I promise I did the reading homework, and I answered all the questions, but I still don't get it!” When I heard these heartbreaking words spoken by Larry, the most proficient reader of all my eighth graders, I knew it was time to help students develop reading comprehension skills in science class. During a yearlong action-research adventure into reading in the content area, I collaborated with a reading specialist in my building, Danielle Johnson, to experiment and modify my way to a lesson in which students successfully practiced reading comprehension skills while developing an understanding of earthquakes. Not only did this lesson help students gain an understanding of the impact of earthquakes, a subject embedded into my state’s eighth-grade science curriculum, but it also addresses one of the new Common Core State Standards for literacy in science, which says students should be able to “cite specific textual evidence to support analysis of science and technical texts” (CCSSO and NGA 2010).
To begin our unit on earthquakes, students plotted the locations of past earthquakes on a world map to reveal fault lines and tectonic plates. This lesson, which can be retrieved from www.mysciencebox.org/bigquake, provided a surface-level look at a large number of earthquakes. Because we live in an area that rarely experiences earthquakes, I wanted to give students a better understanding of the magnitude and impact of these disasters. In my next earthquake lesson, I had students take a deeper look at earthquakes by reading articles about a few historic earthquakes.

In earlier reading lessons, students had struggled to ask questions about the text before reading. When I helped them to ask questions before reading, they failed to rely on the text to answer those questions. However, I knew that questioning was a strategy that would help my students become better readers of science texts, especially since questioning is so key to the work of scientists. In addition, literacy experts Harvey Daniels and Steven Zemelman (2004) recognize questioning as a strategy that is essential to becoming an effective reader. Therefore, I decided to focus on it for this lesson.

**Before reading**

I began the lesson with the following scenario: “I have just developed a time machine!” I told students. “To begin our study of earthquakes, we are going to go back in time to a past earthquake and help the affected people clean up. Your job today is to decide which earthquake’s victims need our help the most.” Providing students with a simple scenario such as this one gives them a purpose, which affects all aspects of their reading: It helps students know what to focus on, aids them in remembering information, and frames how they think about the reading (Tovani 2000).

Next I asked the whole group, “What information should we record about our earthquakes while reading in order to make an informed decision?” Larry shot his hand into the air: “We need to know the location of the earthquake,” he said. Upon hearing Larry’s comment, Emily, another proficient reader, asked, “What about the property damage?” After this spontaneous modeling of the questioning skill, my other students became eager to participate. With minimal prompting from me, their questions flowed into a conversation; I recorded all of their questions on the board:

- How many people died?
- Even if people didn’t die, wouldn’t they still be affected?
- How many people were affected?
- What about all the buildings—were they affected?
- If it’s in the middle of nowhere, does it not matter?
- What about farmland in the middle of nowhere? Couldn’t that be hurt?
- Are some earthquakes stronger than others?
- Don’t earthquakes cause tsunamis?
- Do they cause any other disasters?

Questioning the text is important because it can help clarify meaning, which can lead to more accurate recall of the text and a greater level of understanding (Tovani 2000). One of my quieter classes was slow to volunteer questions for this reading, so I tapped into their prior knowledge about earthquakes by asking, “What do earthquakes do?” A student responded, “They destroy buildings!” I then modeled how to turn that thought into a question by saying, “Maybe we could ask how much property damage the earthquake caused,” and asking, “What else do earthquakes do?” Another student responded, “They hurt people.” So I asked, “How could we turn that thought into a question?” The same student responded, “We could ask how many people died.” This modeling prompted more question asking by various members of the class.

To prevent the explosion of thoughts on the board from overwhelming students, I asked the class to categorize the questions. One student commented, “Look at these three questions: Where were the earthquakes? What was the population? What was the geography like? They all talk about the location of the earthquake.” In a similar fashion, students created three more categories: magnitude, people, and property. To organize their thoughts, students put the four categories and their corresponding questions into a large graphic organizer (see Figure 1). One of my less proficient readers commented, “I’m glad we categorized these questions, because it will help me to make sure that I find all of the important information in the reading, and it will help me to organize my information.”

**Using the text to address questions while reading**

I used reading proficiency data to divide my class into groups of three students. Each group had one more-than-proficient reader, one proficient reader, and one below-proficient reader. Each group member read a different article from the United States Geological Survey Historic World Earthquakes ar-
chive (see Resources). This free resource provides information on nearly every earthquake on record. While the articles are interesting and informative, most are too advanced for eighth-grade readers, so I made adjustments to each reading by deleting some of the less important information and changing the more advanced vocabulary. I modified each of the three articles so that I had three different levels of difficulty.

