Teaching Inquiry with Science Fiction

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Overview

As a literacy teacher at Daroff in West Philadelphia for three years, two of which as a literacy teacher of students from kindergarten through eighth grade I recognize many students have difficulty with concept knowledge. The student population is over eight hundred the building is split into two schools K-5 (lower) and 6-8 upper school. Although many of our students come from low-income families there is potential for greatness at Daroff. Our students live and travel to and from school in a very depressed high violent crime area. The school is predominately African American. I support teachers with classroom management professional development as well as curriculum and instruction in literacy.

After careful review of our current data from Terra Nova, Benchmark, and PSSA students at Daroff continue to demonstrate weaknesses in content area subjects. According to recent research, successful literacy programs supply students with comprehension strategies that engage them in reading complex text. Science fiction holds virtually untapped potential as a means of teaching students critical reading. This unit will consist of helping teachers integrate reading and writing into their science curriculum. Students will use text and activities to explore scientific phenomena to bridge the gap between literacy and inquiry. The key element for this unit is helping students make concept connections to informational text.

Students are allowed to share their personal knowledge of science as they take responsibility of what they want to know and apply to observable events and understand that conceptual knowledge is always changing. Students will increase their experiences and intellectual competence through active learning. In support of this, they will connect science content with the processes of science and develop a deeper understanding of the

science process with scientific knowledge, reasoning, and critical thinking. Exposure to science fiction and informational text will allow them an opportunity to develop and increase their inventory of writing strategies.

In this unit, students are engaged in the strategies used by good readers. The use of science fiction text within the curriculum can encourage teachers to help their students develop a questing questioning, meaning-making stance. The subject area of this unit is science. The goal is to get our most reluctant reader hooked on exploring the nature of inquiry. The untapped potential of science fiction is a method of teaching students to read critically.

Rationale

Many teachers put too much emphasis on facts and not enough on science for thinking. I would like to demonstrate to the teachers of science how to utilize inquiry as a teaching strategy. Dewey's model called for students to be actively involved and the teacher as facilitator and guide. As early as 1916 Dewey wanted students instructed so they could add to their personal knowledge of science. Like Dewey, I want students to take responsibility of what they want to know and apply it to observable events. Although Dewey's model originated at the secondary level, his interpretation of reflective thinking is also applicable at the primary, elementary, and middle year's students. Dewey believed that scientific inquiry should relate to student's experiences and intellectual capability, therefore allowing students to be active learners.

The material in this unit will permit students to rethink worlds through words. Science fiction helps the reader to take apart layers of meaning and ask questions within their current reality. It will be used to develop a theme or as a supplementary piece to other text such as a textbook. Additionally science fiction will be linked to interdisciplinary research projects. The approach is to use science fiction to promote discussions that teach inquiry about problems, data and the role of technology. Students will learn about the integration of scientific inquiry as they explore the scientific content in individual texts. The goal is to teach science within the context of the literacy classroom. This will allow teachers to show the interrelationship between both disciplines. The target audience for this unit is for fifth through eighth grade students in a science or literacy class. Teachers expose students to explicit instruction in content literacy language skills and reading strategies. Important aspects of science introduce students to a deeper understanding of concepts and procedures.

It is important to expose children at every age to informational and narrative text. Recent research has paid considerable attention to the absence of informational texts in

the reading diets of children who are mostly exposed to narrative texts (Duke 2000). This research founded on the premise that if children are exposed to narrative text only they miss many opportunities of the wide range of text structures that informational texts provide such as cause/effect, compare/contrast, problem/solution, listing, and a chronology of events. Exposure to both types of text will allow children to develop an increased inventory of writing strategies.

There have been long-term efforts to improve or reform K-12 science. The American Association for the Advancement of Science identified what students should know and be able to do when they graduate at the end of 12th grade. Science for All Americans (Rutherford & Ahlgren, 1989) defined scientific literacy and the Benchmarks for Scientific Literacy organized the topics by grade level. Science fiction and informational text will expose and allow students opportunities to increase their inventory of writing strategies and focus on the recommendations from Project 2061 that result in the students ability to:

1. begin with questions about nature
2. engage students actively
3. concentrate on the collection and use of evidence
4. use a team approach

Teachers of science demonstrate science content and facilitate activities that engage students toward a level of higher order thinking with scientific knowledge, reasoning, and critical thinking. As a result, students attain concept knowledge of observable events.

