

Teaching Reading in Science

A Supplement to
*Teaching Reading in the Content Areas
Teacher's Manual (2nd Edition)*

Mary Lee Barton
Deborah L. Jordan



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FOR MATHEMATICS AND SCIENCE

Teaching Reading in Science

A Supplement to *Teaching Reading in the Content Areas: If Not Me, Then Who?*

2nd Edition

MARY LEE BARTON

DEBORAH L. JORDAN

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Rationale

Ask students to take out their science textbooks, and what response do you typically get? Groans? Sighs? Comments that are less than enthusiastic?

This reaction is understandable. For many students, reading science is like reading a foreign language. A high school chemistry text can contain some 3,000 new vocabulary terms — far more than are taught in most foreign language classes (Holliday, 1991). In addition, it's not unusual for science textbooks to have a readability level one or two years above the grade level in which they are used. Finally, many textbooks aren't particularly user friendly. This is often the case when they are written by content-area experts without the assistance of professional writers or experienced practitioners who could help ensure that ideas were communicated clearly.

Science teachers, themselves, appear to feel somewhat ambivalent about textbook usage. Although teachers agree that students need to be able to read science, 28 percent of elementary teachers surveyed nationwide in 1998 reported using textbooks only as a reference source; 33 percent reported rarely or never using textbooks (Tolman, Hardy, & Sudweeks, 1998).

Why do teachers feel so ambivalent about textbooks? One possible reason is students' inability to read these texts. Another is that the content of science textbooks can become outdated more quickly than, say, an American literature textbook, rendering these books less useful as the years go by. A third reason cited by critics of science textbooks is that textbooks emphasize product rather than process (Donahue, 2000). In an inquiry-based approach to learning that accompanied the post-Sputnik era of the 1960s, science education has focused largely on *doing* science rather than reading science.

Many educators contend that when students *do* science, they are more engaged in learning than when they read science text. When students actively participate in science, they are involved in collaboration, exploration, and problem solving. Hands-on science activities give students opportunities to

- wrestle with science problems;
- work together to generate and test hypotheses; and
- analyze data, draw conclusions, and write about their findings.

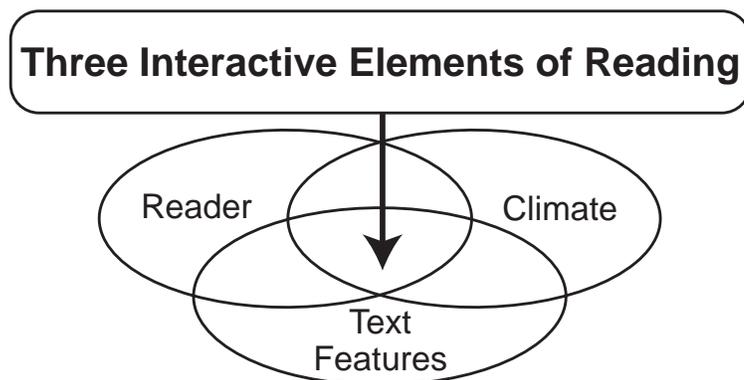
In fact, reading science text and textbooks requires the same critical thinking, analysis, and active engagement as performing hands-on science activities. Science and reading have many process skills in common. As Armbruster (1993) contends, “The same skills that make good scientists also make good readers: engaging prior knowledge, forming hypotheses, establishing plans, evaluating understanding, determining the relative importance of information, describing patterns, comparing and contrasting, making inferences, drawing conclusions, generalizing, evaluating sources, and so on” (p. 347).

In this supplement, as in the *Teaching Reading in the Content Areas (TRCA) Teacher’s Manual*, we present the latest research on reading and learning in science. We also include suggestions on how to help students confront the unique challenges of constructing meaning from science textbooks and on how to embed explicit science reading instruction within the natural context of science instruction in the classroom. Throughout this supplement, you will find references to sections or pages of the *TRCA Teacher’s Manual* that provide a more thorough discussion of a topic or another example of a reading strategy.

In Section 5 of this supplement, you will find references to the five phases of learning — *engage, explore, explain, elaborate, and evaluate* — which are common components of science instructional models. Science teachers are encouraged to use the “5E” approach or instructional models that share these components to build students’ in-depth understanding of science concepts and strengthen their thinking skills (see Section 3, pp. 39–44 for more about the five phases of learning). Reading science texts and other materials is an important part of this process. For students to gain understanding, teachers need to use a variety of strategies, including those that involve manipulative, interactive, and physical materials, to address science content in depth and avoid focusing on isolated or disconnected facts.

Section 1

Three Interactive Elements of Reading



Introduction

Writers Santa, Havens, and Harrison (1996) state it well: “Most students arrive at the science teacher’s classroom knowing how to read, but few understand how to use reading for learning science content” (p. 166). One explanation for this disparity is that students most often learn the reading process using narrative text. They haven’t been taught that reading science requires different reading and thinking skills than reading fiction. Certainly, informational text — and science text, in particular — presents unique challenges to novice readers. Thus, one of the first steps for teachers is to help students understand that reading science text requires them to use different skills than they may have used in the past.

