

A Culture of Literacy in Science

A community of readers and writers in a middle school science class learn science and develop a passion for learning.

Donna Hooker Topping and Roberta Ann McManus

The science teacher's classroom is a typical middle school science room, but those who enter it become immersed immediately in a culture of literacy. Harry Potter peers from a poster that says, "Reading Can Take You Anywhere." A prominent glow-in-the-dark bulletin board reminds students to use the SQ3R (survey, question, read, recite, and review) plan when they read their science texts. Magazines and brochures on tables and windowsills invite the eye to linger. A stop sign above an overflowing bookcase says, "STOP—Take the time to read and enjoy." The daily *Philadelphia Inquirer* sits in a place of honor, rarely left folded for long, as students gravitate to it to find out more about science-related events, or just to check the latest sports scores, comics, or horoscopes.

Today Mike and Pablo are putting the finishing touches on a poster that displays magazine pictures and newspaper headlines that students have been clipping about science in the news. It will join several other posters, similarly assembled, that hang on the wall to remind students that science is present in the real world, not just in school. Knowing that his teacher leaves home before the early morning news shows air, Jake says to her,

I heard on *Good Morning America* this morning that the Centers for Disease Control say we don't have enough smallpox vaccine for all of us.

Without prompting, Jake picks up the newspaper and finds the related article. Steve goes to the computer and clicks on a search engine to read more about it. Jen returns *Horrible Science: Disgusting Digestion* (Arnold, 1998) to the circulating science library at the left of the teacher's lab desk. As she crosses off her name on the sign-out sheet, she tells Stacy it was "totally gross." Stacy picks it up and signs it out. Keisha shows her teacher the draft of the letter she has written requesting information for the class on recycling, and the teacher approves it for printing out on school letterhead stationery. Students gather around Timmy, who has brought *Mad Magazine* from home, and laugh at take-offs on Rube Goldberg's machines. All of this happens before the bell rings.

The Science Teacher Cares About Reading and Writing

High engagement in literacy is typical in this classroom because the teacher is a reader and writer who regularly talks about reading and writing with her students. By this time of the year, she has taught them strategies for tackling science texts. She has "thought aloud" the strategies for reading and writing in science that have worked for her. She has joined them in writing in journals, jotting ideas that help them reflect on the science concepts they have just read or heard about. They have talked

about how the typical television news show account of a scientific event would fill only a paragraph of a newspaper and how newspaper and Internet sites tell much more. She has shared with them the books that she reads for pleasure and encouraged them to do the same. She has assembled a collection of science-related books that she encourages them to check out and read on their own.

This teacher is not a language arts teacher, a reading specialist, or a librarian. She teaches middle school science. After earning a bachelor's degree in secondary education biology 28 years ago, she entered her classroom thinking that her job was to teach *science*, never thinking that part of her job would be to help students transfer their reading and writing skills into science. This was middle school, after all! That sort of instruction took place in the elementary schools. When her students stumbled and fell while attempting to read and write about science, she couldn't understand it. No one had warned her about this problem.

Not willing to let a single student fall by the wayside, however, she joined forces with the district reading supervisor, who was interested in finding ways to help middle and high school students develop their learning strategies in content-area subjects. Now, she still claims that teaching science is her



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students to what they may do when they complete assignments. During this time, students can read *anything*, whether it is science-related or not. Most often, however, they gravitate to the interesting science books in her classroom library. Her school district, like most today, is preoccupied with standards and state testing. Supported by studies by Baumann and Duffy (1997), Krashen (1988), and Pilgreen (2000) that indicate that students' pleasure reading enhances their reading performance and academic work, she

primary responsibility, but her broader goals extend beyond science content. She wants to impart the processes of learning and the passion for literacy.

The bell to start the period rings. Holding up a book from her circulating science library, she says,

Listen to this. "The stomach-brooding frog swallows her eggs or tadpoles into her stomach. When they turn into froglets, they leave via Mom's mouth." You should see the picture! It has the baby peeking out of the mother's mouth. It looks as though she is going to burp up her baby! This book is called *Amazing Frogs and Toads* (Clarke, 1990), and it's here if you'd like to check it out.

Damien stretches forward in his seat and says, "I get it first!" The teacher often begins class with a brief sales pitch for one of the books she has purchased at yard sales, at used book sales, or through book clubs—traditionally the province of language arts teachers only. The titles all relate to science, but they are not textbooks. Through this circu-

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lating library, she invites students to *read*, period, at a time when pleasure reading is often trumped by the competing lures of adolescence. Students take her up on her invitation and discover that reading science can be fun. At the end of the period, Damien rushes to get to *Amazing Frogs and Toads* before Liz and Charmaine, leaving them to search for books that the teacher "sold" last week.

Her students work at different rates. Bothered by the idea that the reward for completing work efficiently should be busywork, the teacher writes DIRT—Daily Independent Reading Time—on her chalkboard each day to direct

knows that DIRT is not a waste of time.

Ultimately, however, her job is to help students learn science. Her science curriculum is in the forefront of her teaching, but the processes of literacy help her deliver that curriculum. She often introduces units and lessons by reading aloud from articles and books that directly relate to her current lessons and units, concurring with Jim Trelease, who says, "Far from suggesting the curriculum be abandoned, I say it should be enriched and brought to life by story" (1989, p. 37). For a unit about diseases, she reads aloud about Alexander Fleming's accidental discovery of penicillin from *Serendipity: Accidental Discoveries in Science* (Roberts, 1989). While the teacher is reading, she sees Melissa get up and go to the bookshelf. She pauses. Melissa says, "Oh, keep going. There's another book over here that tells about this same thing." After searching through the shelves, she finds the book—one that she had read during DIRT.