Science inquiry involves cognitive abilities that develop methods to answer questions as well as teaching strategies to learn about scientific inquiry. Instruction can provide a rich context to build language skills. As students navigate through text and activities, they will compare their thinking with others and communicate ideas with words and graphics. The unit will permit teachers of science and literacy to engage students with inquiry using books for answers and hands on activity to explore scientific phenomena that make reading an important part of the process. Teachers model critical thinking using read aloud or shared reading. The use of science fiction and informational text can take a child beyond his/her home environment and close the gap the student who may not have had an opportunity and access to real world experiences. Additionally they question the ideas they are learning and write in the content area. The research on teaching inquiry with science fiction and informational text suggests the following:

1. find science engaging
2. stretch their capacities to express, digest, and comment on ideas
3. acquire reading strategies
4. build vocabulary and their ability to use complex sentence structure
5. communicate in different genres and forms
6. know how and when to use various ways of representing idea

7. students learn to question and are critical of texts (Educational Leadership/December 2006/January 2007)
8.

The expectation is that students will use reading, writing and oral language to intersect literacy with inquiry science.

Activity Objective

- Students will frame their own questions participating in peer group discussions, making connections between concepts, and the act of writing
- Students will write to clarify learning, remember and generate authentic understanding
- Student will describe their understanding of how to construct a knowledge claim
- Students will write a textbook explanation for peer grade students
- Students will communicate and defend the results of their investigations
- Use one or more of the five senses to gather information
- Gather information about observations and measurements in a systematic
- Develop ideas based on observations
- State specific information about on object or phenomena based on experience
- Predict results that can be used to test assumptions in a model
- Distinguish between system inputs system processes and system outputs and feedback
- Explain how certain questions can be answered through scientific inquiry and/or technological design
- Use evidence, such as observations or experimental results, to support inferences about a relationship
- Given a model showing simple cause and effect relationships in a natural system, predict results that can be used to test assumptions in the model
- Use evidence observations, or a variety of scales to describe relationships.
- Compare and contrast different types of change
- Describe repeating structure patterns or periodic patterns
- Explain and apply scientific knowledge

Learning Objective

- Students will learn unit concepts
- Science Writing Heuristic will promote a deeper understanding of science learning
- Science Writing Heuristic will promote thinking and a higher level of learning
- Science Writing Heuristic will promote deeper learning including meaningful learning versus memorization
- Students will develop a sound understanding of the purpose of a knowledge in science
- Students will understand the value of the textbook writing task for their own improved understanding
- Students will recognize the relationship between the question and the type of evidence required to answer the question and make the claim

Strategies

There are several models for combining literacy with Inquiry-Based Science. The one utilized in the unit comes from one developed by Romance and Vitale an integrated model called Science IDEAS (http://scienceideas.org/). This model allows traditional language arts in upper elementary and replaces it with challenging content-area texts. Students are encouraged to think deeply about the topics as teachers integrate reading comprehension instruction and writing. Teachers guide students in noticing text structure, learning new vocabulary, identifying main ideas, asking questions, and making inferences. The effectiveness of this model can increase levels of student achievement on nationally norm science test and reading comprehension. Another integrated instructional approach to science and literacy is Guided Inquiry supporting Multiple Literacy. As teachers guide students' in sustained inquiry on specific topics centering on physical phenomena using investigations, both teacher and students read, ask questions, collect and analyze data from text. Students increase their science content knowledge and scientific reasoning.

A learner is scientifically literate when they examine data to support a claim. This is an important skill for two reasons, first understanding the work of scientists, and learning how to learn science to generate new scientific ideas. The Science Writing Heuristic developed by two researchers will help to promote a mode of thinking in the science classroom. In theory, the Science Writing Heuristic enables students to make a connection between claims and evidence. The Science Writing Heuristic strategy is a series of activities to guide teachers and students in thinking and writing. It is a two-part model for teachers and students. The strategy is a tool to facilitate student understanding of science concepts of how they come to know scientific understanding (metacognition).

