FEATURE

Evaluating SCIENCE Information with Thinking Routines

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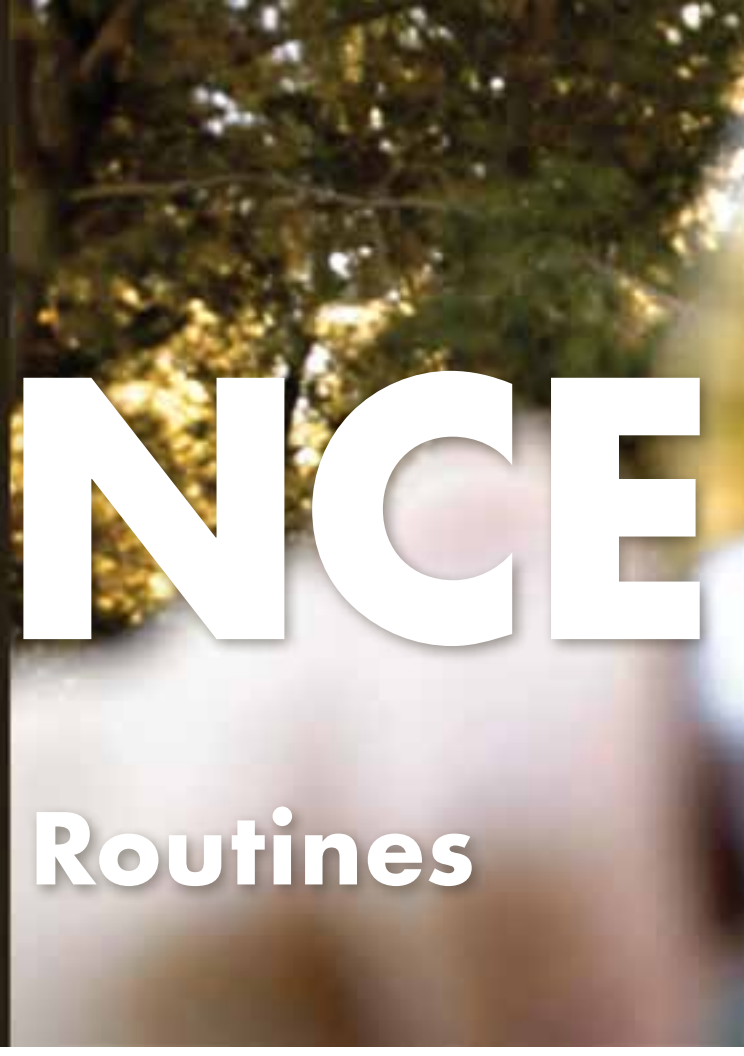

2010 Science Books & Films Finalists for the Middle Grades Science Book Prize for Excellence

Chaikin, Andrew, Victoria Kohl, and Alan Bean. 2009. *Mission Control, This Is Apollo: The Story of the First Voyages to the Moon.* New York: Viking.

Deem, James M. 2008. *Bodies from the Ice: Melting Glaciers and the Recovery of the Past.* Boston: Houghton Mifflin.

Siy, Alexandra. 2009. *Cars on Mars: Roving the Red Planet.* Watertown, MA: Charlesbridge.

Thimmesh, Catherine. 2009. *Lucy Long Ago: Uncovering the Mystery of Where We Came From.* Boston: Houghton Mifflin.

Turner, Pamela S. 2009. *The Frog Scientist.* Boston: Houghton Mifflin.

Science Books & Films, the journal of the American Association for the Advancement of Science (AAAS), reviews books for young readers in the sciences to identify winners of these categories: Children's Science Picture Book, Middle Grades Science Book, and Young Adult Science Book. At each age level five finalists are selected for the annual AAAS/Subaru SB&F Prize for Excellence. This January my fifth-grade classes are analyzing and evaluating the middle grade finalists.

To provide criteria for the evaluation process, I have adapted a rubric created by D. Timothy Gerber, associate professor of biology at the University of Wisconsin-LaCrosse. He has created a Mock SB&F Prize for Science Books webpage with his rubric and other information, which can be found on the UW Murphy Library website (AHCRC 2009).

