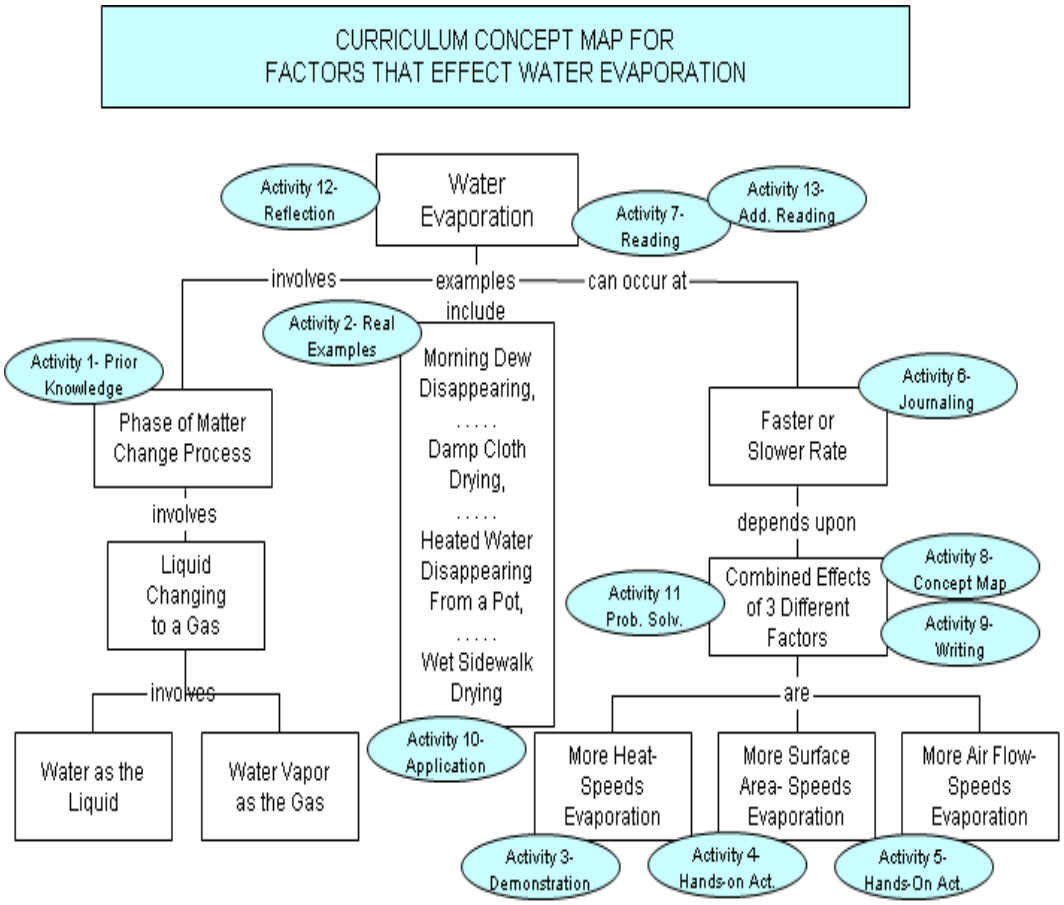
- Propositional Concept Mapping:
- For teachers – they identify and organize the key science concepts to be taught.
- For students, they are an important step in deepening comprehension and for expository writing.
- Links CCSS; FL's and NGSS)