Teachers use the Science Writing Heuristic question activities to teach students to write about and discuss their understandings of hands on activities and concepts presented in text. Teachers develop a student centered teaching approach to encourage students to take more ownership over the procedures and outcomes of practical activities. This strategy helps students improve conceptual and meta-cognitive understanding.

Portions of the strategy require students to set up their own questions for investigation in class or group discussion. The teacher helps to guide students in question formulation and a final project a research paper summarizes the results of the investigation. Some students can write as their summary project a textbook explanation for their peers using a list of topics suggested by their teacher. Grade level students provide feedback from this project. Students then compose final drafts of their textbook explanations. Students can also complete a pre and posttest of multiple choice and short answer questions to measure conceptual understanding. This strategy will enable students to develop a deeper understanding of hands on activities and improve scientific literacy. As students reformulate conceptual understandings in writing, they build on their ability to learn and understand science.

Lesson Plan 1 (up to three weeks)

Writing and Scientific Literacy

Objective(s)

- Students will recognize the relationship between the question and the type of evidence required to answer the question and make the claim
- Science Writing Heuristic will promote a deeper understanding of science learning
- Science Writing Heuristic will promote thinking and a higher level of learning
- Science Writing Heuristic will promote deeper learning including meaningful learning versus
- Students will frame their own questions participating in peer group discussions, making connections between concepts, and the act of writing
- Students will write to clarify learning, remember and generate authentic understanding

- Student will describe their understanding of how to construct a knowledge claim
- Students will communicate and defend the results of their investigations
- Gather information about observations and measurements in a systematic
- Develop ideas based on observations
- Predict results that can be used to test assumptions in a model
- Use evidence, such as observations or experimental results, to support inferences about a relationship

Strategy – Science Writing Heuristic (SWH), Guided Inquiry supporting Multiple Literacy's (GIsML), Book Talks, Cubing

Material: notebook, Handout 1.1, Handout 1.2, Handout 1.3, The Science IDEAS Web http:/scienceideas.org, Overview Landforms (http://www.fossweb.com/modules3-6/Landforms/index.html), Robert A. Heinlein "All You Zombies-----", Ender's Game

Procedure – Engage students in collaborative thinking and reasoning to make students' ideas the anchor for discussions, use Share Reading sessions (Robert A. Heinlein "All You Zombies-----"/ Ender's Game) to give students opportunities to engage in their own hands-on investigations and teachers an opportunity to model and coach strategies.
Assessment – Pretest and Posttest, consisting of multiple-choice questions and three essay questions to measure conceptual understanding

Handout 1.1

The Science Writing Heuristic Teacher Template

1. Explorations of pre-instruction provide understanding through individual or group concept mapping.
2. Pre-laboratory activities, including writing, make observations, brainstorming, and posing questions.
3. Students' participation in activity
4. Negotiation phase I-writing personal meanings for activity (writing notebook)
5. Negotiation phase II-sharing and comparing data interpretations in small groups (making a group chart)
6. Negotiation phase III-comparing science ideas to textbooks or other printed resources (writing group notes in response to focus questions)
7. Negotiation phase VI-individual reflection and writing (writing a report or textbook explanation)
8. Exploration of post-instruction understanding through concept mapping

Handout 1.2

Notebook writing activity: Use the guiding questions to help you develop your own questions of interest. Document how you set up investigations, represent data you have collected, and develop explanations for the phenomena you are investigating. You can also use graphic elements such as drawings, tables, and graphs into your writing.

What are the ideas and questions you bring to the study of a phenomenon?

What have you done in the course of your inquiry?

What are your observations?

What are your claims?

What are the claims of the author?

What evidence do you have to support your claims?

What evidence do others have to support their claims?

Read others ideas or entries to compare their thinking, and reflect on how your ideas have changed.

Handout 1.3

The Science Writing Heuristic Student Template

Beginning ideas-What are my questions?

