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
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.

Middle School
Physical Science

High School Science
Grade 10-11

Elementary Science
– K-5 begins to build that foundation

Chemistry and Chemical Reactivity

Solids and Liquids

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 moment to another. The way to measure the speed 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 mean speed.
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
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
**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.
Learning with Understanding...

3 Major Findings...

**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)
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

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Importance of Prior Knowledge
Organized-Easily Accessed- Changed as Needed when New Learning Occurs

Knowledge-Based Strategies

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Definition

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Activity

Responses Required
Graham Woods was knocked out of his crease on the first over after lunch.
Roberto Clementi sacrificed and knocked in a run.
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.
Methods of nutrition serves as a core idea in distinguishing among categories of eurkaroyta.
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

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

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
- 38% of High School students performed at the proficient level in 2009
- Scores were higher than 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 1st grade general knowledge
  - 1st grade general knowledge - strongest predictor of children’s science achievement from grade 3 to 8th 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
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

CURRICULUM CONCEPT MAP FOR FACTORS THAT EFFECT WATER EVAPORATION

Activity 12 - Reflection
Activity 7 - Reading
Activity 13 - Add. Reading

Activity 1 - Prior Knowledge
Activity 2 - Real Examples

Water Evaporation

Involves
Phase of Matter Change Process

Involves
Liquid Changing to a Gas

Water as the Liquid
Water Vapor as the Gas

Examples
Morning Dew Disappearing,
Damp Cloth Drying,
Heated Water Disappearing From a Pot,
Wet Sidewalk Drying

Activity 10 - Application
Activity 11 - Prob. Solv.

Activity 6 - Journaling
Activity 8 - Concept Map
Activity 9 - Writing

Combined Effects of 3 Different Factors

Activity 11 - Prob. Solv.
Activity 3 - Demonstration
Activity 4 - Hands-on Act.

Faster or Slower Rate

Depends upon
More Heat-Speeds Evaporation
More Surface Area-Speeds Evaporation
More Air Flow-Speeds Evaporation

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Concept maps have many purposes:

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

**Student**
1. Studying
2. Writing
3. Comprehension
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)
Knowledge-Based Instruction (KBI) Model

consists of

Knowledge-Based Teaching (KBT)

emphasizes

Roles of Teachers in Instruction

include

Curriculum Planning

Instructional Task Development

Teaching and Assessment

is basis for

Concept Mapping as a Tool

to focus on

Content Knowledge to be Learned

is basis for

Knowledge-Based Instructional Routines

that emphasize

Learning with Comprehension

Knowledge-Based Learning (KBL)

emphasizes

Roles of Students as Learners

include

Content Analysis of Text

Writing with Guidelines

Study Aid Strategy

Note: For Content Analysis of Text: a knowledge-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:
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.
Knowing how the concepts are organized within a text is important for teaching and for learning.

**Our Solar System**

**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** (PRAHMH•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?
Space consists of

Solar System includes

Central Star revolves around Planet and Asteroids and Comets

Sun is the Source of almost all Energy

Burning Sphere of Gases has on its surface Sunspots

1 Million Km in Diameter Prominences

Most Massive Object emit are

Satellites are called One or More Moons

Small and Rocky Objects are located between Mars and Jupiter

Small Mass of Dust and Ice are

All Directions travels in Heat or Light travels as

Heat or Light is the Source of almost all Energy

Sun is the Central Star

Planets may have Satellites

Comets and Asteroids can be described as

Most Massive Object

One or More Moons

3

Sunspots

Prominences

Less Light

Red Streams and Loops of Gases

Cooler than Surroundings

Example of propositional concept map constructed from Our Solar System passage
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

• 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
Definition
Gas: have no definite volume. Gases also take the shape of its container. Some properties that can be smelled:

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:

- Air
- Oxygen
- Helium
- Natural gas

Examples
- Methane
- Oxygen
- Helium

How the molecules look

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 move rapidly.
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
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
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

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

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

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

Research funded in part by two National Science Foundation grants as well as DD Eisenhower Funds
Science IDEAS: Patterns of Research Evidence


Science IDEAS: Multi-Year Findings (MAT Science)

![Diagram showing science achievement differences in years from 1992 to 2001.]

**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)

Reading Achievement Differences (in Months)

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

- 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

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<th>District</th>
<th>School Name</th>
<th>Grades</th>
<th>Avg. Minority</th>
<th>Avg. Free Lunch</th>
<th>PLANNING YR01-02</th>
<th>YR 1 YR02-03</th>
<th>YR 2 YR03-04</th>
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**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

<table>
<thead>
<tr>
<th>Year</th>
<th>Grade</th>
<th>Exp. Duration</th>
<th>Participants</th>
<th>Effects of Science IDEAS on Student Achievement: Science</th>
<th>Effects of Science IDEAS on Student Achievement: Reading</th>
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<td>3 Classes</td>
<td>+.93 GE (MAT)</td>
<td>+.35 GE (ITBS)</td>
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<td>2002 – 2007*</td>
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<td>2003 – 2008**</td>
<td>3-5</td>
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<td>+.42 GE (ITBS)</td>
<td>+.72 GE (ITBS)</td>
</tr>
<tr>
<td>2007</td>
<td>1-2</td>
<td>1 Yr.</td>
<td>2 Schools</td>
<td>+.16 GE (ITBS)</td>
<td>+.58 GE (ITBS)</td>
</tr>
<tr>
<td>2011-2013***</td>
<td>1-2</td>
<td>Multi-</td>
<td>7 Schools</td>
<td>+.29 GE (ITBS)</td>
<td>+.32 GE (ITBS)</td>
</tr>
</tbody>
</table>

*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

<table>
<thead>
<tr>
<th>Grade 1 Year 3 Science</th>
<th>Reading</th>
</tr>
</thead>
<tbody>
<tr>
<td>ITBS GE Difference</td>
<td>+.31</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Grade 2 Year 3 Science</th>
<th>Reading</th>
</tr>
</thead>
<tbody>
<tr>
<td>ITBS GE Difference</td>
<td>+.42</td>
</tr>
</tbody>
</table>

Transfer Effects

<table>
<thead>
<tr>
<th>Grade 3 Year 3 Science</th>
<th>Reading</th>
</tr>
</thead>
<tbody>
<tr>
<td>ITBS GE Difference</td>
<td>+.42</td>
</tr>
</tbody>
</table>

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)


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!