Propositional Concept Maps

Element # 4
Propositional Concept Mapping

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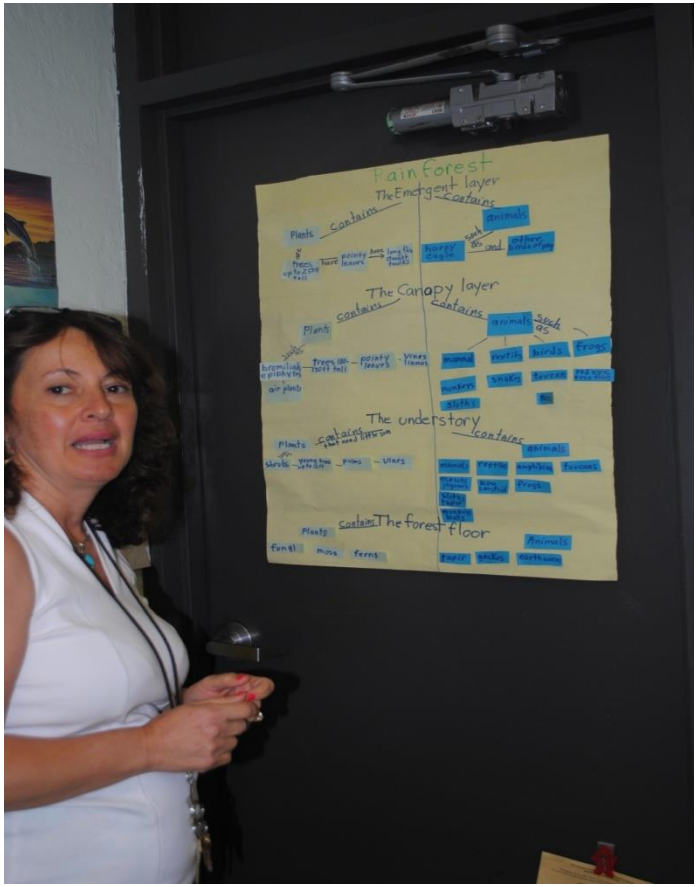
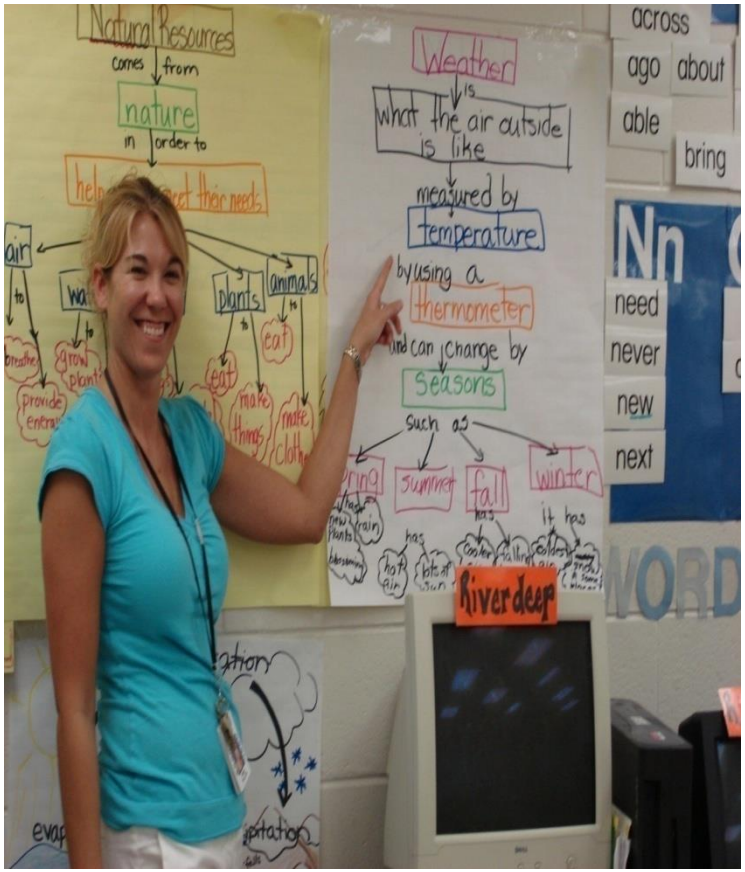


2nd grade teacher explains how the students suggested to organize the class map on the rain forest



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

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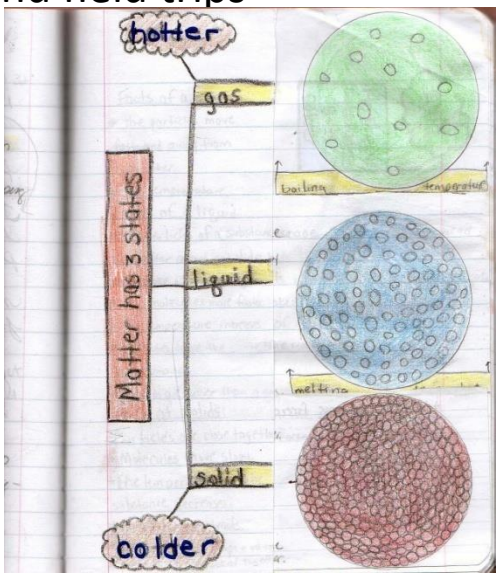
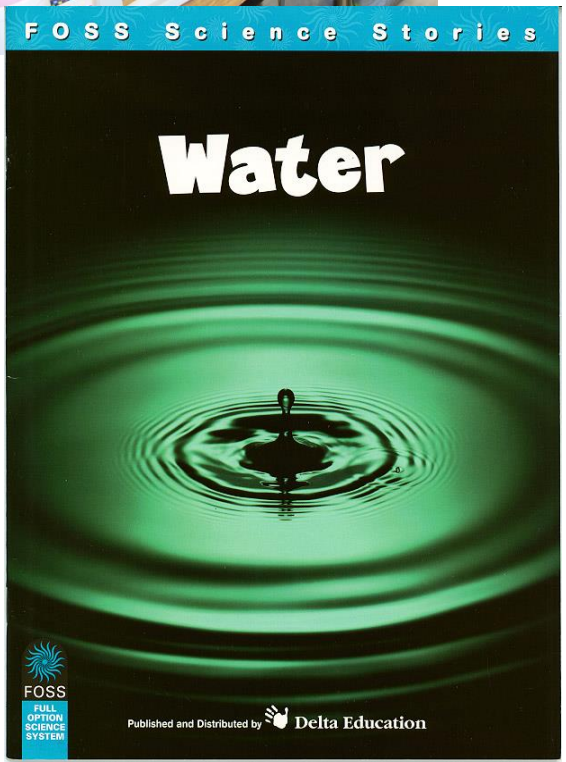
Element # 6
Application

