Meeting the Reading Challenges of Science Textbooks in the Primary Grades

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Four teachers in an urban elementary school support primary students’ comprehension of challenging topics, vocabulary, and text structure in their assigned science books.

The four primary-grade teachers featured in this article are like many other teachers in public and private schools across the United States—they use science textbooks for science reading instruction. Textbook-based instruction in elementary school science has been a curricular mainstay in American education, but it presents teachers with significant challenges.

Frey and Fisher (2007) defined textbooks as compendiums of curriculum resources and materials for teachers and students. Designed by commercial publishers for use exclusively in schools, these materials guide instruction and provide students with nonfiction texts gauged toward reading and interest levels. The teacher’s edition includes all materials in the student textbook, plus guidelines to differentiate instruction for English learners, struggling readers, or students with learning disabilities. Teachers are also provided with assessment guides and tools, reproducible worksheets, and additional multimedia materials (e.g., CD-ROMs, audiotapes).

While textbooks provide a systematic introduction to content area information (Moore, Moore, Cunningham, & Cunningham, 1986; Moss, 1991) and frame what gets taught, and how, they

- Commonly use difficult technical vocabulary and abstract concepts, especially in science (Yager, 1983)
- Present a superficial treatment of topics delivered in a dry, uninteresting manner (Tyson & Woodward, 1989; Tyson-Bernstein, 1988)
- Lack organization and a user-friendly style that promotes reading with understanding (Chambliss, 1994; Kantor, Anderson, & Armbruster, 1983)

Even with these challenges, students must learn to read content area textbooks fluently to be successful academically.

Students in primary grades are particularly challenged by the use of science textbooks. Not only do they have to make meaning from textbooks that are hard to read and understand, but they are often not provided opportunities to read nonfiction texts on their own, rendering this genre unfamiliar and more challenging.

The shift in reading instructional approaches away from basal reading to literature-based programs has increased young students’ access to mostly fiction texts. The use of informational texts in primary grades is less common and in some settings has been limited to a few minutes a day (Duke, 2000).

Due to the proliferation of nonfiction texts in upper elementary grades and beyond, there is a push to integrate more content area instruction and use of nonfiction texts in younger grades (e.g., Duke & Bennett-Armistead, 2003; Duke, 2004; Frey & Fisher, 2007). While schools are making greater efforts to include nonfiction texts (e.g., trade books, magazines, websites) during reading instruction, nonfiction textbooks still predominate in content area subjects. To support content area learning, teachers must find ways to make textbook reading more meaningful for young students.
The Study

This article highlights the work of four primary-grade teachers at an innovative U.S. urban public school, P.S. 57, the James Weldon Johnson Leadership Academy, located in East Harlem, New York. These teachers engaged their respective students in science reading using textbooks, but each teacher took a different pedagogical approach that resulted in high student engagement and active learning while reading, writing, and discussing information in the textbooks.

These teachers volunteered for this qualitative naturalistic research study (Lincoln & Guba, 1985), which involved hour-long weekly classroom observations while nonfiction reading was taught, over a period of five months. As the researcher, I sat quietly off to the side to be minimally intrusive (Corsaro, 1981) while recording the observations with field notes (Sanjek, 1990). Teachers were intermittently interviewed about their curricular focus, goals, use of materials, perspectives on teaching nonfiction reading and writing, and perspectives on students as science and literacy learners. Lesson plans, excerpts of the curriculum materials, blank student worksheets, and completed samples of students’ written work were collected weekly, as relevant.

Data were analyzed holistically, and data were interrogated from a perspective that language is a social practice (Gee, 1999, 2004) and that academic language in science is a specific language register (Cummins, 2000; Gee, 2004; Krashen, 1993; Lemke, 1990) valued and promoted in school. It involved an iterative process of reading and rereading written records of participants’ language use during the lessons, along with curriculum materials and students’ work samples, to identify themes related to aspects of situated language use and classroom discourse (oral and written) that promoted academic learning and access to academic language in science.

This article presents five challenges of using science textbooks, with examples of classroom discourse and teacher–student interactions. These examples are intended to show a balanced description of a range of instructional strategies teachers employed during nonfiction reading and related writing lessons, without trying to reconstruct the whole story of what occurred week to week in each classroom, over the course of the study. This article frames the challenges of teaching students to read and make sense of information from nonfiction textbooks with pedagogical strategies teachers employed to address these challenges.

