The National Science Education Standards suggest that middle school science teachers use “historical examples...to help students see the scientific enterprise as more philosophical, social, and human” (NRC 1996). Fortunately for today’s science teachers, science-related, historical nonfiction has become a popular literary genre; teachers can select books on a wide range of topics to help learners of all ages explore the history and nature of science. (See Figure 1 for a list of titles appropriate for young adolescents, Figure 1 on page 28 of the Jackson article, or NSTA Recommends in each issue of Science Scope.) However, the reading of these books alone does not necessarily lead students to make personal connections to science or understand science as a human endeavor interdependent with culture, society, and history. Teachers must structure students’ reading to ensure that they consider specific aspects of science while reading and discussing books. One way for teachers to focus their students’ attention on components of the nature of science is through the use of literature circles.
Literature circles

Literature circles were initially developed for young adolescents’ classroom reading (Daniels 1994) and have since grown to be a very popular choice for middle school language-arts teachers. Literature circles are “small, temporary discussion groups” in which students are provided prompts or roles (Daniels 1994). The purpose of literature-circle roles is to guide students to develop understanding of particular concepts as they explore the text and meaningfully participate in small-group discussion. As students are reading, they perform specific roles and take notes that are used to support participation in small-group discussion. Several basic roles appropriate for the reading of most books have been offered by Daniels (1994) (see Figure 2). In addition to these all-purpose roles, others have been designed specifically with the goals of focusing students’ attention to issues of the nature of science and promoting students’ connection with science as they read historical nonfiction (Straits 2005; Straits forthcoming):

- **Everyday Life Connector**—Search the reading for events, ideas, characters, objects, and so on that remind you of everyday life. Pay particular attention to science concepts.
- **Science Skeptic**—Analyze how science is done in the book. How does it compare to our inquiry investigations? Consider specific aspects of experimental design. For example, are scientists in the book controlling variables, repeating their tests, avoiding bias, and using a large enough sample size?
- **Power Investigator**—Sometimes people with political, social, and/or economic power influence science. For example, they might determine who does science and who does not, or which ideas are investigated and which are not. Find out which group(s) have power and list a few ideas about how they are using their power to help or get in the way of scientists.
- **Science Translator**—While reading, take note of science vocabulary and concepts in the book. Use the internet, textbook, and other sources to find out more information about these ideas.
- **Historian**—Scientific developments of the past are
described in the book. Find out other things that happened at the same time (e.g., 1368–1644, Ming Dynasty; 1819, birth of Walt Whitman; 1908, Chicago Cubs win World Series)

• Science Biographer—As you encounter different people doing science in the reading, use sources such as the textbook and the internet to locate interesting biographical information about each person, especially those connected to science.

• Nature of Science Investigator—There are several factors that accurately describe science (scientific knowledge is based on evidence; scientists can never know for certain that a conclusion is correct; scientific knowledge changes over time; there are multiple ways to solve problems in science; scientists are often very creative in their attempts to solve problems; and scientists are people, influenced by their own personal beliefs and by society). While reading, look for examples of these factors in the book.

• Science and Culture Connector—Science is greatly influenced by culture (the beliefs and values of particular societies at particular times in history). Consider ways science was influenced by culture in the past and ways that science is influenced by our culture today.

Group meetings are important times of learning as they provide a forum for active reflection that promotes the development and sharing of meaningful, personal connections to learning. During discussion in their small groups, students can use information gathered via roles to help clarify meaning, draw parallels to other situations, articulate related personal experience, offer additional information, critique and analyze the text, and connect the text to the nature of science and investigative skills learned in class. While discussions are prompted and guided by literature-circle roles, conversations are far from limited to simply reporting information; roles should enrich conversations, not delineate them. It should be made explicit to students that “group meetings aim to be open, natural conversations about books, so personal connections, digressions, and open-ended questions are welcome” (Daniels 1994). In fact, it is these personal connections that are of particular value when discussing the interaction between science and social influences such as economics, history, culture, politics, and so on. For example, while discussing a book about inventions or discoveries of the past, students may talk about current events, their own family and personal experiences, as well as any number of topics ranging from professional athletes to today’s environmental policies and concerns.

At the conclusion of each discussion, group members rotate roles and decide on a new section of text to be read. When the entire text has been completed,
often after several group meetings along the way, group members create a presentation that represents their understanding of the topics/texts explored. These final presentations may take on any number of creative forms, such as impersonations of characters, an interview with the author(s), a news broadcast reporting events from the text, or a eulogy for a character (the preceding suggestions as well as many others are explained in Daniels 1994). Final presentations are valuable as they require students to organize information in unique ways, thereby demanding higher-level learning. The presentations serve as an opportunity for assessment and arouse the interest of other students in the topics/texts presented. If time allows, students can then choose new topics/texts, form new groups, and begin another round of literature circles.