Students use the following criteria to assess these potentially award-winning science books:

- language
- visual presentation
- organization/text structure
- presentation of facts
- supplemental materials (index, table of contents, maps, timelines, bibliography)
- gender and racial representation
- interest to middle schoolers

In conjunction with the rubric (see figure 1), I have decided to use some of the thinking routines I've learned in the Project Zero Institute at Harvard Graduate School of Education. Thinking routines are approaches to instruction that foster a culture of thinking within the classroom—and help develop good thinking dispositions among students (Harvard 2008).

NOT MET	ADEQUATE	CRITERIA	GOOD	EXEMPLARY
		The book is engaging to students in grades 5–8.		
		The book is appropriate for students in grades 5–8.		
		The book has a clear purpose and is well-organized.		
		The scientific concepts are accurately presented. The book contains no serious errors or deficiencies in explanations of science content or processes.		
		The science portrayed in the book is open to inquiry and should encourage the reader to ask questions.		
		When fitting, the book shows both men and women of different ages and backgrounds are involved in science.		
		The book encourages students in science to reflect on the science they are engaged in.		
		The visual representations accurately depict the scientific concepts being examined.		
		The visual representations provide an alternate way for students to examine the concepts being discussed in the text.		
		The visual representations engage the young reader and enhance the text.		
		Captions accompanying each visual representation follow the above criteria.		
These criteria are based on the official SB&F award criteria.				

Figure 1. Mock SB&F Prize for Science Books rubric.

The Elaboration Game

As a group, observe and describe several different sections of an artwork.

1. One person identifies a specific section of the artwork and describes what he or she sees. Another person elaborates on the first person's observations by adding more detail about the section.

A third person elaborates further by adding yet more detail, and a fourth person adds yet more.

Observers: Only describe what you see. Hold off giving your ideas about the art until the last step of the routine.

2. After four people have described a section in detail, another person identifies a new section of the artwork and the process starts over.

Creative Questions

Brainstorm a list of at least 12 questions about the artwork or topic. Use these question-starts to help you think of interesting questions:

Why . . .?

What are the reasons . . .?

What if . . .?

How would it be different if . . .?

Suppose that . . .?

What if we knew . . .?

What would change if . . . .?

Review your brainstormed list and star the questions that seem most interesting. Then, select one of the starred questions and discuss it for a few moments.

Reflect: What new ideas do you have about the artwork or topic that you didn't have before?

"The purpose of teaching thinking is to prepare students for a future of effective problem solving, thoughtful decision making, and lifelong learning…But simply having a skill is no guarantee that you will use it. In order for skills to become part of day-to-day behavior, they must be cultivated in an environment that values and sustains them" (Tishman, Perkins, and Jay 1995, 1–2).

Specifically, we are using Elaboration Game, Creative Questions, and Think/Pair/Share at various stages of the evaluation process. For example, as an introduction to the visual presentation of the books, students are using the Elaboration Game to practice looking closely and deeply at visual material, reflecting on what they are observing, and finally, reflecting on their thinking about their observations.

We projected a photograph from *Bodies from the Ice* onto a screen in the front of the classroom and played the Elaboration Game. (Students also had a color copy of the photograph at their tables for closer evaluation.) I divided the screen into four quadrants, and we explored one quadrant as a whole class using the steps in the routine. At their seats, the students then explored the remaining quadrants in small groups. Next, I used the Creative Questions routine. I recorded their final questions on chart paper so that we would have a visual record of what everyone was thinking.

Among the questions raised were:

- "What are the people doing?"
- "Are there more people [than those in the photograph], and how long will they be there?"
- "Where does the stream come from and where does it lead?"
- "Are these people scientists?"
- "What is the elevation?"
- "Is the machine a pump?"
- "Do they work for one country or are they from all over?"
- "Are they conducting a science experiment?"
- "Are they collecting water samples?"
- "I wonder if the people are doing construction."
- "Who took the photograph?"

At the end of the routine, I asked the students to reflect by answering questions about their thinking process:

What was good about the thinking you did?

"It really stretched our brains." "We learned to get better at making observations by practicing." "We discovered a lot of things [together] I could not see alone." "I didn't just blurt things out." "Look closely—people tend to overlook things." "I think that I saw what the thing physically looked like." "I trained my brain to observe better."

What could have been better? What will you do next time to improve your thinking?

"My group went off track sometimes." "I could have tried to make less obvious observations." "I will use a magnifying glass." "I made a lot of inferences instead of observations—I will try to focus on what I SEE!" "I didn't look hard enough."