In addition to the general reading skills needed to comprehend narrative text, readers of science text also must be able to apply the following knowledge and skills:

- Understand specialized vocabulary terms and phrases that are unique to science.
- Understand vocabulary terms and phrases that have different meanings when used in science.
- Interpret scientific symbols and diagrams.

Notes

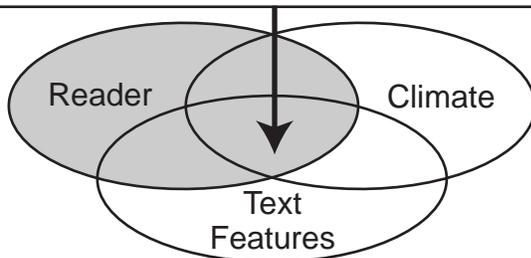
- Recognize and understand organizational patterns common to science texts.
- Make sense of text using text structure and page layout that may not be user friendly.
- Infer implied sequences and recognize cause-and-effect relationships.
- Infer main ideas and draw conclusions that may not be explicitly stated.
- Use inductive and deductive reasoning skills.

These skills are discussed in more detail in the sections that follow, which also include suggestions for planning instruction that will help students become more effective consumers of science reading material. As in the *TRCA Teacher's Manual*, this supplement discusses teaching reading in science in terms of three interactive elements that affect comprehension: the reader, the climate, and text features.

The Role of the Reader

Notes

Three Interactive Elements of Reading



Things to Think About

1. How do students' experiences and prior knowledge of science affect their learning?
2. How can teachers help students recognize and change any misconceptions they have about science?
3. How can teachers motivate students to learn and practice reading strategies?

Prior Knowledge

For students to make sense of what they read, they need to be able to grasp and make sense of new information in light of what they already know. When readers activate and use their prior knowledge, they make the necessary connections between what they know and new information. Teachers should help students recognize the important role that prior knowledge plays and teach them to use that knowledge when learning science through reading.

Teachers can show students how to activate prior knowledge by demonstrating basic pre-reading techniques such as

- brainstorming ideas that a topic brings to mind;
- previewing a passage, noting headings and bold print; and
- constructing a graphic organizer, web, or outline from passage headings for use in note taking.

Notes

Teachers also need to ensure that their students have the prior knowledge and experience they need to make these connections. Discovering what students already know about a topic helps teachers design instruction around the missing knowledge. A number of strategies can help teachers determine what students know before they begin studying a new topic:

- Semantic Mapping (p. 61)
- Word Sort (p. 69)
- Anticipation Guide (p. 72)
- Directed Reading/Thinking Activity (p. 76)
- K-W-L (p. 91)
- Problematic Situation (p. 99)
- Learning Log (p. 114)

Prior knowledge must not only be adequate for learning to occur, it also must be accurate. Unfortunately, sometimes students come to their science classes with a number of misconceptions about topics they will be studying. Helping students confront and resolve their misconceptions requires concentrated effort on the part of teachers and students. The strategies listed above can help teachers identify students' misconceptions.

Another strategy that addresses students' misconceptions is the extended anticipation guide (Duffelmeyer & Baum, 1992). This strategy requires learners to identify their beliefs prior to reading and to justify these ideas — or revise them — when they read information in the text that supports or contradicts their understanding. (See pp. 72–75 in this supplement for instructions on using this strategy in the classroom.) Because letting go of misconceptions is so difficult, this issue is extensively addressed in Section 3, “Strategic Teaching.”

Mental Disposition

Exemplary science educators know that students' attitudes about reading and learning science affect their achievement. Of particular concern, then, are reports that students' motivation to learn wanes over time. For example, Holloway (1999) notes that "intrinsic motivation for literacy and other academic subjects declines in middle school" (p. 80). What can teachers do to increase students' motivation to learn from reading science text?

In addition to connecting reading assignments to students' real-world experiences, teachers need to show students that becoming effective consumers of science text has value. Students need to see firsthand that practicing the right reading strategies will improve their achievement.

This is especially true of struggling readers. Some of these students also have a poor attitude toward reading and often don't see the connection between the effort they put forth to read and complete their assignments and the grades they earn in class. Marzano, Pickering, and Pollock (2001) cite a set of studies demonstrating that simply showing students that added effort improves their achievement actually increases students' achievement. The authors note that since "students might not be aware of the importance of believing in effort," teachers should "explicitly teach and exemplify the connection between effort and achievement" (p. 51).