Application activities may include any combination of new

- Hands-on investigations
- Writing and Journaling
- Reading additional books and related narrative non-fiction (10 recommended)
- Revisions of the concept map
- Novel projects and field trips





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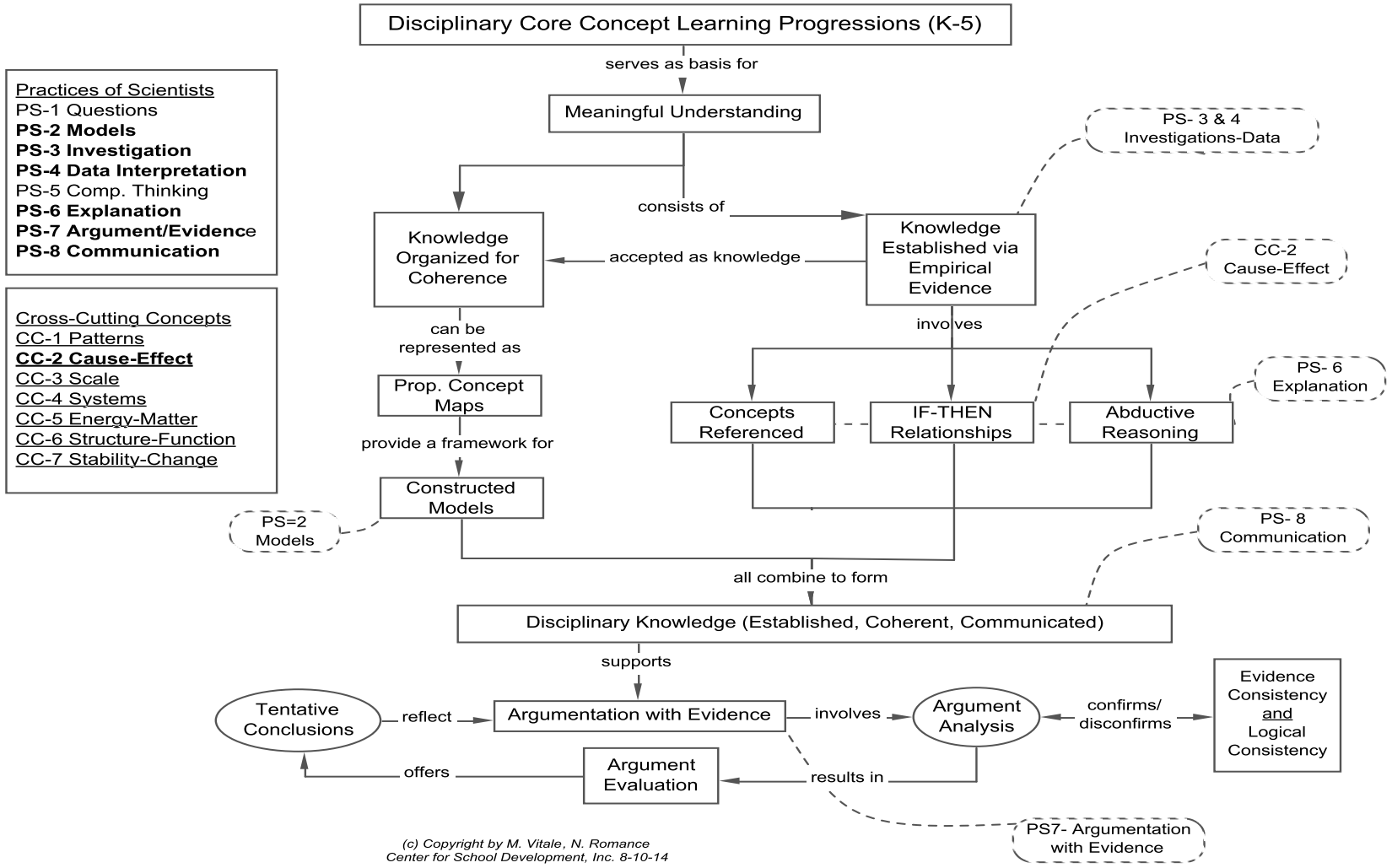
Science IDEAS Model