Challenge 1: Difficult Technical Vocabulary

Science texts are often dense with difficult technical vocabulary and abstract concepts (Yager, 1983). Understanding specialized terms and concepts is essential for meaningful and engaged reading.

Research-Based Strategies. When teaching children to understand unfamiliar or difficult vocabulary, focus on increasing reading comprehension (Harvey, 1998). Help students use their background knowledge and apply reading strategies such as rereading, examining boldface words, and attending to context clues (Blachowicz & Fisher, 2006).

Classroom Discourse and Teacher–Student Interactions. Mrs. Counts, special educator and veteran teacher of 19 years, taught third graders with learning disabilities in an early morning small-group academic intervention model. In Academic Intervention Services (AIS), six to eight of the academically neediest students from several third-grade classes met in the same small group for the entire academic year. Mrs. Counts offered explicit instruction on understanding vocabulary and science knowledge through a focus on the reader’s comprehension strategies (Englert & Mariage, 1991; Harvey, 1998).

Explicit attention to word-solving strategies while reading is important for disabled (Englert & Mariage, 1991) and nondisabled readers. In the following example, Mrs. Counts modeled and demonstrated how to use context clues to learn the meaning of a new
The text prompted readers to apply reading strategies. It directed students to “Monitor & Clarify: Name two ways that plants protect themselves. Remember, you can reread the text and use the chart to figure out the answers. Make a note on your graphic organizer about any fix-up strategies you used” (Gambrell & Wortman, 2008, p. 2).

Instead of asking students to start reading to find the answers right away, Mrs. Counts referred to part of her teaching point from her lesson plan:

Teach: You have all read “Plants Fight Back!” I read it as well. There were some sections on page 2 where I had to stop and monitor my reading because there was so much information. Take a look at page 2 of the article. Look at the section entitled “Secrets to Survival.” There was a lot of information about how plants protect themselves here. Let’s monitor our reading to make sure that we got all of the important information. Let’s see if we can use a fix-up strategy to find two ways which plants protect themselves. (Mrs. Counts’s lesson plan, January 29)

Before teaching, she asked, “What strategies could you use to help you name at least two ways that plants protect themselves?” Students named several reading strategies:

1. Think about it
2. Skim the passage
3. Reread
4. Look at captions, labels, charts
5. Read on and go back

Then, she continued teaching. “When I look at the fix-up strategies, I think that the reread strategy fits well here. Let’s reread this section to see if we can clarify two ways in which plants protect themselves.” Students read individual copies of the excerpted article from the science textbook for several minutes, making note to themselves about what reading strategies they used to help figure out unknown words. As they shared their strategies, one boy explained that he skimmed the text, saw the word protection, and went to read that particular section. Using an interactive whiteboard to project a copy of the text on a large screen, Mrs. Counts highlighted the vocabulary word (e.g., protection) in yellow and also highlighted the previous sentence (e.g., “Acacia trees in Africa really know how to defend themselves.”). Mrs. Counts directed students’ attention to the screen and read the text aloud, providing additional visual and oral language support. She asked students to figure out the meaning of the word protection from the previous sentence and from the clues in the sentence that followed (e.g., “The long, sharp thorns on their branches are their first form of protection.”). After discussing the meaning of protection (e.g., how trees defend themselves or keep safe from animals), Mrs. Counts reread the sentence, this time verbally emphasizing the word first: “If thorns are the first form of protection for the trees, we have to read on to find out their second form of protection.” They read on as a class, and, after a brief discussion, the students surmised that acacia trees grow thorns and produce poisonous leaves to protect, or defend, themselves from animals that want to eat their leaves.
Attention to keywords that show sequence, and to highlighted vocabulary words (e.g., boldface, italics) and their definition, is essential for making meaning (Blachowicz & Fisher, 2006), but using technology to project a large visual image of the text made it stand out and provided an additional level of scaffolding that helped students focus. Learning-disabled students benefit from explicit attention and a methodical approach to applying reading strategies as they read on their own, and with the teacher, to support meaning making (Englert & Mariage, 1991). Most important, they were prompted to think consciously about the reading strategies they applied to help them make sense of the text (Englert & Mariage, 1991).

**Challenge 2: Dense Presentation of Concepts**

Nonfiction textbooks present limited information about many topics, and densely pack in concepts (Tyson & Woodward, 1989; Tyson-Bernstein, 1988). Students may learn only superficial information and gain limited understanding.