Instructional Implications

To demonstrate to students how their effort affects their achievement, Marzano et al. (2001) suggest that students periodically assess their level of effort on assignments and track the impact of their effort on the grades they earn. Teachers can give students a set of effort and achievement rubrics (see Exhibit 1 on p. 6), which students can use to assess their effort and achievement. In addition, a chart (see Exhibit 2 on p. 7) can be provided so students can record and track their progress.

Notes

When students observe the impact that their effort and attitude have on their progress, they begin to see the value of applying reading strategies to improve their comprehension and learning. They also gain a sense of control over their learning — a crucial step in assuming more responsibility for their own learning.

Exhibit 1. Effort and Achievement Rubrics

Effort and Achievement Rubrics for Science

Scale: 4 = excellent; 3 = good;
2 = needs improvement; 1 = unacceptable

Effort Rubric

- 4 I worked on my science assignment until it was completed. I pushed myself to continue working on the task even when difficulties arose, when a solution was not immediately evident, or when I had trouble understanding what an author was saying. I used obstacles that arose as opportunities to strengthen my understanding and skills beyond the minimum required to complete the assignment.
- 3 I worked on my science assignment until it was completed. I pushed myself to continue working on the task even when difficulties arose, when a solution was not immediately apparent, or when I had trouble understanding what an author was saying.
- 2 I put some effort into my science assignment, but I stopped working when difficulties arose, when a solution was not immediately evident, or when I had trouble understanding what an author was saying.
- 1 I put very little effort into my science assignment.

Achievement Rubric

- 4 I exceeded the objectives of the assignment.
- 3 I met the objectives of the assignment.
- 2 I met a few of the objectives of the assignment, but didn't meet others.
- 1 I did not meet the objectives of the assignment.

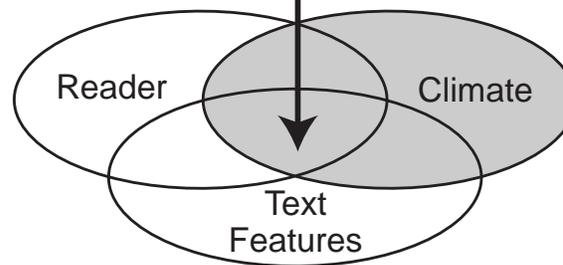
Exhibit 2. Effort and Achievement Chart

Notes

Student <u>Jon Starek</u>	Assignment	Effort Rubric	Achievement Rubric
Monday, Sept. 21	Study and describe parts of three different flowering plants. Read text about plant parts and find parts on actual plants to complete worksheet.	4	4
Wed., Sept. 23	Homework: Read the article "How Plants Grow."	3	3
Thurs, Sept. 24	Write a two-page narrative on key points made in the article and how these reinforce or conflict with what I thought I knew about how plants grow.	3	3
Fri., Sept. 25	Read text pages on experimental design and design experiment on germination rate of plants.	3	3

The Role of Climate

Three Interactive Elements of Reading



Things to Think About

1. How does climate affect students' attitude toward learning science?
2. What do effective science teachers do to create a classroom climate that is conducive to learning?

A fifth grade teacher always begins the year by asking her class this simple question: "What is science?" The varied responses students give usually cover three basic themes:

"Science is fun. It's doing experiments and watching butterflies emerge from their chrysalises."

"Science is reading boring textbooks. I hate it."

"Science is watching movies or videos."

What shapes students' attitudes about science? Certainly, students' attitudes are deeply affected by the climate in which they learn. Teachers' beliefs, attitudes, and values help to create the climate in which children develop their own feelings about subject matter. In fact, as early as the fifth grade, students have developed definite attitudes about science. Sadly, many students graduate from high school despising science, considering it boring and too difficult. As the authors of *Science for All Americans* (Rutherford & Ahlgren, 1990) note, "They see science only as an academic activity, not as a way of understanding the world in which they live" (p. 186).

Given the effect that attitude has on learning, it's essential that science teachers create a positive classroom climate. The term *climate*

refers not only to the affective dimensions discussed in the *TRCA Teacher's Manual*, but also to physical dimensions. As Program Standard D of the *National Science Education Standards* (National Research Council [NRC], 1996) asserts, "The K–12 science program must give students access to appropriate and sufficient resources, including quality teachers, time, materials, and equipment, adequate and safe space, and the community" (p. 218).

The climate in today's exemplary science classrooms is grounded in the high standards and vision described in the *National Science Education Standards* (NRC, 1996): "All students, regardless of age, sex, cultural or ethnic background, disabilities, aspirations, or interest and motivation in science, should have the opportunity to attain high levels of scientific literacy" (p. 20). Science instruction is no longer viewed solely as preparation for college-bound students. Today's science students come from all walks of life and have a wide range of backgrounds and experiences.