Concept-Focused Framework for Addressing NGSS



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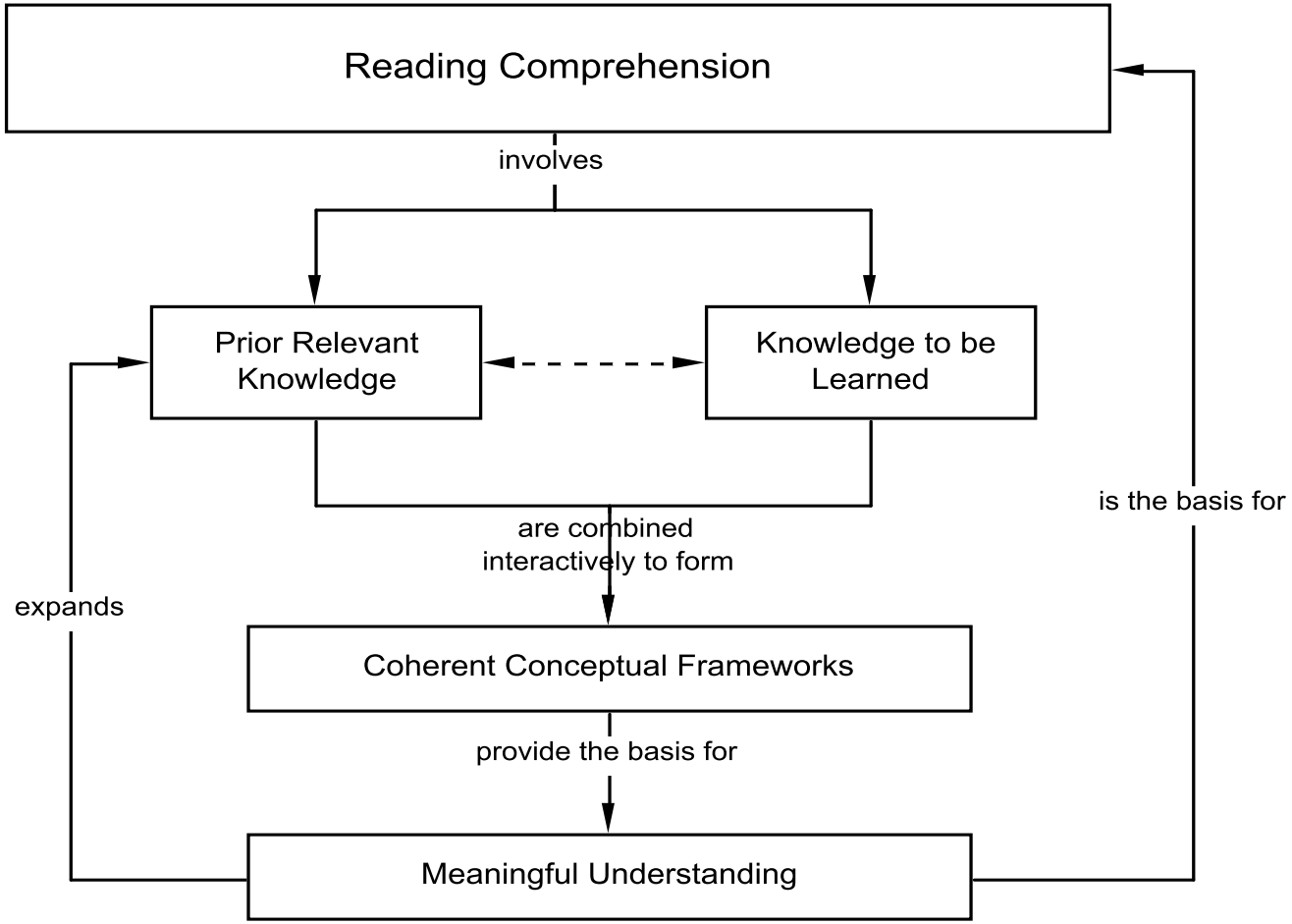
Content-Focused Perspective for Addressing Reading Comprehension



Science IDEAS Model: Addressing CCSS Comprehension with Science Informational Text

- Science IDEAS Model …
  - Advocates for the *integration* of specific Science IDEAS knowledge-based literacy guidelines that have been validated across our multi-year implementation. The literacy guidelines…..
    - Address reading, writing, speaking and communicating within science, a conceptually rich content domain
    - Align with the broad goals implicit within both the CCSS and the National Assessment of Educational Progress (NAEP)
    - Actively engage learners in "…thoughtful engagement with high quality informational texts that builds knowledge, enlarges experiences …" and provide the necessary background knowledge for reasoning and for evidence-based discussion and argumentation.