**Research-Based Strategies.** To help students unpack the dense presentation of concepts in nonfiction textbooks, ask them to discuss the information the author conveys and what they are learning (Routman, 2000). When they talk about what they are learning, students have more opportunities to synthesize what they know with what they are learning from listening to the text read aloud—and comprehension improves.

**Classroom Discourse and Teacher–Student Interactions.** Like Mrs. Counts, first-grade teacher Ms. Tsveer, who had been teaching primary grades for five years, read aloud from an enlarged text, but Ms. Tsveer used a Big Book version of the teacher’s guide of the science textbook. The textbook was too difficult for most students to read on their own, so Ms. Tsveer engaged in shared reading and led whole-class discussions to address concepts about seasons.

The following example is from a unit on the four seasons. Ms. Tsveer previously read chapters about spring and summer, and was preparing to introduce the season of autumn in this lesson. Before reading about autumn, she prompted students to review what they knew about spring and summer using a framework provided by the textbook. (Student names are pseudonyms.)

Ms. Tsveer: One thing the author writes about is animals and how animals take care of themselves and find food in the spring and summer. What else does the author talk about?

Saquan: So when it’s raining and the sun is out, it’s a sun shower.

[Ms. Tsveer redirected students’ thinking to address larger concepts, not just details about the weather.]

Ms. Tsveer: Yes, but the author focuses on headings, just like we wrote in our nonfiction books. So in the spring it talks about the kind of weather it is. It’s raining, and it starts to get warm. They talk about the plants. What happens to the plants in the summer and in the spring? What happens to the animals in the summer and spring? What do we know about the weather in spring?

Christian: It’s mostly raining.

Maisha: In spring, they wake up from hibernation.

Ms. Tsveer: What about the plants in spring?

Joel: Plants start to grow.

Ms. Tsveer: What do we know about the weather in summer?

Jahida: It’s hot.

Ms. Tsveer: What happens to the plants in the summer?

Jahida: The plants grow even bigger.

Ms. Tsveer: What do we know about the animals in the summer?

Evelyn: In the summer, it’s hot, and I always hear chirping outside my window.

Ms. Tsveer: There are two things that the author wrote about animals in the summer. What’s one thing the animals do to stay cool in the summer?

Alex: The animals, they come out to look for food.

Ms. Tsveer: How do they stay cool?
teacher Mrs. Miah, a 10-year veteran, goes beyond the information in the text, using video and additional Internet resources to provide supplemental materials that students used to express their learning. First, she conducted a whole-class guided reading lesson in which students read about the uses of electricity and why people have to find other sources of fuel. Mrs. Miah directed students’ attention to specific sections of the text. The text was brief, so she quickly focused students’ attention through discussion, directed silent reading, and answering brief questions in their notebooks.

Mrs. Miah: In this city, we use a lot of electricity. Can you name some ways we use electricity?

Students: [Several students contributed one answer each.] Computer, fan, cable box, lamp, television—

Mrs. Miah: Let’s read to find out more. Read from the main passage. [Students read silently for several minutes before answering other questions.] On page 452, that’s a power company. It produces electricity. But making that electricity, what is that called?

Tameika: A generator.

Mrs. Miah: How do I get electricity in my home? Electricity plants produce this energy; they are generators and send it across wires. Look at the picture of prairie grass. It is used to make the fuel...it says here in the text the company uses switch grass to make fuel. What kind of natural resource is coal?

Yelka: Nonrenewable. Can’t replace them, and it takes years.

Mrs. Miah: Who is trying to produce a new form of energy? Who is trying to produce a new source of energy, and how do you know? Turn and talk. [Students turned to their discussion partners (in pairs and triads) and talked for about three minutes.] Okay, scientists face forward. What is this company trying to do?

Isha: Produce energy.

Mrs. Miah: The company is using switch grass. What kind of energy do they want to create
that’s gonna help our world? Look in your text.

[Students reviewed the text before answering.]

Michael: The company is trying to use a fuel with switch grass and coal.

Mrs. Miah: They are helping us save coal, because coal and oil are nonrenewable sources. What’s another way you can create electricity?

Mrs. Miah and the students continued to discuss the information in the text for several minutes. The students read targeted sections of the textbook silently on their own to gain information and to check for and reinforce understanding. These third graders were challenged to skim the headings and find the sections that pertained to topics the teacher addressed, then read to determine the most important information (Harvey, 1998). They were asked to summarize the section and answer two of five written comprehension questions from their textbooks in their notebooks.