What constitutes an effective learning environment? According to the NRC (2000), an effective learning environment is characterized by four dimensions:

- **Learner centered:** Respecting and understanding students' prior experiences and understandings and using them to build new understandings.
- **Knowledge centered:** Helping students focus on the "big" ideas and "develop well-organized bodies of knowledge and organize that knowledge so that it supports planning and strategic thinking" (p. 122).
- **Assessment centered:** Helping students learn to monitor and regulate their own learning, to think critically, and to receive instruction that is informed and supported.
- **Community centered:** Requiring students to "articulate their ideas, challenge the ideas of others, and negotiate deeper meaning along with other learners" (p. 122).

Notes

Instructional Implications

What can teachers do to ensure that their classrooms incorporate these elements?

Learner centered

To ensure that the classroom environment is learner-centered, teachers should consider the individual needs of their students. As each lesson is planned, it's important to consider the extent to which each student has the background knowledge needed to understand the concepts that will be taught. This step may point to the need to create learning experiences that provide students with additional information about particular concepts prior to giving them reading assignments.

Engaging students in concrete learning activities can help prepare them to learn more abstract ideas. These activities can introduce students to concepts, which will then be reinforced, confirmed, or enriched through reading. Consider using an anticipation guide, DR/TA, K-W-L, problematic situation, graphic organizer, PLAN, or other pre-reading activities to activate, build, and reinforce background knowledge students need in order to make connections while reading. (See Section 5, pp. 49–125 of this supplement for these pre-reading strategies.)

Knowledge centered

In a knowledge-centered learning environment, students are offered a variety of opportunities to learn about the discipline of science. Teachers help students recognize the “big ideas” in science and differentiate between main ideas and supporting material in their science textbooks. They also ask students to use this knowledge to make connections among these ideas and apply them in new situations. As discussed in the next section, “The Role of Text Features,” science text can be difficult for even experienced readers. Teachers should reread text material that they plan to assign to see if

main ideas are expressed clearly and if the relationships among ideas are evident.

To get the most out of their science textbooks, students must understand how the information is organized and how the concepts presented relate to one another (Misulis, 1997). Teachers can provide students with graphic organizers that will help them recognize and understand relationships among the ideas they read in their texts. In addition, teachers should incorporate questioning and reflection strategies that focus students' attention on understanding knowledge derived from the text and on making connections between what they have observed and what they have read. A number of strategies, including reciprocal teaching, learning logs, and question-answer relationships, are designed to clarify students' understanding of what is presented in class and in their textbooks. (See Section 5 of this supplement for these strategies.)

Assessment centered

Assessment-centered classrooms encourage students to monitor and regulate their learning in response to feedback from self-assessment and teachers' assessments. Learning to monitor and regulate their own learning is a skill that can benefit students throughout their education — indeed, throughout their lives.

There are many ways to teach and reinforce students' self-assessment skills. For example, teachers can encourage students to assess their own learning by collecting data, comparing results with others, and applying what they have learned. As students become adept at monitoring their learning, they will be better equipped to assess their understanding of text and to monitor and regulate their understanding as they read.

Teachers can encourage the art of self-evaluation in a number of ways. First, they can model for students how they monitor their understanding when reading and learning new information. In addition, teachers can ask students to reflect on their learning using

Notes

writing-to-learn activities or leading discussions about what learning strategies are most effective when comprehension problems arise.

Finally, teachers should explain — and model — that assessment activities offer learners and their teachers valuable feedback. For example, instead of simply grading and returning students' lab reports, teachers might note areas that need further work and require students to use these comments to make any needed revisions.

Thoughtful educators also use assessment results to revise their instructional approaches. In this way, they treat assessment not as a product, but rather as part of an ongoing process that supports learning and informs instruction.

Community centered

A community-centered classroom offers students a safe environment in which they can learn from their mistakes and from one another.

One way to begin to create this kind of environment is to give students extra credit for sharing their confusion and questions about what they have read, a strategy suggested by Schoenbach, Greenleaf, Cziko, and Hurwitz (1999). The authors also suggest telling students that the more explicit they are about where in a text they got lost or why they think something is difficult for them to understand, the more credit they will receive. The benefits of this strategy are many. For one, talking with others can help students more specifically identify the questions they have or the topics they find confusing. Second, classroom dialogue and conversation help develop a sense of community among students and between students and the teacher. Another strategy suggested by Schoenbach et al. (1999) is to invite students to bring in reading materials that will “stump” the teacher so the teacher can model “think-alouds,” which lets students know that teachers, too, often have to use strategies to understand what they are reading.

In summary, the characteristics of science learning present a unique challenge — and opportunity — for science teachers as they design

the classroom learning environment. By identifying individual students' needs, helping students to focus on "big ideas," using assessment as a springboard for learning, and creating a community in which students learn and deepen their understanding together, teachers can help ensure that students leave their classes with a positive view of the benefits of learning science.