Reflection is an important and continual process in the thinking classroom. Students are asked to reflect on their thinking in specific ways using different protocols. Teachers, too, must continually reflect on what they see as evidence of student thinking. I noted that their observations and descriptions continued to build and deepen as they became more experienced. At first I had to point out that one comment was an interpretation, rather than an observation, but soon each student was correcting his or her own inferences, or students let a peer know when he or she was making an inference rather than an observation.

Evaluating the Science Books

Working through one book at a time, students examined and discussed the visual images with a partner. They used a rubric for each book, filling in details to support their judgments. For example, comments on the visuals in *The Frog Scientist* ranged from "exemplary" to "not met." Those giving the lower rankings were concerned with a photograph of a frog dissection. They wrote that while it might be appropriate for eighth-graders, it was "too gory" for fifth-graders and, therefore, not a successful or appropriate photograph.

To evaluate the organization of the text and its supplemental materials I used a routine called Think/Pair/Share. Students were given these questions: What determines if a nonfiction book is well organized? What kinds of additional materials are needed to aid the student in reading a nonfiction book? They thought for two minutes, shared their ideas with a partner, then thought for two more minutes and recorded any new ideas. These final thoughts were posted so that everyone's thinking was "made visible," and so we could share and refer back to the ideas as the project continued.

This article will have gone to press before the students have completed their analysis of language and representation of facts in the books. Questions they will wrestle with while reading the books in their entirety will include: How is the use of language distinctive? How does the narrative engage you? What makes the book hard to put down?

And before analyzing the facts and scientific processes presented, I will continue to ask questions to lead students in formulating their own questions about language and accuracy: Are the relationships between ideas, facts, and scientific process shown in a way that you can understand? Has the author left open the door for new ideas or new ways of thinking about old ideas, especially if the book concerns itself with current and changing material (Pluto, for example, or wind energy)?

As librarians and educators we want students to develop into effective users of information, but before that can happen, we must be certain they think critically about the resources they read. To do a close reading and analysis of anything, one must possess the disposition toward inquiry that the AASL standards for learners (2007) identify, and that Project Zero thinking routines foster and demonstrate. When students evaluate in a methodical and rigorous manner some of the best science books available to them, they exhibit sustained intellectual curiosity and attention over time. Developing intellectual stamina is both fruitful and necessary for developing into independent researchers and is essential to become part of a participatory culture in which it is all too easy to react emotionally rather than respond intellectually.

Works Cited:

Alice Hagar Curriculum Resource Center. 2009. "Mock SB&F Prize for Science Books Election." <www.uwlax.edu/murphylibrary/departments/curriculum/stem/mocksb&f.html> (accessed November 24, 2009).

American Association of School Librarians. 2007. "Standards for the 21st-Century Learner." <http://ala.org/ala/mgrps/divs/aasl/guidelinesandstandards/learningstandards/AASL_LearningStandards.pdf> (accessed November 18, 2009).

Harvard Graduate School of Education. 2008. *The Project Zero Classroom* 2008: Views on Understanding. Cambridge: Harvard Graduate School of Education.

Sosa, Maria. 2009. "Selecting Science Books for Children." *Science Books & Films.* <http://beta.sbfonline.com/articles/Pages/SelectingScienceBooksforChildren.aspx> (accessed November 18, 2009).

Tishman, Shari, David N. Perkins, and Eileen Jay. 1995. *The Thinking Classroom: Learning and Teaching in a Culture of Thinking.* Boston: Allyn and Bacon.

Initial Questions to Consider about Visual Representations

Are the photographs, illustrations, and other graphics engaging?

Are they appropriate for middle schoolers?

Are they necessary?

Do they provide an alternate way to examine the concepts being discussed in the text?

Do the captions explain/enhance the pictures?

When appropriate and fitting, are people of different ages, genders, and backgrounds shown involved in science?

Think/Pair/Share: Active Reasoning and Explanation

This routine "involves posing a question to students, asking them to take a few minutes of thinking time and then turning to a nearby student to share their thoughts."

Adapted from Frank Lyman. (1981). "The Responsive Classroom Discussion: The Inclusion of All Students." In A. Anderson (Ed.), *Mainstreaming Digest* (pp.109–13). College Park: University of Maryland Press.

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