To add depth of knowledge, Mrs. Miah displayed on the interactive whiteboard a video on conserving resources, “Learning About Natural Resources” (Discovery Education, unitedstreaming.com). She expanded the breadth and depth of information provided in the textbook through this multimedia resource, adding to the body of information students could consider as they formulated their understanding of how to conserve energy and why they should be interested in conserving Earth’s resources.

After watching the video and discussing what they learned, Mrs. Miah asked the students to design a poster that would explain to family members how to conserve energy at home. While the textbook presented information on how to conserve, it did not address the economic and political aspects of the overconsumption of resources and the dangers of polluting the environment. The video and Internet resources supplemented the information from the textbooks. Students used their ideas from the hand-drawn posters to create digital images and text in PowerPoint presentations (see Figure 1), and these slides were entered into a student writing contest sponsored by the local gas company.

Challenge 4: Information Delivered in a Dry, Uninteresting Manner

Because textbooks are written concisely, in a “matter of fact” tone, and state information as objective facts, the language is “straightforward” and critiqued as “boring” (Sewall, 1988).

Research-Based Strategies. Dramatize the text (McMaster, 1998) to act out its meaning, to breathe life into the language and encourage students to make text-to-self and text-to-world connections.

Classroom Discourse and Teacher–Student Interactions. Ms. Wallace, a vibrant, expressive second-grade general education teacher in her second year of teaching, turned the “boring” text into a resource teaming with possibilities for connections to real-world phenomena. While teaching beginning concepts of force (push and pull), she selected one student at a time to read aloud small sections of the textbook. After each section, she engaged the class in question-and-answer sessions to recall and interpret what was just read. She elaborated on the text, prompting students to make text-to-self connections and engage in comprehension checks through literal understanding, summarizing, and paraphrasing. Most important, Ms. Wallace got students out of their seats to dramatize what they read.

After asking a volunteer student to read the section in the textbook on force, Ms. Wallace paraphrased the main idea aloud. Then she asked students to stand and demonstrate pull and push. “When you pull something, it comes toward you. When you push something, it moves away from you,” she explained. “When you push or pull something, you are using force.”
Figure 1
Sample Student-Created PowerPoint Slides

CHANGE LIGHTS
You can use energy savers. It lasts longer than the regular light bulbs.

DIFFERENT WAYS TO GO TO SCHOOL
You should walk to school because if you use a car or bus you’re polluting the air.

USE BIKES INSTEAD OF CARS
Use bikes instead of cars because it does not pollute the air.
Cars use nonrenewable resources like oil. Please stop using cars. You can use a bike.
While students remained seated, they spent two minutes demonstrating pushing and pulling with their arms (both arms pushing outward from the shoulders, both arms grabbing air and pulling it toward them). Then they stood up and pushed and pulled their chairs for one minute. They sat down again, pushed and pulled their textbooks, and discussed how force was used to move objects.

A boy read the next section. The main message of the reading was that if you use more force, things will move faster and farther. Ms. Wallace demonstrated this with kicking and integrated the researcher into the example:

If Professor Bryce here threw you the ball, and you kicked it, how would it move? If you kicked it softly, how would it move? Would it move fast? Or go far? What about if you gave it a strong kick? How would it move? Would it move faster and farther?

She urged students to kick their imaginary balls. She instructed them to stand and kick “the ball” hard. She instructed them to “use all your force!” and then enlisted the researcher in throwing them an imaginary ball. The students and Ms. Wallace herself kicked the imaginary ball. It was quite hilarious to see 20 legs flying repeatedly in the air. There were no accidents, because she made sure students had sufficient room to move. After the dramatization, Ms. Wallace summarized, “If you want something to go far and fast, you have to use all your…” and most students responded in unison, “force!”

**Challenge 5: Lack of Organization and Structural Style**

Textbooks have been critiqued for a lack of organization and reader-friendly style that promotes reading with understanding (Chambliss, 1994; Kantor, Anderson, & Armbruster, 1983).

**Research-Based Strategies.** Use the textual and structural features of the text to prepare students for what they are about to learn (Cook & Mayer, 1988). Bring students’ attention to the organization and structural elements provided to preview the text before reading, set a reading purpose, and access background knowledge that may help establish relevant connections to information in the text.