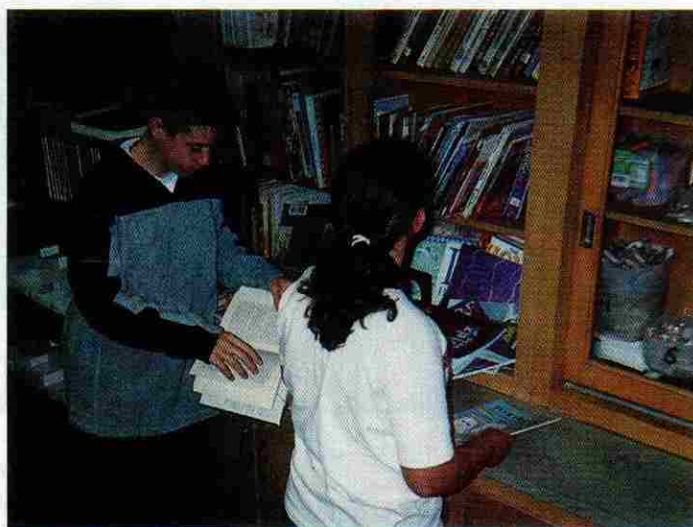
Guiding Reading and Writing in Science

Students in this class not only become interested in reading science, but they also learn how. After reading aloud an account of the discovery of Lyme disease, for example, the teacher gives students an article about it from a science journal. Some argue that difficult readability should preclude the use of such sources, but this teacher regularly provides primary source material—from magazine and newspaper articles, pamphlets, brochures, and the Internet—for the latest updates in science. She accommodates the difficulty in readability by previewing the Lyme disease article and giving students a printed guide that calls their attention to key facts, ideas, and organizational patterns in the text. The guide invites their responses and provides a chart on which they can organize the information that they find.

She helps students develop a repertoire of strategies for dealing with science and other content-area texts. Reading guides (Wood, Lapp, & Flood, 1992) alert students to the text's organization and key ideas. K-W-L (Ogle, 1986) helps students think about what they *know*, *want to know*, and what they *learned* from texts and lectures. RAFT (Santa, 1988) helps them strengthen the clarity of their writing by assuming different *roles*, writing to different *audiences* in different *formats* about the *topics* that they study in her class.

She and the reading supervisor have devised a strategy that they call Text Boxes to help students slow down their reading and monitor their comprehension when reading difficult texts about unfamiliar topics. The boxes of a reading guide correspond with the

She has assembled a collection of science-related books that she encourages students to check out and read on their own.



Students select their own reading materials from the science room's bookcase during DIRT—Daily Independent Reading Time.

paragraphs, diagrams, and photos on a particular page of the text. Each box has two columns; students take notes about important facts and ideas in the first, and reflect and question the text in the second. They have developed the Listen-Stop-and-Write technique, breaking the teacher's lecture into three-minute segments interspersed with two-minute writing periods, which helps students focus on their listening and note-taking (Topping & McManus, 2002). The teacher also designs assessments to reinforce learning. For example, just before students take a test on DNA, she plays a short clip from the movie *Jurassic Park* and asks students to watch, listen for, and list the DNA vocabulary mentioned in this film. Brains activated and geared toward science, students perform well on the test.

Schoolwide Accountability for Literacy

The school is committed to creating lifetime readers. During a once-a-week, schoolwide sustained silent reading period, everyone—students, teachers, administrators, and support personnel—reads silently from self-selected books. Afterward, everyone writes a response to what they have read. These writings are not book reports; rather, they are opportunities to respond to books by reflecting on what in the books has amazed them, surprised them, or made them laugh. The sharing of these reflections among adults and adolescents are the “grand conversations” about which Atwell (1987) writes.

The school's adults savor the relationships that they develop with students by sharing their respective reading experiences. Maria's favorite subject to read about was dragons. She knew how they ate, their favorite names for their babies, and how

they escaped from tight spots. The teacher was impressed and said so. With the conversation link now open, Maria became comfortable enough to ask the teacher for help in science. Kristina was reading Tom Clancy's *Rainbow Six*, and the teacher noticed that this book kept reappearing week after week during sustained silent reading time. Not wanting to be without a book, Kristina kept this book in her locker from week to week. The teacher, also a Tom Clancy fan, feigned shock:

How can you possibly leave my favorite author in a stuffy old locker and only read him once a week? Doesn't the suspense kill you?

The teacher and Kristina developed a friendly, teasing relationship. Debby began to read romance novels during

Photo by Roberta Ann McManus

sustained silent reading time and shared complaints with the teacher every time the bell rang to end the reading period. One day, the teacher heard a fight outside the classroom door. She went into the hall and saw Debby and another girl clawing and screaming at each other. Summoning her best teacher stare, the teacher said, "Get to your homerooms." Debby looked at the teacher, stopped fighting, and walked into homeroom, while the other girl continued to protest. In homeroom, the other students challenged Debby. "Why did you stop fighting her?" Debby said, "Cuz she [the teacher] is my friend; we talk about books" (Topping & McManus, 2002).

Adolescence is a turbulent time, at best. During this crucial period of their lives, students should have an opportunity to forge bonds with significant adults through literacy. The science teacher hopes that her students will not only learn science, but will also learn the skills and rewards of literacy that will continue throughout their lives. Establishing a community of readers and writers is the place to start. ■

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