Tests/experiments-What did I do?

Observations-What did I see?

Claims-What can I claim?

Evidence-How do I know? Why am I making these claims?

Reading-How do my ideas compare with other ideas?

Reflection-How have my ideas changed?

Lesson Plan 2 (up to three weeks)

Reading Strategy Instruction

Objective(s)

- Given a model showing simple cause and effect relationships in a natural system, predict results that can be used to test assumptions in the model
- Use evidence observations, or a variety of scales to describe relationships.
- Compare and contrast different types of change
- Describe repeating structure patterns or periodic patterns
- Explain and apply scientific knowledge
- Students will develop a sound understanding of the purpose of a knowledge in science

Strategy: Read Aloud, Shared Reading, Charting questions (categorizing questions), K-W-L, Think-Pair-Share, two column note taking and paraphrasing

Material: Handout 1.4, (Nonfiction, Fiction**),** Wonder books (daily opportunities to explore thoughts, and questions in writing), Handout 1.5, (Daily Response Sheet) Handout 1.6 (The Major Point Interview), Handout 1.7, (Reading aloud discussion questions)

Procedure – Teachers provide direct explanation, modeling the research process and demonstrate the importance of engaging in nonfiction inquiry. Model the key ingredient of instruction. Go through the inquiry process with demonstrations and guided practice allowing students several opportunities to apply the strategy independently. Students get

opportunities to apply targeted reading strategies of their choice with independent reading (Reading Workshop – Handout 1.4). Guide students in sustained inquiry about specific topics. They choose a book they are interested in collect and analyze data as they read for twenty minutes. The teacher and students read discuss ideas and ask questions about specially written texts.

Handout 1.4

Annotated Bibliography for students

Barr, L. 2003. **Volcano! When a Mountain Explodes**. Capstone Press. (Discusses what causes volcanic eruptions, the three main types of volcanoes, early myths about volcanoes, and the environmental impact of eruptions.)

Card, O.S. 1994. **Ender's Game.** Tom Doherty Associates. (The Earth is under attack and the survival of the human species depends on a military genius who can defeat the alien "buggers." Recruited for military training, Andrew "Ender" Wiggin's childhood ends the moment he enters his new home: Battle School.)

Chambers, C. 1997. **All About Maps**. Franklin Watts. (Discuss how and why we use maps and examines the many different forms that they take.)

Christian, S. 1998. **What Makes The Grand Canyon Grand?**: The World's Most Awe-inspiring Natural Wonders. John Wily and Sons. (Focuses on seven of the world's most awe-inspiring natural wonders, including Mount Everest, the Grand Canyon, and Carlsbad Caverns.)

Cole, J., Stamper J., **Voyage to The Volcano**. Illus. by Speirs J. (Dorothy Ann, one of the kids in Ms. Frizzle's class thought she would be learning about volcanoes, just studying them in books -- but Ms. Frizzle had other ideas. She took them all the way to Hawaii, where they waded through lava and saw a real volcano blow its top. They had a great time -- even though the trip was sometimes almost too hot to handle! This is one explosive adventure that none of us will ever forget!)

Doherty, C. A. , Doherty K.M. 1997. **The Erie Canal**. Blackbirch Press. (Discusses the history of thee human-made Erie Canal as well as basic, engineering, architecture, and mechanical procedures involved in its construction.)

Farmer, N. (2004) **The House of the Scorpion.** Simon & Schuster Children's Publishing. (In a future where humans despise clones, Matt enjoys special status as the young clone of El Patrâon, the 142-year-old leader of a corrupt drug empire nestled between Mexico and the United States.)

Fraser, M. A. 1997. **In search of The Grand Canyon**: Down The Colorado River with John Wesley Powell. Henry Holt and Co. (This account tracks Powell's 1869 expedition day by day as the Party passes through the rapids, whirlpools, and canyons along the river.)

Graf, M. 2003. **Mammoth Cave National Park**. Capstone Press. (Discover Mammoth Cave Nathionl Park. Explore how it formed; the people, animals, and plants that live there; its weather; and more.)