Notes

Section 5

Reading Strategies

Strategies for the Three Phases of Cognitive Processing		Preactive Preparation Before Reading	Interactive Assistance During Reading	Reflective Reflection After Reading
Vocabulary Development	Page Number			
S-1 Concept Definition Mapping	50	x	x	x
S-2 Frayer Model	53	x	x	x
S-3 Semantic Feature Analysis	58	x	x	x
S-4 Semantic Mapping	61	x	x	x
S-5 Student VOC Strategy	64	x	x	
S-6 Word Sort	69	x	x	x
Informational Text				
S-7 Anticipation Guide/Revised Extended Anticipation Guide	72	x	x	x
S-8 Directed Reading/Thinking Activity (DR/TA)	76	x	x	x
S-9 Graphic Organizer	81	x	x	x
S-10 Group Summarizing	87			x
S-11 What I Know; Want to Learn; Learned (K-W-L)	91	x		x
S-12 Pairs Read	94		x	
S-13 Predict; Locate; Add; Note (PLAN)	95	x	x	x
S-14 Problematic Situation	99	x		x
S-15 Proposition/Support Outline	101		x	x
S-16 Reciprocal Teaching	105	x	x	x
S-17 Survey, Question, Read, Recite, Review (SQ3R)	106	x	x	x
S-18 Think-Aloud	107		x	
Reflection Strategies (Questioning; Writing; Discussing)				
S-19 Creative Debate	109			x
S-20 Discussion Web	111			x
S-21 Learning Log	114	x	x	x
S-22 Question-Answer Relationship (QAR)	117			x
S-23 Questioning the Author (QtA)	120		x	x
S-24 Role/Audience/Format/Topic (RAFT)	122			x
S-25 Scored Discussion	124			x

S-3. Semantic Feature Analysis

What is it?

Semantic feature analysis (Baldwin, Ford, & Readence, 1981; Johnson & Pearson, 1984) helps students discern a term's meaning by comparing its features to those of other terms that fall into the same category. When students have completed a semantic feature matrix, they have a visual reminder of how certain terms are alike or different.

How could it be used in science instruction?

This strategy is very effective when examining discriminating features (e.g., categorizing vertebrates, invertebrates, types of rocks, powders, and crystals). This strategy can be used to *engage* student thinking, as a way to collect data while students *explore* similarities and differences, or as a way to quickly *evaluate* students' knowledge.

How to use it:

1. Select a general category of study.
2. Create a matrix. Along the left side, list key terms in the chosen category. Across the top of the matrix, write features that these words might share.
3. Ask students to then use an "X" to indicate if the feature applies to the word or write in specifics about the features.
4. Encourage students to *explain* the rationale behind their choices.
5. As the unit progresses and understanding of each term or concept deepens, the teacher or students can add terms and features to the matrix.

For further discussion of this strategy, see the *TRCA Teacher's Manual*, pp. 79–81.

Vocabulary Development

Notes

Semantic Feature Analysis Grid

Category: _____

Terms	Features				

Category: Vertebrates

Terms	Features	backbone	cold-blooded	warm-blooded	gills	lungs	smooth skin	scales	feathers	fur or hair	produce milk for young
fish	X	X		X			X				
amphibian	X	X		X	X	X					
reptile	X	X			X		X				
bird	X		X		X			X			
mammal	X		X		X				X	X	

Vocabulary Development

Category: Rocks

Terms	Features	dull	shiny	soft	hard	porous	one color	many colors
sandstone	X		sometimes	sometimes	sometimes			X
shale	X		X				X	
obsidian		X		X			X	
pumice	X			X	X		X	
marble		X		X			mainly	
quartzite		X		X				X

Category: Waves

Terms	Features	wavelengths	frequencies (Hz)	detected by	transfer
radiowaves	>1mm		$1-10^8$	radios	radiation
microwaves	1 m–30 cm		10^8-10^{12}	microwave detectors	radiation
heat	2.5 m–25 m		$10^{11}-10^{12}$	thermometer	conduction, convection, radiation
light	400nm–750nm		$4 \times 10^{14}-7.5 \times 10^{14}$	eyes	radiation
X-rays	1pm–1nm		$10^{17}-10^{20}$	X-ray film	radiation
sound	1.5cm–16.5m		20–20,000	ears	vibration

S-13. Predict; Locate; Add; Note (PLAN)

What is it?

PLAN is a study-reading strategy for informational text that helps students read strategically (Caverly, Mandeville, & Nicholson, 1995). PLAN is an acronym for four distinct steps that students are taught to use before, during, and after reading. The first step is to *predict* the content and text structure; students create a probable map or diagram based on chapter title, subtitles, highlighted words, and information from graphics. The second step is to *locate* known and unknown information on the map by placing checkmarks (✓) next to familiar concepts and question marks (?) next to unfamiliar concepts; this causes students to activate and assess their prior knowledge about the topic. The third step, *add*, is applied as students read; they add words or short phrases to their map to explain concepts marked with question marks or confirm and extend known concepts marked with checks. *Note* is the fourth step; after reading, students note their new understanding by using this new knowledge to fulfill a task (e.g., reproducing the map from memory, writing in their learning log, discussing what they have learned, or writing a summary). This reinforces their learning and ensures that they have fulfilled their purposes for reading.