Science IDEAS Model

Addressing CCSS Comprehension with Science Informational Text

Previewing the Text: In order to guide the learner (guided reading), you, yourself, must know *how the concepts in the text are organized and presented.*

Prior Knowledge and Experience Support Comprehension: To guide student comprehension of text, it is important for you to guide students *to access on a continuing basis what prior curricular knowledge they have and what relevant everyday experiences that they have that they can draw upon.*

Grade 5
LAFS.5.W.3.8

Science IDEAS Model

Addressing CCSS Comprehension with Science Informational Text

Strings of Simple Sentences Make Comprehension Difficult.
Complex Sentences Can Also Make Comprehension Difficult.

Primary texts are often written as strings of simple sentences in order to accommodate readability formulas. However, because important connecting words are removed, understanding and comprehension are often more difficult to achieve. Therefore, *as you guide students reading and re-reading of sentences in a paragraph, try to link sentences together by adding connecting words.*

When complex or compound sentences are encountered, discuss with students how to dissect these sentences so that the relationship between the clauses are clear. Sometimes with complex sentences, there is a cause statement (dependent clause) and an effect statement (independent clause). For compound sentences, there may be two effects or two causes. Dissecting sentences in this manner supports comprehension.

Grade 4	Grade 5
LAFS.4.L.1.1	LAFS.5.L1.1
LAFS.4.L.1.2	LAFS.5.L1.2

Science IDEAS Model

Addressing CCSS Comprehension with Science Informational Text

Bold Faced Words: These words are often associated with sentences that *give a definition*. BUT, BEWARE!. Usually, the *entire paragraph may actually be the definition* which, when approached that way, makes learning more complete for students.

Grade 4	Grade 5
LAFS.4.L.1.1	LAFS.5.L.1.1

Clarify Use of Pronouns: Pronouns are used to lessen the word complexity of texts. However, more often than not, students don't know what they refer to. Therefore, it is very important to *guide students to always identify the noun referent of a pronoun and then replace the pronoun in the sentence*. Sometimes, a paragraph may have two pronouns in a row. You must do the same thing again until students become very familiar with this process.

Science IDEAS Model

Addressing CCSS Comprehension with Science Informational Text

Building Fluency with Science: Without being able to read fluently, there is little comprehension. Here is an easy strategy: (a) first *you model how the passage should sound* when it is being read with fluency, and (b) have the children read the passage together several times while increasing the speed with which it is read. This gives students a chance to hear how the words and sentences should sound.

Grade 4	Grade 5
LAFS.4.RF.4.4	LAFS.5.RF.4.4
LAFS.4.SL.1.2	LAFS.5.RI.4.10

Science IDEAS Model

Addressing CCSS Comprehension with Science Informational Text

Making Content the Focus of Content-Area Reading: When reading informational text, you need to guide students by *(a) carefully reading and discussing the concepts in each paragraph, (b) linking the concepts in each paragraph to the previous paragraph, (c) trying to summarize what the page is about, and, finally, (d) making a list of all the important concepts and trying to organize them in the form of a small graphic organizer (e.g., mini-concept map).*

	Grade 4			Grade 5	
LAFS.4.R.1.1	LAFS.4.R.2.4	LAFS.4.W.2.5	LAFS.5.RI.1.1	LAFS.5.RI.2.4	LAFS.5.RI.1.3
LAFS.4.R.1.2	LAFS.4.R.2.5	LAFS.4.W.2.6	LAFS.5.RI.1.2	LAFS.5.W.1.2	LAFS.5.RI.4.10
LAFS.4.R.1.3	LAFS.4.W.2.4		LAFS.5.W.2.5	LAFS.5.W.2.4	

Science IDEAS Model

Addressing CCSS Comprehension with Science Informational Text

Linking Hands-On Activities with Reading and Performance-Based Assessments (Writing/Journaling): Each activity (*first-hand investigations*) is linked to one or more concepts. Following the activity, students should have an opportunity to read (*second-hand investigations*) about those concepts. This supports comprehension. Then, students should have an opportunity to engage in a variety of forms of writing with illustrations/pictures of the activities/ideas they are learning.

