Improving Science Reading Comprehension

by Jill Caton Johnson and Lisa Martin-Hansen

Students in science classrooms are given numerous opportunities to read expository text in a variety of formats and for a variety of purposes. They read to solve a problem, understand the steps in an experiment, gain base knowledge about a concept, answer their own questions, compare their inquiry results with what others have found, expand their basic understanding of a concept, and for enjoyment. Students in science classrooms also read a variety of text formats. They read books, directions for experiments, newspaper articles, websites, and peer work. The reading tasks going on in science classrooms today are quite extensive and do complement efforts being made in schools to improve reading achievement.

However, science teachers need to support struggling readers with strategies that will enhance their comprehension of science reading materials. This article offers a few easy-to-implement strategies that science teachers can use before, during, and after reading.

Before-reading strategies

Front-load meaning when reading expository materials. This prepares students for reading and helps comprehension, as they have some prior knowledge of the subject matter. Specifically, prediction and vocabulary work are important for students to do before they begin reading.

Having students predict what the reading will be about is important because it can help activate prior knowledge they have on the topic. It allows them to start connecting the new reading with their established knowledge. One fun way to initiate prediction is the Probable Passage (Beers 2003). With this strategy, the teacher lists key words and concepts for the students. Then, based on these words, students must write a prediction about what they will be reading (see Figure 1). Students may be instructed to separate key words into categories to facilitate a prediction. Teachers may also provide students with the title of the reading to prompt predictions if it appears students need support. Students can revisit their prediction and discuss its accuracy.

Students can also participate in an anticipatory set (Readence, Bean, and Baldwin 1981, Vacca and Vacca 2001; Rasinksi and Padak 2004). An anticipatory set is a set of about five controversial statements about a concept (see Figure 2). The teacher writes these out and shares the statements with students. They then have to either agree or disagree with the statement. This forces students to think about a concept before reading about it. Just like probable passage, students can revisit the statements after reading to see if their understanding of each statement has changed.

During reading strategies

Helping students process what they are reading while they are reading it has been shown to improve comprehension (Pressley 1999). Activities designed to have students reflect during the reading process are effective and easy to implement. Such activities allow the teacher to identify comprehension problems as soon as they occur, instead of backtracking to identify problems once the entire reading has been completed. This metacognition, realizing that meaning is interrupted, is critical if students are to read proficiently. Having students reflect on reading while reading also sends the essential message that reading is thinking and that a reader is actively thinking throughout the reading.

One strategy to increase comprehension while reading is to have students keep a response log. These logs can be structured or open-ended. Most structured response logs are two, three, or four-column charts that have the reader respond to specific information in a reading. In contrast, an open-ended log allows students to choose what they respond to. For example, in Figure 3, the reader is asked to locate something important in

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the reading, categorize it in one of four ways, and then provide a personal response to the information. Students should provide 5 to 10 responses to a given reading, depending on its length. The teacher can use these response logs to ascertain points of confusion, interest, and mastery. Teachers can do response log checks once or twice a week.

Another strategy that students can use while reading is Say Something (Harste, Short, and Burke 1988). This strategy also encourages students to think while reading. Students work in small groups and read a passage from a text chosen by the teacher.

Prior to student reading, predetermined stopping points are marked. For example, a chapter from a text may be divided into 10 sections. Students mark each section as a stopping point. All students begin reading and read until stopping at point one. Students take turns "saying something" about what was read. All students in the group are expected to respond to the text. The groups are student-run, but the teacher serves as a rotating facilitator to assist and observe groups as needed. When everyone is done reading, students take turns saying something. Prompts like the one in Figure 4 can be used to help students articulate their thinking about the reading (Stubblefield unpublished). Students in the group

FIGURE 1 **Probable passage vocabulary for a reading from *Volcanoes and Earthquakes***

Title of selection: *Volcanoes and Earthquakes*

Words from text: ash, fault, mantle, seismic wave, lava, plate, vent, epicenter, magma

FIGURE 2 **Sample anticipation guide**

Book: ***Storms***

Agree	Disagree	
		Tornadoes generally last 15 minutes or less.
		If you are in your car during a tornado, you should stay in it.
		The funnel cloud is dark because of the debris it picks up.
		You should lie on the ground during a thunderstorm.
		The heat from lightning causes thunder.
		All major storms result from cold and warm air mixing.
		Hurricanes are the least dangerous storm.
		The eye of a hurricane is calm.
		A watch and a warning are the same thing.

FIGURE 3 **Response log for *Using Force and Motion***

Page	What the text said...	Code	My response...
9	In space, the force of gravity is less, so bones in the spine move further apart.	!	Wow…cool. It's hard to imagine that some astronauts get 2 inches taller when they are in space. Do they notice the difference?