Graf, M. 2004. **Zion National Park**. (Explore Zion National Park, how it formed, the people, animals and plants that live there, its weather, and more. Includes bibliography and index.)

Henry, M. 1991. **Brighty of The Grand Canyon**. Illis. by Wesley Dennis. Simon and Schuster Children's. (Describes the adventures of Brighty, a lone little burro who roamed the high cliffs of the Grand Canyon and touched the hearts of all who knew him.)

Hiscock, B. 1997. **The Big Rivers: The Missouri, The Mississippi, And The Ohio**. Illus. by B. Hiscock. Atheneum. (Describes the conditions that led up to severe flooding in the Mississippi River valley in 1993.)

Holling C. H. 1941. **Paddle-to-the-sea**. Houghton Mifflin. (The story of a young Native American boy who carves a small wooden man in a canoe and sets him off on a journey he could never make. The boat travels from a tiny stream through the Great Lakes and Niagara Falls to the open sea, facing many adventures along the way.)

Le Guin K.U. 2004. **Catwings**. Bantam Books. Illis. by S. D. Schindler. (Four young cats with wings leave the city slums in search of a safe place to live, finally meeting two children with kind hands. Mrs. Jane Tabby cannot explain why her four precious kittens were born with wings, but she's grateful that they are able to use their flying skills to soar

away from the dangerous city slums where they were born. However, once the kittens escape the big city, they learn that country life can be just as difficult!

Le Guin K.U. 2008. **The Lathe of Heaven**. Simon & Schuster Trade. (In a future world racked by violence and environmental catastrophes, George Orr wakes up one day to discover that his dreams have the ability to alter reality. He seeks help from Dr. William Haber, a psychiatrist who immediately grasps the power George wields. Soon George must preserve reality itself as Dr. Haber becomes adept at manipulating George's dreams for his own purposes.

Lobel, A. 1993. **Ming Lo Moves The Mountain**. William Morrow. (A funny tale about a couple who live in the shadow of a mountain and their efforts to move it so their crops will get more sun.)

Locker, T. 1993. **Where The River Begins. Puffin Books**. (Two brothers and their grandfather go on a camping trip to locate the source of the river that flows by their home. The text is richly illustrated with paintings that evoke detail and reflect the changing landscape and weather.)

Matson, N. 1999. **The Boy Trap. Front Street**. (Fifth-grader Emma decides to do a science fair project to prove scientifically that girls are better than boys. In the process, she learns about herself, her friends, and research methods.)

Schullery, P. 2001. **America's National Parks**: The Spectacular Forces That Shaped Our Treasured Lands. Tehabi Books/DK Publishing. (Fifty-six of America's national parks are captured in the photo filled book. It includes interesting, easy to understand background on the geological and ecological forces that continue to make each national park worthy of protection.)

Sherman, J. 2004. **Hydroelectric Power**. (Introduces the history, uses, production, advantages and disadvantages, and future of hydroelectric energy as a power resource.) Taylor, B.1992. Maps And Mapping. Kingfisher. (Explains what maps are and why they are used, introduces map symbols, and describes the work of cartographers.)

Verne, J. 1995. **Around the World in Eighty Days.** Penguin Young Readers Group. (An eccentric Englishman accepts a challenge to circle the globe with unprecedented speed. Exotic locales, seemingly insurmountable obstacles, and comic relief provide a fantastic blend of adventure, entertainment, and suspense.)

Verne, J. 1992. **Journey to the Center of the Earth.** Doherty, Tom Associates, LLC. (A team of explorers makes an expedition into a crater in Iceland which leads to the center of the earth and to incredible and horrifying discoveries.)

Verne, J. 2006. **Twenty Thousand Leagues Under the Sea**. Dover Publications. (Retells the adventures of a French professor and his two companions as they sail above and below the world's oceans as prisoners on the fabulous electric submarine of the deranged Captain Nemo.)

Webster, C. 2005. **Mountains**. Capstone Press. (Describes mountains, including how they form, plants and animals on mountains, how people and weather change mountains, mountains in North America, and Mount Everest.)

