

TRANSPORTING STUDENTS INTO THIN AIR

USING
SCIENCE
TO
ENHANCE
READING

by Patricia Bricker, Nick Rogowski,
Melissa Hedt, and Nadeen Rolfe

Rarely do teachers take time to blur the boundaries between content areas. If students can be shown how knowledge interrelates, they can use the information taught in one class to help them with the material in another. The burden of covering vast amounts of content will be eased if teachers work together, showing students how to use the information they already know.

—Tovani 2000, p. 64

Any teacher who has taught a typical middle school class knows the challenges of meeting the needs of a diverse group of students. How do I teach my required curriculum, support students who are struggling, and enrich instruction for those who are gifted? With this in mind, the *Into Thin Air* unit was designed as an interdisciplinary unit for a small group of academically gifted sixth-grade students.

Unit planning began with language arts and social studies teacher Nadeen Rolfe. She started the year with a unit on geography and then transitioned students into reading nonfiction texts. She chose Jon Krakauer's *Into Thin Air* because the book allowed her students to engage in a highly motivating inquiry about what it would be like to climb Mount Everest. Additionally, the book highlights many science and social studies standards and is a high-level nonfiction read for her academically gifted students. Hands-on science exploration would enhance students' understanding of the text while giving them real-world applications of science concepts. More importantly, students could understand the interconnectedness of subject areas. Nadeen decided to partner with the school's science/mathematics instructional coach, Nick Rogowski. Together, they generated science learning outcomes connected to the *Into Thin Air* text and created lessons that included hands-on, minds-on activities that would immerse students in the scientific, social, and personal struggles people face while attempting to climb the world's tallest mountain. The unit successfully blended science, language arts, mathematics, and social studies goals through a combination of independent reading, thought-provoking conversations, reflective writing, and hands-on science investigations. In this article, we highlight the reading strategies used.

PAVEL NOVAK

A close look at the implemented reading strategies

The use of reading strategies is key to successful reading of any text, but especially important for comprehension of challenging nonfiction texts like the ones selected for the *Into Thin Air* unit. Adolescent students can have a tendency to read fluently, but not necessarily understand and process everything they are reading. The sixth graders involved in this unit read at exceptionally high levels and are accustomed to reading texts in school far below their own levels. The use of reading strategies is essential for these readers to support comprehension of higher-level texts and keep them engaged with the topic and texts.

Engaging text at an appropriate reading level

All the students in Nadeen's classes were reading nonfiction and informational texts. These types of texts are being emphasized at Asheville Middle School because comprehension of nonfiction is the largest area of weakness in reading for students. Nadeen wanted to be able to teach all of her students how to read nonfiction and to effectively negotiate text styles, text features, content-specific vocabulary, illustrations, and captions. She knew from experience that choosing the right text for students was critical, especially with nonfiction texts, which students often find more challenging and less engaging to read. *Into Thin Air* seemed a great match for this group of high-level readers for several reasons: It reflects students' interests, is at a high-reading level, is longer in length (372 pages), allows for a deeper level of thinking about complex issues, and is simply a fabulous read. Basically, *Into Thin Air* struck the balance Nadeen needed to engage and challenge her high-level readers with a nonfiction text.

It has been a priority at this school to acquire multiple copies of engaging texts, especially nonfiction texts, and a book for each student was readily available in the school and classroom libraries. In the past, we have been able to pull together text sets by blending books from school, public, and classroom libraries. While this particular text was known to the teachers

because of their own personal reading, we often choose texts from the NSTA/Children's Book Council Outstanding Science Trade Book lists that are published each March and from the NSTA Recommends reviews (www.nsta.org/recommends).