How could it be used in science instruction?

Much of what is written in science follows one of the five patterns discussed earlier in this manual: compare/contrast, concept definition, description, generalization/principle, or process/cause-effect. However, when text does not appear to be organized according to one of these patterns, PLAN provides students with another way to *explore* the relationships among the ideas in the text and to create a visual they can use to take notes while reading. Using graphic organizers also helps students to see connections as they

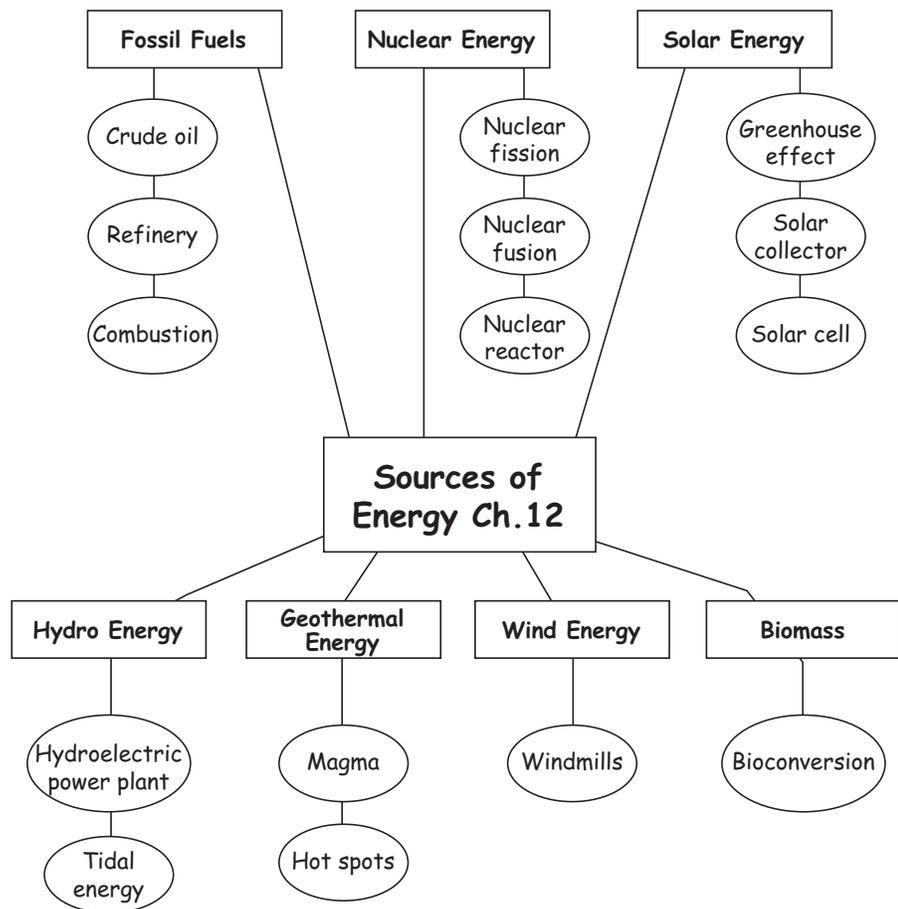
Informational Text

construct their understanding of science concepts. PLAN encourages students to *self-evaluate* what they know about a topic. It also provides an opportunity for students to *explain* and *elaborate* on what they know or have learned through their reading.