Coding system
! Interesting
? Confusing
I Important/Main point
W Want to know more about

FIGURE 4 **Say Something starters** (adapted from Beers 2003)

Question	Clarify	Connect
I don't get this part…	Oh, I get it…	This reminds me of…
Why…	Let me explain…	This is similar to…
What do you think…	Now I understand…	The differences are…
What is…	This makes sense now…	I have heard of this…
What does this mean…	No, I think it means…	An example is…
What if…	This is really saying…	

Predict	Comment	Explain
I predict that…	This is hard because…	My understanding is…
I wonder if…	This is confusing because…	The basic idea is…
I think that…	I think that…	
The next idea will…		

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support each other by clarifying questions that arise and/or further discussing points of interest. Talking about reading is a powerful tool that can assist in comprehension (Almasi, McKeown, and Beck 1996).

Students also need to be aware of text structures and their important link to main ideas (Dickson, Simmons, and Kameenui 1995). Text structures are captions, headings, illustrations, charts, tables, lists, subtitles, titles, and other conventions that authors use to organize a text. These send messages to students about what is important in the reading. Authors rarely place tables in a text that are irrelevant to the main idea. Therefore, students need to be shown that these text structures do indeed give additional information on what the author feels is most important. A teacher can have students connect these structures with the main ideas of a text while reading. One way to do this is to simply have students identify text structures and explain how they relate to the main idea of the text (see Figure 5).

After-reading strategies

When students are done with a particular reading, their thinking and understanding of a text does not stop. Readers continue to process and make sense of what they read long after the actual reading event. Science teachers can provide students with opportunities to further process their reading, which in turn can deepen student comprehension.

Literacy teachers frequently use literature circles to help students process their understanding of a text. This strategy can also be used in science classrooms. Literature circles are small groups of students placed together to discuss what was hard, confusing, interesting, conflicting, questionable, or relevant about what they have read. Literature circles of four to five students can form for one assigned reading or can meet several times to discuss a longer reading assignment or unit of study. Some teachers assign roles such as discussion director, illustrator, and connector (Daniels 1994) for each student in a literature group so that everyone is encouraged to participate. We recommend that all students be prepared for literature circles by having a written response to the reading prepared, questions listed, or vocabulary terms in need of explanation so that

FIGURE 5 **Text structures found in *Life in the Ocean***

Text structure	Page	Purpose of text structure/Message to the reader
Photograph	10	The author inserted a picture of this fish because it lives in the twilight zone of the ocean. This fish was picked because it has large eyes that help it find food in this zone, which is dark.
Bold words	14	The term *midnight zone* is bold to show that it is an important concept. It is one of the four zones of the ocean.

there is a starting point for small group discussion. Teachers can assess student performance by observing and reading the written responses students prepare for literature circles. Teachers may also require a final reflection paper from each member of the literature circle. Some teachers encourage each group to prepare a project or presentation that demonstrates the information learned or discussed by the group.

Another after-reading activity is to have students re-create what they've read in a different form. For example, students could re-create the journey of oxygen through the respiratory system in a skit. Students can also use a creative writing technique known as RAFT (Vanderventer 1979) to present the information found in a reading. Using RAFT, students are asked to write from a Role, for a particular Audience, in a particular Format, on a particular Topic. For example, students studying weather could be asked to write as a storm cloud, to an audience of sunshine lovers, in the form of an editorial, about the bias toward the Sun.

Special support to struggling students

All teachers in every discipline have students who are poor readers. There are several ways you can provide extra support to these readers. First of all, put reading assignments on audiotape and allow students to listen to them once they have attempted the reading on their own. Teachers can have older students or adult volunteers make tapes for them. This repeated exposure can enhance comprehension and alleviate student frustration. Teachers can also provide students with a reading buddy. The reading buddy can serve as the first contact for answering questions about the text. This can eliminate a line of students waiting to ask the teacher questions. Teachers can also provide graphic organizers that assist students in focusing on the main ideas. These can be outlines for students to follow during reading, a list of questions to check for comprehension before a student moves on to the next section, or a dictionary keyed to the text to help identify essential vocabulary.

Partnering science and reading

Concepts being taught in science often rely on students' reading to build background knowledge or to follow inquiry procedures. Science teachers need to know strategies they can implement to aid in students' comprehension of the specific concepts they teach. If students can't comprehend the materials science teachers provide them, then their understanding of scientific concepts will suffer. When you teach science, you are also teaching students how to read for a variety of purposes and with a variety of materials—both of which will prepare students to become better readers. ■

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