Grade 4		Grade 5	
LAFS.4.RI.2.6	LSFS.4.W.1.3	LAFS.5.W.2.4	LAFS.5.W.3.7
LSFS.4.W.1.1	LSFS.4.W.3.7	LAFS.5.W.2.5	LAFS.5.W.4.10
LSFS.4.W.1.2	LSFS.4.W.3.8	LAFS.5.W.2.6	LAFS.5.W.1.2
LSFS.4.L.2.3			

Science IDEAS Model

Addressing CCSS Comprehension with Science Informational Text

Using Multiple Texts: When guiding students in reading informational text, it is very valuable *to have at least three different texts on the same topic that students can read.* When they get really good at this, try to increase the number of books and reference materials they will read on the same topic. (The benefits from doing so are amazing.)

Grade 4		Grade 5	
LAFS.4.W.3.7	LAFS.4.RI.3.9	LAFS.5.RI.2.5	LAFS.5.RI.3.7
LAFS.4.W.3.8	LAFS.4.RI.3.10	LAFS.5.RI.2.6	LAFS.5.RI.3.9
LAFS.4.W.3.9		LAFS.5.W.3.8	LAFS.5.W.3.9

For grades 3-5, students should read from 5-10 books on the general topic; for middle and high school, reading across multiple sources clearly deepens understanding/comprehension and writing.

Science IDEAS Model

Addressing CCSS Comprehension with Science Informational Text

English Conventions (Grammar): Select a page from the science mentor text that you are using. This page can provide a meaningful context to examine such things as: parts of speech (e.g., nouns, verbs, pronouns, adjectives, complete sentences, main idea, cause/effect, punctuation and capitalizing). So while you are teaching the grammar, you have something interesting to focus on (e.g., push, pull, tuning forks, solids) rather than 'my dog'.

Grade 4		Grade 5	
LAFS.4.SL.2.4	LAFS.4.L.1.2	LAFS.5.L.1.1	LAFS.5.L.2.3
LAFS.4.L.1.1	LAFS.4.L.1.3	LAFS.5.L.1.2	LAFS.5.L.3.5

Science IDEAS Model

Addressing CCSS Comprehension with Science Informational Text

Information Follow-Up: After learning a concept in class, students should be encouraged to research topics further at home, using tools such as the internet (with parental supervision) and additional texts. By presenting the information to the class and creating visual aids (concept maps or posters), students are able to demonstrate mastery of a subject, as well as the proper organization of ideas and how they link together. This process develops in-depth student comprehension of concepts.

Grade4			Grade 5		
LAFS.4.RL.3.7	LAFS.4.RI.3.7	LAFS.4.W.3.8	LAFS.5.RL.1.1	LAFS.5.RI.2.4	LAFS.5.W.2.4
LAFS.4.RI.1.2	LAFS.4.RI.3.9	LAFS.4.W.3.9	LAFS.5.RI.1.2	LAFS.5.RI.2.6	LAFS.5.W.2.6
LAFS.4.RI.1.3	LAFS.4.RI.2.4	LAFS.4.SL.2.4	LAFS.5.RI.1.3	LAFS.5.RI.3.7	LAFS.5.W.3.7
LAFS.4.W.2.4	LAFS.4.W.2.6	LAFS.4.W.3.7	LAFS.5.SL.1.3	LAFS.5.RI.3.9	LAFS.5.W.3.9

Using K-5 Science as a Framework for Addressing Common Core State Standards in Reading and Writing

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Paper presented at the School Science and Mathematics Association Annual Convention, November 6-8, 2014, Jacksonville, FL

Science IDEAS Model

Meaningful Science Text Understanding through Reading

Understanding Factors that Affect Water Evaporation

Water evaporation is a scientific process in which a liquid is changed into a gas. In evaporation, water is the liquid that is changed into a gas called water vapor. Some examples of evaporation are morning dew disappearing, a damp cloth drying, heated water disappearing from a pot, or a wet sidewalk drying.

Water evaporation can occur at a faster or slower rate. The rate of evaporation depends upon the combined effects of three different factors. One factor is heat. More heat speeds evaporation while less heat slows the evaporation process. A second factor is surface area. Having a greater the surface area speeds evaporation. Finally, the third factor is air flow. The greater the air flow, the faster evaporation occurs.