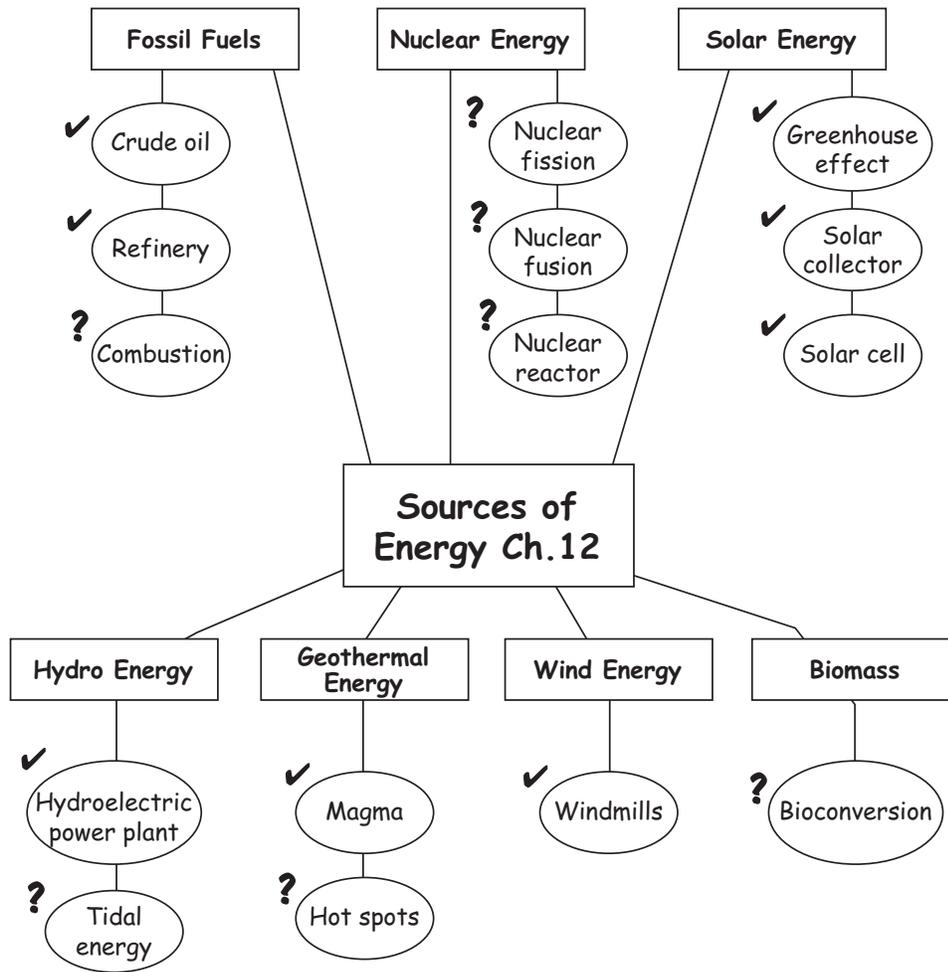
How to use it:

1. Model the four PLAN steps (Predict; Locate; Add; and Note) for students.
2. Give students opportunities to practice using the PLAN strategy with various organizational patterns.

Step 1: Predict

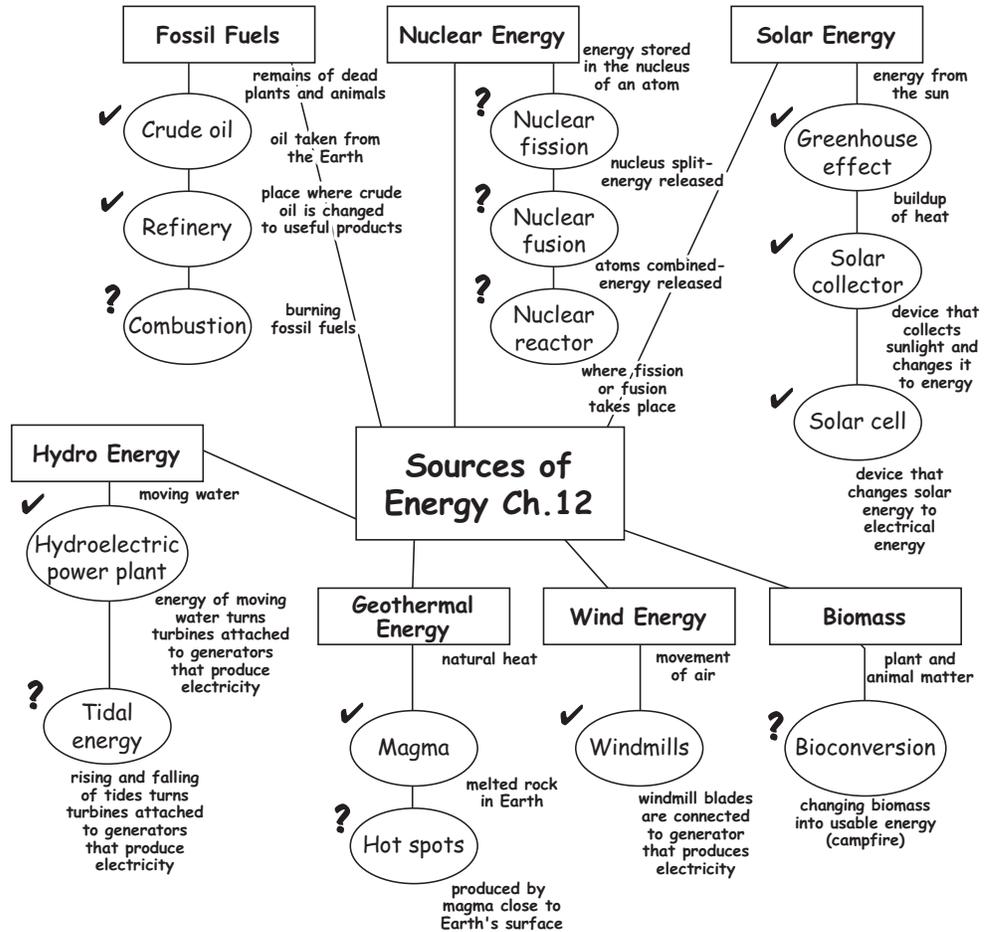


Step 2: Locate



Informational Text

Step 3: Add



Note. Basic format only from "PLAN: A Study Reading Strategy for Informational Text," by D. C. Caverly, T. F. Mandeville, and S. A. Nicholson, 1995, *Journal of Adolescent and Adult Literacy*, 39(3), pp. 190–199. Copyright 1995 by the International Reading Association.