Webster, C. 2005. **Plains**. Capstone Press. (Describes plains, including how they form, plants and animals on plains, how people and weather change plains, plains in North America, and the west Siberian plain.)

Webster, C. 2005. **Valleys**. Capstone Press. (Describes valleys, including how they form, plants and animals in valleys, how people and weather change valleys, Death Valley, and the Great Rift Valley.)

Webster, C. 2005. **Canyons**. Capstone Press. (Describes canyons, including how they form, plants and animals in canyons, how people and weather change canyons, canyons in North America, and canyons of the world.)

Webster, C. 2005. **Hills**. Capstone Press. (Describes hills, including how they form, plants and animals on hills, how people and weather change hills, hills in North America, and Silbury Hill.)

Daily Response Sheet

Handout 1.5

1. Pages read: _____ to _____

2. List three important facts or concepts found in today's reading:

3. Write a paragraph of 4 or 5 sentences summarizing the most significant aspects of today's lesson.

4. Write a sentence or two describing something you do not understand, something you would like more information about, or something you now see in a different light.

The Major Point Interview

Handout 1.6

Use only the questions and rubrics that focus on the strategy being studied. After you have read a book you are drawn too, answer the following questions.

1. Did the information remind you of anything you know about?

2. Make a list of any information you are reminded about?

3. Did it remind you of any experiences or things that have happened?

4. Are there things you know about or things that helped you understand this book?

5. What do you understand now that you did not understand before?

6. Can you predict what is about to happen? Why did you make that prediction? What in the book helped you to make that prediction? What do you already know that helped you to make that prediction?

7. What did you wonder about while you were reading this story?

8. What questions do you still have about this book?

9. Are there some parts of the story that are more important than the others are? Which ones? Why

10. What to you think the author thought was most important so far in this story?

Reading Aloud Discussion Questions

Handout 1.7

Before the read-aloud

What can you tell me about (topic)?

Who can tell me what a (. . .) is?

Has anyone ever seen a (. . .)? Tell us about it.

Why do you think I chose this book to read to you?

Why might we want to read this book?

What do you think this book might be about?

What do you want to find out about (. . .)?

During the read-aloud

Does this remind you of anything you've read in your textbook or discussed in class?

How does it relate to that?

What does (. . .) mean?

Why do you think that happened the way it did?

What do you think will happen next?

Why do you think they (said/did) that?

Do you think that is important? Why?

What do you notice in this illustration?

After the read-aloud

What did you notice in the book?

What does the book remind you of in your own life?

What would you tell a good friend about this book?

What is your favorite illustration? Why?

How is this person’s life like yours? How is it different?

How is this book like another you have read? How is it different? Which one do you like better?

What did you learn from this book that surprised you or you did not know before?

What do you think is the most important information in this book?

How does this relate to what you have read in your textbook or discussed in class?

Appendix
Pennsylvania State Standard

3.1.7 Unifying Themes

A. Explains the parts of a simple system and their relationship to each other.

B. Describe the use of models as an application of scientific technological concepts.

C. Identify patterns as reported processes of recurring elements in science and technology.

D. Explain scale as a way of relating concepts and ideas to one another by some measure

3.2.7 Inquiry and Design

A. Explain and apply scientific and technological knowledge.

B. Apply process knowledge to make and interpret observations.

Annotated Bibliography for teachers

Albright, L.K. (2002). **Bringing the ice maiden to life: Engaging adolescents in learning through picture book read-alouds in content areas.** Journal of Adolescent & Adult Literacy, 45, 418-428.

Barrow, H. L., (2006). **A Brief History of Inquiry: From Dewey to Standards**. Journal of Science Teacher Education 17. 265-278. (This paper describes how interpretations of inquiry have changed during the 20th Century. These multiple meanings have resulted in (a) confusion among K-12 teachers of science and (b) various interpretations by science teacher educators. Suggestions are provided for pre-service programs (both science and methods courses), professional development for new and veteran teachers of science, and science education community to reach consensus about what is inquiry.)