You could conducted several hands-on experiments to investigate these factors. For example, by using a hair dryer, you could demonstrate that heating the same sized cloth could make evaporation occur faster. This is the same process used by a clothes dryer. In another experiment, you could show that spreading a wet cloth could result in faster evaporation than squeezing a comparable cloth into a ball. In a third experiment, you could show that increasing the air flow using a fan could increase evaporation rate. The second and third experiments could explain why drying clothes or towels outside is much faster if they are spread out and located so a breeze can reach them.

Science IDEAS Model

Meaningful Science Text Understanding: Identifying Key Concepts

Understanding Factors that Affect Water Evaporation

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Science IDEAS Model

Meaningful Science Text Understanding: Key Concepts

Understanding Factors that Affect Water Evaporation

scientific process liquid is changed into a gas water (liquid) changed into water vapor.

examples morning dew disappearing, a damp cloth drying, heated water disappearing from a pot

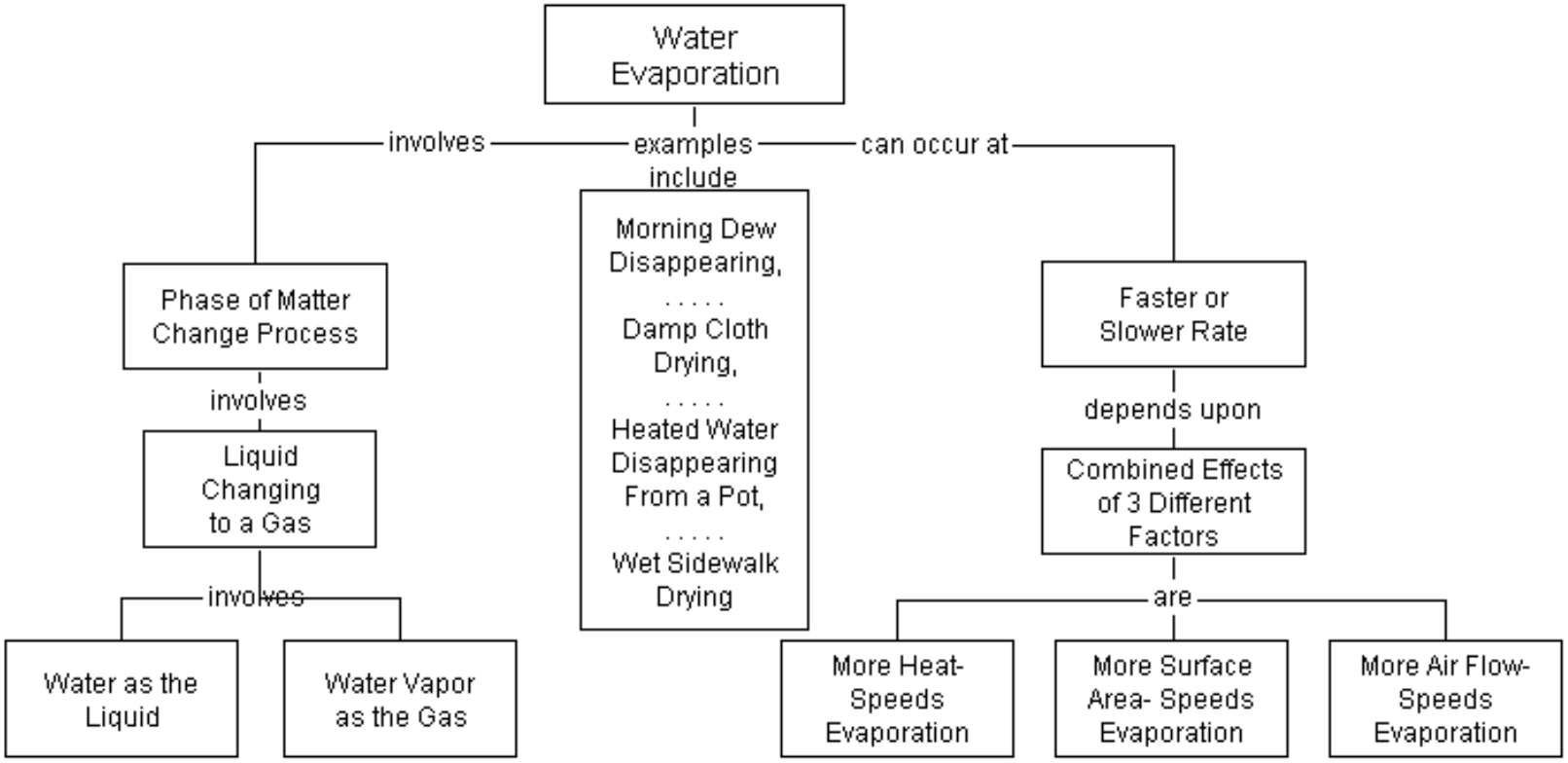
wet sidewalk drying.

evaporation can occur at a faster or slower. combined effects of three different factors.