S-19. Creative Debate

What is it?

The creative debate strategy promotes discussion, original thinking, and thinking from different perspectives. Students debate a topic from a character's point of view.

How could it be used in science instruction?

This strategy gives students the opportunity to *engage* intelligently in public discourse and debate, *exploring* past and present matters of scientific concern. It encourages students to look at both sides of an issue, weigh the facts, and make an informed decision. These are necessary skills for scientifically literate citizenship.

How to use it:

1. Assign students a reading passage with a relevant debate topic.
2. Establish debate criteria.
3. Two-thirds of the class will debate while the remaining third of the class observes.
4. Debaters should be in two rows, facing each other. One row of students should support the issue; the other row should oppose the issue. Students do not have to agree with the positions they are representing.
5. Each student selects a character to portray and takes on the mannerisms and voice of the character during the debate.
6. Students debate from their character's point of view for ten minutes while the observers collect data.
7. Provide time for students to discuss the activity. Encourage the observers to share the data they collect. Reflective questions might include, "How difficult was it to share information from a different perspective? What did you learn? What might you do differently next time?"

For further discussion of this strategy, see the *TRCA Teacher's Manual*, pp. 158–159.

Reflection Strategies

Examples of Debate Topics

- Everybody can do science.
- Potential research subjects should be told about both the risks and benefits of the research projects.
- New technology can change cultural values and social behavior.
- Any belief about the world is as valid as any other.
- Animals should not be used as research subjects.
- The international community should adopt and enforce laws to prevent further global warming.
- Companies should be allowed to drill for oil in protected wilderness areas.
- Cloning of humans should be allowed.
- Funding for future space programs should be reduced.
- Unwanted, frozen, human embryos should be used for genetics research.
- Genetically engineered food crops are safe for human consumption.

About the Authors

Mary Lee Barton, M.S. Ed., has worked in the areas of literacy, learning, and professional development for more than 25 years. She brings a wealth of practical classroom experience to her writing and professional development workshops. As a consultant at McREL, Barton coauthored *Teaching Reading in the Content Areas: If Not Me, Then Who?* (2nd ed.) and its supplement, *Teaching Reading in Mathematics*. Her articles “Addressing the Literacy Crisis: Teaching Reading in the Content Areas” and “Motivating Students to Read Their Textbooks” have appeared in the *NASSP Bulletin*. She has trained thousands of teachers and administrators across the country in content-area reading and writing instruction. Currently, Barton is a writer and a business and education consultant in private practice. She trains and provides technical assistance nationally to educators and business clients on literacy issues in education and in the workplace.

As a senior consultant for McREL, Deborah L. Jordan, M.A., has provided technical assistance and training to teachers, curriculum developers, and school administrators nationally over the past four years. Jordan focuses on improving science education through extensive work with standards and their relationship to curriculum, instruction, and assessment. Prior to joining McREL, her 16 years of experience included teaching Chapter I Reading at the middle school level, teaching in the regular elementary classroom, and serving as a district science coordinator.

Workshops Available

McREL delivers training and consultation on *Teaching Reading in the Content Areas: If Not Me, Then Who?* to teachers, reading specialists, staff developers, and administrators.

The **Teachers Workshop** (designed for upper elementary, middle, and high school educators) provides an overview of content area reading instruction; engages participants in applying vocabulary, reading, and discussion strategies to specific content covered in their classrooms; and offers practical suggestions on integrating these strategies into existing curricula.

The **Training-of-Trainers Workshop** is designed for teachers who have a background in reading or who have completed the Teachers Workshop. Participants delve more deeply into critical conceptual ideas underlying the teaching of content area reading skills; receive guidelines for facilitating adult learning; discuss training issues, questions, and concerns; share and critique training plans for teaching content area reading strategies; and discuss schoolwide implementation planning.

The **Teaching Reading in Mathematics Workshop** is designed specifically for mathematics teachers. Participants will examine vocabulary, informational text, and reflection strategies that can help them effectively teach mathematics.

The **Teaching Reading in Science Workshop** is designed specifically for science teachers. Participants will examine vocabulary, informational text, and reflection strategies that can help them effectively teach science.

For more information about scheduling workshops and consulting services, contact McREL at 303.337.0990.