Hapgood, S. and Palincsar, A. S. (2006/ 2007). **Where Literacy and Science Intersect**. Educational Leadership. 64. 56-60 (Learning about the world and sharing one's own discoveries can be powerful motivators for learning to read, write, and speak effectively.)

Harvey, S. (1998). **Nonfiction Matters Reading, Writing, and Research in Grades 3-8**. (Nonfiction Matters offers teachers the tools to help students explore nonfiction and dig deep to reach more complete understanding of the real world and report these insights in a compelling manner. Stephanie Harvey shows how students can read expository text, engage in research, and write authentic nonfiction that is captivating, visual, and full of voice. The inquiry projects she describes require in-depth learning: topic selection, question development, research exploration, reading for content, organization, synthesis, writing to convey meaning, and presenting findings - all skills that develop independent thinkers who know how to make decisions, solve problems, and apply their knowledge insightfully.)

Klentschy, M., & Molina-De La Torre, E. (2004). **Students' notebooks and the inquiry process**. In E. W. Saul (Ed.), Crossing borders in literacy and science instruction: Perspectives on theory and practice (pp. 340-354). Newark, DE: International Reading Association

Topping, D., McMannus, R. (2002). **Real Reading Real Writing Content-Area Strategies**. (With mutual respect and fifty-seven years of combined professional experience, Topping and McManus demonstrate how realistic research applications build strong literacy skills and subsequent content comprehension. The first two chapters trace the authors' journeys-one in academia and the other in the middle school classroom-to collaboration. The next seven chapters are packed with organizing principles and practical methods, not as a cookbook approach but as an extended description of what works for a creative and enthusiastic teacher who dares to model the behavior she expects while seeking answers and feedback from students and fellow professionals. With a streetwise perspective, the authors apply a repertoire ranging from the old SQ3R to more recently addressed multiple learning styles. The book teaches meticulous note-taking from written and oral sources and gives students a payoff with a high-energy Super Bowl of Science. Chapter 11 drives home that study skill or process instruction should be an integral part of each lifelong-learning classroom. A final chapter emphasizes planning and classroom management as key to student discipline and teacher satisfaction. A research source, with full bibliographical information available, accompanies each method. Curriculum directors, principals, teachers, and homeschool instructors serious about integrating study skills and higher level thinking into all content areas should have at least two copies of this excellent blend of theory and practice-one for reference and one to lend. Topping and McManus provide suggestions and attitudes that ensure success for teachers and students in all levels of education. Illus. Charts. Biblio. Appendix. 2002,Heinemann, 188p,)

Wallace, Carolyn S., Hand, Brian, Yang Eun-Mi,. **The Science Writing Heuristic: Using Writing as a Tool for Learning in the Laboratory** (pp. 355-367). (This chapter describes a procedure for helping students think through and reflect on their science experiences, called the “Science Writing Heuristic.” Seventh-grade students in a life science course were given a variety of writing tasks that caused them to highlight the connections among questions, claims, data, and evidence. The authors conclude that as a result, students were better able to grapple with the concept of a knowledge claim in science and became more skilled in seeking evidence to support their claims. In addition, students' metacognitive skills improved.)

Westcott, W. B., Spell, J. (1999) **Tearing Down the Wall: Literature and Science** English Journal November 1999.

Zigo, D., Moore, M. T. (2004) **Science Fiction: Serious Reading, Critical Reading** English Journal Vol. 94, No 2 November 2004.

Zimmermann, S., Keene, O. E. (1997). **Mosaic of Thought**. (When it published ten years ago, Mosaic of Thought became a runaway bestseller as the first book to explicitly describe the use and benefits of strategy-based comprehension instruction. Since then comprehension, strategy instruction has exploded, leading to numerous inspiring variations on Mosaic's instructional principles, as well as a widening of the comprehension research base.)

Zmach,C. C. Sanders, J., Patrick,J. D., Dedeoglu,H., Charbonnet, S.,Henkel,M., Fang,Z., Leonard L. L., and Pringle, R. (2006/2007). **Infusing Reading into Science Learning** (Researchers and middle school teachers teamed up to give students effective reading instruction in science class.)