**Classroom Discourse and Teacher–Student Interactions.** Curriculum materials sampled in this study (e.g., Gambrell & Wortman, 2008; Harcourt, 2008) have used these textual and organizational features. Textbook publishers were sure to include bold headings and subheadings, real photos, guiding questions, review questions, highlighted vocabulary, pictures with captions, and suggested ideas for inquiry activities. The bold colors and detailed, interesting photographs provided both a practical and conceptual hook for students, rendering the text quite engaging, structurally.

All four teachers in this study pointed out textual features to support students’ nonfiction reading and sense making while they engaged students interactively in reading aloud or silently. Mrs. Counts, the special educator working with a small group of third graders in the AIS morning session, read aloud to students from digital versions of the text projected on the whiteboard, modeling fluent reading and attention to textual features. Ms. Tsveer, the first-grade teacher, read aloud from a Big Book version of the textbook while pointing out the repetitive organizational patterns of the texts that addressed each season across several chapters. Ms. Wallace, the second-grade teacher, asked students to read aloud while attending to textual features such as headings and photos, to aid understanding. Mrs. Miah, the third-grade classroom teacher, directed students to use the textual and organizational features on their own during guided reading instruction, where they previewed, skimmed, and read silently to gain information, which was assessed through literal and inferential comprehension questions. The challenge of navigating through the textual and organizational features of the text was reduced by teachers’ explicit attention to these elements of text and the publishers’ use of effective layout and design.

**Effective Strategies for Overcoming Challenges of Textbook-Based Science Reading**

Textbook publishers have been criticized for producing texts that are quite challenging for young readers. Textbooks use difficult vocabulary, condense information about many topics, present a superficial view of information, use language that is uninteresting, and lack organizational structure that promotes reading comprehension. Armbruster and Anderson
(1988) observed that publishing companies have responded to these critiques by increasing their use of textual features to assist with learning technical terms (e.g., boldfaced words, definition of the word within the body of the text, including a glossary) and bolstering interest (e.g., using real photographs of animals, plants, and diverse people, showing people in contemporary settings engaging in activities pertaining to the topics presented in the texts).

It is imperative that [teachers] focus intently on addressing the challenges of textbook reading by employing strategies that support reading comprehension and reader reflection.

Teachers in this study engaged primary-grade learners (e.g., general education students and students with diagnosed learning disabilities) in listening to, reading, and talking about the science textbook. They showed students how to apply words-solving strategies to figure out the meaning of key vocabulary terms. They pointed out the structural and organizational features of the text to support student awareness of how topics were presented. Teachers also found innovative ways to use technology to enhance reading experiences and added drama as an interpretive and expressive tool for making sense of nonfiction texts.

Several key findings emerged from this study:

1. Teachers fostered a meaning-based approach to reading nonfiction textbooks that promoted thoughtful, reflective reading. With the gradual release of responsibility model (Pearson & Gallagher, 1983)—which integrates reading aloud, guided reading, and independent practice, coupled with feedback—students were encouraged to take ownership of their learning as they gained competence and confidence as readers. The teacher’s role in textbook-based science reading was to prepare and guide readers to focus on pertinent textual features and provide several reading strategies that supported making sense of content.

2. Students benefited from a focus on their reading strategies as teachers helped them to articulate what strategies they found helpful (Harvey, 1998) for learning with nonfiction textbooks. Students’ awareness of their own reading strategies empowered them to consciously select ways to engage meaningfully with textbooks, while nudging them to learn more about the textual demands and concepts explored in the text.

3. Teachers increased learning opportunities for students as they used a multimodal approach to reading science textbooks that built on students’ multiple intelligences (Armstrong, 2003; Gardner, 1999), including art and movement. Using the interpretive and expressive forms of language and nonprint texts enhanced visual, spatial, and bodily kinesthetic intelligence and meaning-making possibilities, rendering learning fun and interesting.

4. Using technology (e.g., interactive whiteboards) to create an enlarged digital or projected image of the text supported student access to the language and meaning in science textbooks. An enlarged version of the text fostered engagement and attentiveness. The interactive technology boosted student awareness of textual features, specialized use of language, and structural supports that developed reading comprehension.

5. Students enhanced their learning by creating authentic literacy projects after reading nonfiction science textbooks. In this study, students created PowerPoint slides to share their knowledge of how to conserve more of the earth’s resources. They read the science textbook, other books, and Internet sources, then selectively tailored their advice about how to best save energy to a community-based audience (e.g., the local gas company, families). What resulted are
needed to ensure that primary-grade learners benefit from a recognition that textbooks are potentially rich resources for learning about the world. Teaching students how to learn from textbooks requires explicit attention simultaneously to organization, structure, and content.