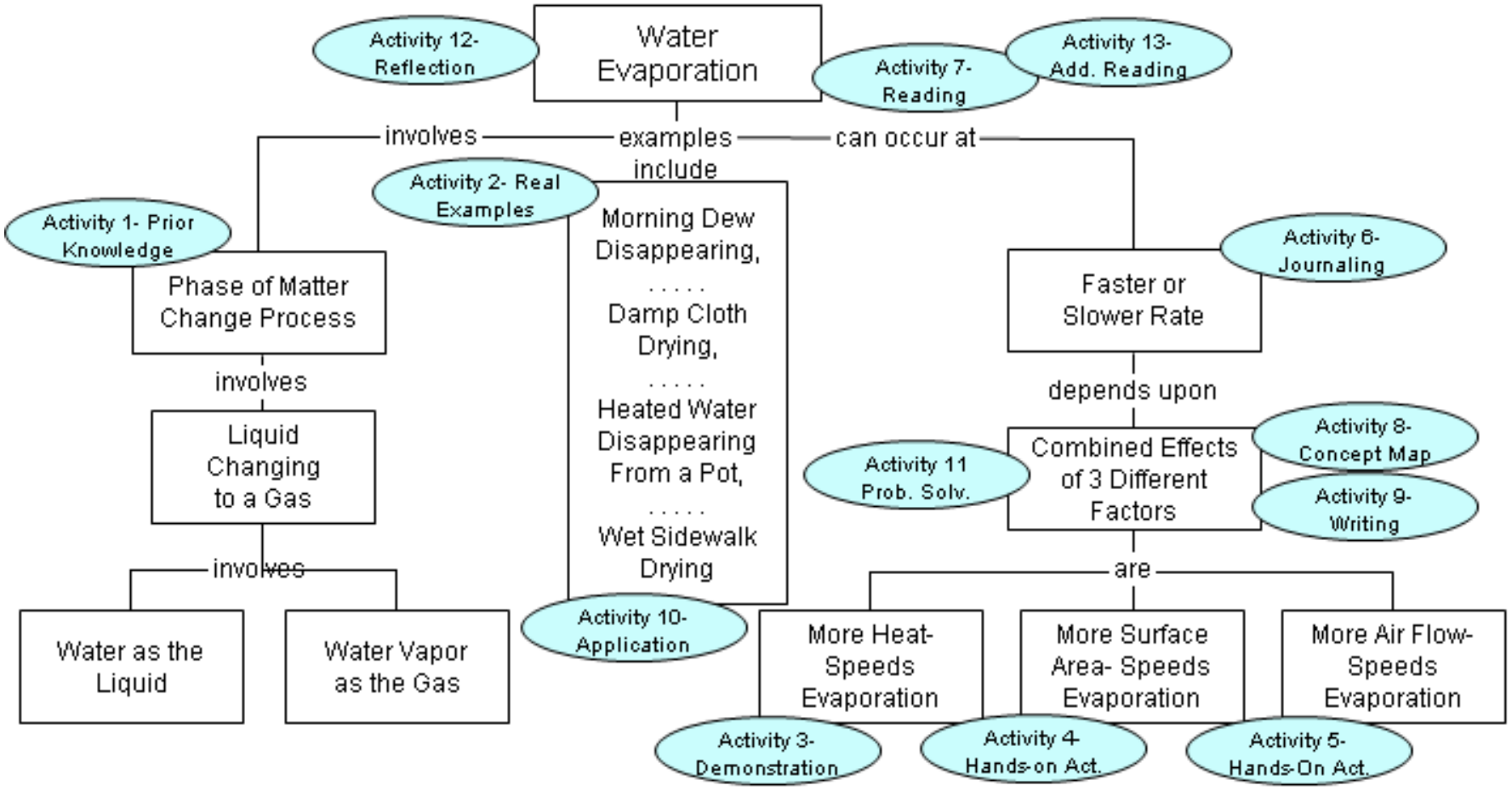
heat speeds evaporation greater surface area speeds evaporation. greater the air flow, faster evaporation .

experiments a hair dryer, spreading a wet cloth increasing air flow

CURRICULUM CONCEPT MAP FOR FACTORS THAT EFFECT WATER EVAPORATION



CURRICULUM CONCEPT MAP FOR FACTORS THAT EFFECT WATER EVAPORATION



Science IDEAS Model

Meaningful Science Text Understanding: Writing from Concept Map

Understanding Factors that Affect Water Evaporation

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