**Why literature circles work**

Readers may approach the book from a more information-based or emotion-based stance depending on their individual purposes for reading. The information-based, or *efferent*, stance accentuates the meaning readers take from the book, whereas the emotion-based, or *aesthetic*, stance prioritizes the previous experiences that readers bring to the text (Rosenblatt 1978). As they are reading a book, individual readers may be oriented to any point along the continuum between efferent and aesthetic, based on textual clues and an individual’s expectations and reasons for reading. For example, most fictional books orient readers toward the aesthetic. However, there is often a great deal of information to be taken from these texts. Consider Jack London’s *To Build a Fire*, in which London visits a familiar theme, the folly of man’s presumed superiority over nature. In this short story, a man and a dog take an ill-fated hike in the subfreezing temperatures of the Yukon Territory and the man’s fear, panic, and ultimate acceptance of death are detailed as he freezes to death, unable to build a fire. Readers may bring with them fear of cold, hunger, and death, fears that surface in them as they read. However, they can also take from this story information about seasonality and the tilt of the Earth, the biotic and abiotic features of the taiga, and human physiology and thermoregulation. Likewise, students come pre-positioned toward the efferent while reading most assigned science texts, including historical nonfiction. To identify with science and to see it truly as a human struggle, endeavor, passion, and need, students must be taken explicitly from their efferent stances and guided to view science reading from an aesthetic stance. Literature-circle roles are invaluable as they can guide learners toward both efferent and aesthetic interactions with text.

**Final considerations**

Literature circles are an extremely flexible instructional strategy; there is no one right way to use them. However, as you plan your instruction you may want to consider these lessons learned.

- **Text selection**—Success with literature circles depends on the text selected as well as the reading interests and abilities of students. In selecting books to use, it is beneficial if the topic(s) covered in the text parallel concepts taught in class. For example, classroom instruction about atomic theory, isotopes, and radioactive decay should be provided in concert with literature circles reading books that describe Marie Curie or the Manhattan Project. Your students are another important consideration.

**FIGURE 2**

Generic literature-circle roles developed by Daniels (1994). These roles have become mainstays of the literature circles classroom and are appropriate for use with texts of nearly any topic.

- **Questioner:** Your job is to write down a few questions that you have about this part of the book.
- **Literary Luminary:** Your job is to locate a few special sections or quotations in the text for your group to discuss.
- **Illustrator:** Draw some kind of picture related to the reading you have just done. It can be a sketch, cartoon, diagram, flowchart, or stick-figure scene.
- **Summarizer:** Your job is to prepare a brief summary of today’s reading.
- **Researcher:** Your job is to dig up some background information on any topic related to your book.
- **Word Wizard:** Your job is to be on the lookout for a few words that have special meaning, are puzzling or unfamiliar, or stand out in the reading.
- **Scene Setter:** Your job is to carefully track where the action takes place during the daily reading. Describe each setting in detail.
in text selection. Ask colleagues and/or review student files to get a sense of individuals’ reading abilities. Encourage students to select texts at their reading level. Finally, don’t judge a book by its cover; be sure to read the books yourself before assigning them.

- **Group size**—Not all literature-circle roles need to be completed by each student or in preparation for each group meeting; group size is not dictated by the number of roles. Rather, group size should maximize the participation and learning of group members. Groups of three to five are generally preferred as they are large enough to allow for varying viewpoints and rich conversation and small enough to allow opportunities for members to contribute.

- **Time**—A basic premise of the circles is that the most meaningful learning comes not from the reading of text, but from the discussion of text. Optimally, students would meet in their discussion groups two or three times per week. However, more important than the number of meetings is the length of the meetings. As with most science instruction, longer intervals of time are ideal. Allow a minimum of 25–30 minutes per group meeting. If your schedule allows 60 minutes per week for discussion groups to meet, consider two longer meetings rather than three short ones. Whatever schedule you decide, stick to it! A recipe for disaster is to hold literature-circle meetings “if time permits.” Depending on the frequency of meetings and the length and difficulty of the texts, a single literature-circle cycle may last a few to several weeks. Whatever the duration, throughout the reading assignment remember that reading their texts and performing literature-circle roles represent a significant time demand for students—adjust other homework assignments appropriately.

- **Assessment**—Monitoring student discussion and roles can provide opportunities to give students feedback about their preparation for and participation during discussions. In addition to serving as formative assessment, monitoring student discussion will allow teachers to gather ideas for more formal assessments. Guided by roles, students will often ask extremely important discussion questions, compelling group members to explore personally meaningful connections to the text and the science presented within it. These very questions may be used later as individual summative assessments. Finally, group presentations provide opportunities for students to engage in higher-level learning as they synthesize a representation of their learning from the text and discussions and provide opportunities for you to assess each group’s ultimate learning outcomes.

- **Teacher’s role**—During discussions the teacher’s role is one of facilitator. Productive and meaningful group discussion does not just happen; students will require support and prompting as they learn to discuss respectfully and productively. Taking time as a class to brainstorm the elements of productive discussions can be a valuable exercise. Also, as you read the texts in preparation for literature circles, it’s helpful if you perform some of the roles yourself. These will provision you with questions, discussion topics, insights, and connections of your own to offer to groups that may need some prompting during their discussions. Finally, when all other groups are running smoothly, it is a great idea to join a literature circle as a group member. This participation has two key benefits. It will allow you to demonstrate for your students techniques for productive, respectful, and inclusive discussion and, most importantly, it will allow your students to see an adult’s genuine enthusiasm for reading about the history of science.

**References**


William Straits (wstraits@csulb.edu) is an assistant professor in the Department of Science Education at California State University, Long Beach in Long Beach, California.