Teachers must use the features of textbooks, such as the table of contents, headings and subheadings, and other textual features (e.g., boldface words, photographs with captions, diagrams and labels), as a lead-in to content area learning and a focus on academic language development. Reading and discussing those textual features, while attending to specialized vocabulary, preview questions, information presented in the passages, and comprehension review tasks, prepare young readers to learn more content and meet the language demands presented in textbooks.

Supplementing textbooks with other nonfiction texts (e.g., magazines, trade books, nonfiction websites for children) will enrich the curriculum (Moss, 1991, 2005; Routman, 2000; Sewall, 1988), but teachers must consciously provide guidance and support for mining the textbooks for content area understanding.

The four primary-grade teachers in this study defied those views and integrated science reading instruction, using textbooks in ways that challenged young students to read for understanding. They believed the textbooks served as a resource, not a predetermined curriculum, and therefore acted on their perceived academic freedom to select chapters and implement comprehension strategies to address content they deemed relevant, given their instructional goals, students’ needs, and perceived constraints related to time and instructional value.

Conclusion
As the textbook industry continues to thrive (Manzo, 1998; Ness, 2005), a meaning-based pedagogy is needed to ensure that primary-grade learners benefit from a recognition that textbooks are potentially rich resources for learning about the world. Teaching students how to learn from textbooks requires explicit attention simultaneously to organization, structure, and content.

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The four primary-grade teachers in this study used various approaches to support student learning of science through textbook-based reading. In all classes, the teachers and students discussed the information at length and read aloud sections of the text. Teachers pointed out the pattern of ideas

**Take ACTION!**

1. Teach the features of nonfiction textbooks. Model and explain how to gain information from the title, headings, guiding questions, pictures and captions, diagrams, and special vocabulary words. Preview the chapters using these features.

2. Before reading textbooks, encourage primary-grade students to articulate reading strategies (e.g., skim, read on and go back, read captions, labels and charts) that will help them make sense of what they read. After reading, check for comprehension.

3. Focus on meaning first. Read aloud (teacher or students) challenging sections of the textbook, and discuss the meaning with the class. Help young students make relevant text-to-self and text-to-text connections.

4. Dramatize concepts by acting out the information in the textbook to express meaning and deepen student understanding.

5. Use technology meaningfully. Project enlarged digital images of the textbook to focus students on textual features. Use videos and Internet-based resources to supplement the information provided in the textbooks.

6. Create purposeful, authentic writing that responds to what students read in the textbooks. Encourage students to reflect on the meaning they construct by relating the content to real-world issues. Incorporate technology in writing by producing digital texts using images and print.
introduced in the textbook and helped students summarize and synthesize what they were learning. In one class, students used their bodies to demonstrate movement and enhance their understanding of science concepts. Teachers also used technology to gain access to additional nonfiction information; provide students with an interactive experience, which served to motivate and focus them while reading; and support them in creating their own digital texts in response to their reading.

As Routman (2000) so aptly stated, “Being able to skim, scan, interpret, summarize, visualize, compare, draw thoughtful conclusions, and understand nonfiction texts is critical to becoming a well educated, thoughtful citizen” (p. 461). Teaching students to learn from nonfiction textbooks teaches them how to learn for life (Moss, 2005).

References


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MORE TO EXPLORE

**IRA Books**

- Fun-tastic Activities for Differentiating Comprehension Instruction, Grades 2–6 by Sandra K. Athans and Denise Ashe Devine

**IRA Journal Articles**

- “A Framework for Supporting Scientific Language in Primary Grades” by Sheryl L. Honig, The Reading Teacher, September 2010
- “Improving Reading in a Middle School Science Classroom” by Rich Radcliffe, David Caverly, James Hand, and Deanne Franke, Journal of Adolescent & Adult Literacy, February 2008
- “Introducing Science Concepts to Primary Students Through Read-Alouds: Interactions and Multiple Texts Make the Difference” by Natalie Heisey and Linda Kucan, The Reading Teacher, May 2010
- “Moving Beyond the Page in Content Area Literacy: Comprehension Instruction for Multimodal Texts in Science” by Amy Alexandra Wilson, The Reading Teacher, October 2008