My students studied the 1811–1812 New Madrid earthquake, the 1906 San Francisco earthquake, and the 1964 Alaska earthquake. I chose these three earthquakes because they provided a variety of settings that led students to consider many different issues, such as the differences between urban and rural settings, the differences between warm and cold settings, and the possibilities of multiple earthquakes or major foreshocks and aftershocks. Each reading explained the location and magnitude of a particular earthquake, noted whether that earthquake caused foreshocks, aftershocks, or other natural disasters, and described the devastating effects of the earth-

**FIGURE 1** Earthquake-questions graphic organizer

<table>
<thead>
<tr>
<th>Location: Where was the epicenter? What is the population like at the epicenter? What is the geology like at the epicenter? What other areas felt the effects of the earthquake?</th>
<th>Magnitude: What was the magnitude of the earthquake? What other events or earthquakes accompanied the earthquake?</th>
</tr>
</thead>
<tbody>
<tr>
<td>People: How many casualties were there? How many people were affected?</td>
<td>Property: How were man-made structures affected? What is the estimated property damage? How was the land affected?</td>
</tr>
</tbody>
</table>
shake it up with reading

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Earthquake discussion student response sheet

The earthquake that my group chose to help clean up is ____________________________________________________________.

The first reason we chose this earthquake over the others is because this earthquake ____________________________________________________________, while the other earthquakes ____________________________________________________________.

The second reason we chose this earthquake over the others is because this earthquake ____________________________________________________________, while the other earthquakes ____________________________________________________________.

The third reason we chose this earthquake over the others is because this earthquake ____________________________________________________________, while the other earthquakes ____________________________________________________________.

Discussing and comparing readings

After reading, students presented the earthquake they read about to the other students in their group and then worked with their group to decide which earthquake’s victims to help. I gave each student a minute and a half to present the earthquake to the group and then gave the groups five minutes to discuss and decide which earthquake victims to help. I required the groups to provide three reasons why they chose one earthquake over the others, which made for rich discussion and critical thinking among group members. For example, one group responded, “We chose to help the New Madrid earthquake victims because they experienced three earthquakes that had magnitudes greater than 7.5 and a lot of aftershocks, while victims of the other two earthquakes only experienced one earthquake and less aftershocks. Second, the New Madrid earthquake destroyed the victims’ farmland, which is how they made their living. Third, the earthquake hit a rural area, which may have less people to help out than a city.” Since each group member was responsible for providing information about a particular earthquake to the group, students took ownership of the project, resulting in high participation levels. In addition, I

FIGURE 2 Earthquake discussion student response sheet

The earthquake that my group chose to help clean up is ____________________________________________________________.

The first reason we chose this earthquake over the others is because this earthquake ____________________________________________________________, while the other earthquakes ____________________________________________________________.

The second reason we chose this earthquake over the others is because this earthquake ____________________________________________________________, while the other earthquakes ____________________________________________________________.

The third reason we chose this earthquake over the others is because this earthquake ____________________________________________________________, while the other earthquakes ____________________________________________________________.
required students to individually record the group’s decision on their own response sheet (see Figure 2), which held them accountable for participating.

To wrap up the lesson, I took a poll to see which earthquake victims each group wanted to help. I asked a group who supported the New Madrid earthquake to share one reason why the group chose it. In order to promote a debate, I asked a group supporting each of the other two earthquakes to share a counterargument. Excitement rose as students argued their cases. We proceeded in this manner until most of the groups’ ideas were shared. I required each group to share at least one argument in order to promote full class participation. This seven-minute discussion allowed students to expand their thinking and realize how dynamically different earthquakes can be. It also enforced the importance of using supporting ideas to make a strong argument.

Assessment
After this exercise, I assessed students’ understanding of earthquakes and their general comprehension of the text. Students’ graphic organizers demonstrated their level of understanding of the effects of earthquakes, the magnitudes of earthquakes, and the other disasters that surround earthquakes. In addition, through students’ discussion response sheets, I determined their level of comprehension of the text and critical thinking.

Conclusion
In this science reading lesson, I required my students to decide what information would be important in the text, read to find the information, and then rely on the information to solve a problem. Because there was not a specific answer to the problem, students were able to explore their own ideas. This project helped them to question the text, address the text with their questions, and synthesize information while problem solving.

In the future, I would like to explore this strategy with other topics, such as comparing other natural disasters, ecosystems, or environmental issues. I am currently working on a similar project where students will explore and compare the different causes and issues related to global climate change.

When I ended this lesson, I was confident that my students could find answers to scientific questions on their own through understanding science texts. At the end of the year, I gave students a survey about the different reading strategies that we used throughout the year. Seventy-nine percent of my students agreed that this strategy helped them to understand the text the best.

References

Resources
My science box: The big one—www.mysciencebox.org/bigquake

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