Text sets to present multiple perspectives

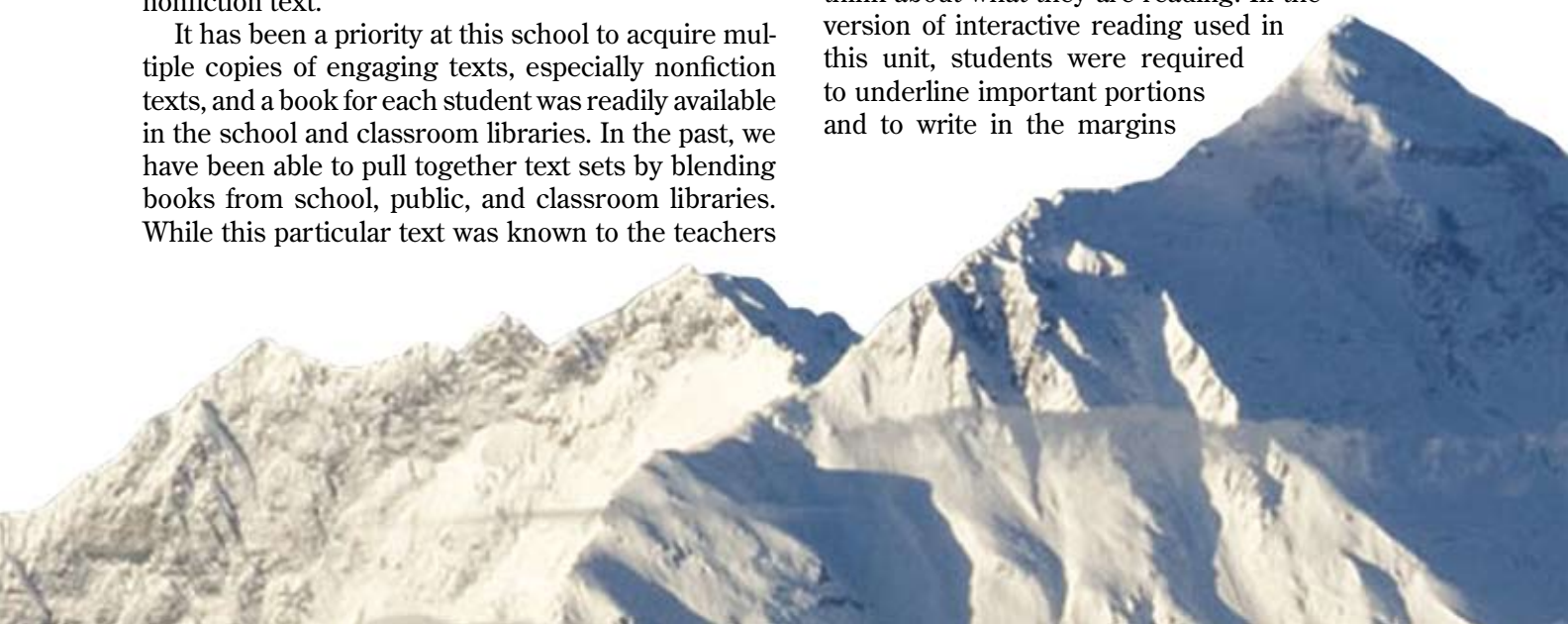
I liked it when we were reading the book and we had all the second articles because if I was reading the book and I didn't understand something, it explained it in the articles. Like why helicopters don't fly above certain elevations. It's because the air is too thin and the helicopter blades can't catch enough air and there's not enough air to be able to hover.

—Will, sixth-grade student

To help students more fully understand ideas connected to the text, Nadeen and Nick found short articles and compiled them into the student notebooks that were created in small binders specifically for this unit. These articles addressed both science and social studies concepts, including the geography and climate of Mount Everest, social aspects of climbing the mountain, scientific connections, and additional perspectives on what it would be like to climb Mount Everest. An article about the native people of the area (Sherpas) discussed how these people helped visitors climb the mountain and what Tibetan prayer flags mean. There were articles that explained in greater detail how hail is formed and the process of becoming frostbitten. Several maps were included, as well. The variety of resources appealed to students' diverse interests.

Interactive reading

Interactive reading supports comprehension by engaging students with the text, forcing them to really think about what they are reading. In the version of interactive reading used in this unit, students were required to underline important portions and to write in the margins



using sticky notes when needed (they did not write directly in the borrowed books). Their margin notes were supposed to include questions and connections, as well as any other thoughts that seemed important. The teacher modeled this strategy by reading and thinking aloud while marking her own text, which was displayed with a document camera. Students then practiced the strategy with short passages of text in a guided whole-class setting before using it independently. This strategy provided the teachers with a tremendous amount of insight into what students were thinking and wondering as they read, and was an effective way to monitor student thinking and progress. In some cases, the questions students generated about the articles would be answered later in the book or in upcoming science investigations.

Book-club structure

As students read *Into Thin Air* independently and in their language arts class, Nadeen would have one-on-one conferences with students about their reading while others read or worked on project requirements. Students also met with Nick for science investigations and group conversations about the text. Approximately once a week, the group discussed what was happening in the book and shared their questions or thoughts during these informal discussions. Nick would often ask, “Is there anything you want to talk about from the book?” Occasionally Nick would ask questions such as, “What did you think about this? Any problems with reading?” but the conversations felt more like an authentic adult book club—organic and without premade questions or teacher tasks.

Honoring students and respecting their abilities can be scary territory for teachers because the outcomes can be out of the teacher’s control. Allowing students to read through the book independently, without assigned time frames, and to discuss the book with each other were important factors in the success of the unit. Perhaps because students did not feel bound to the constrictions of typical reading assignments at school, they were more intrinsically motivated to complete the book. They were enthused and excited to talk with each other during the book discussions.

Combining reading with hands-on, minds-on experiences

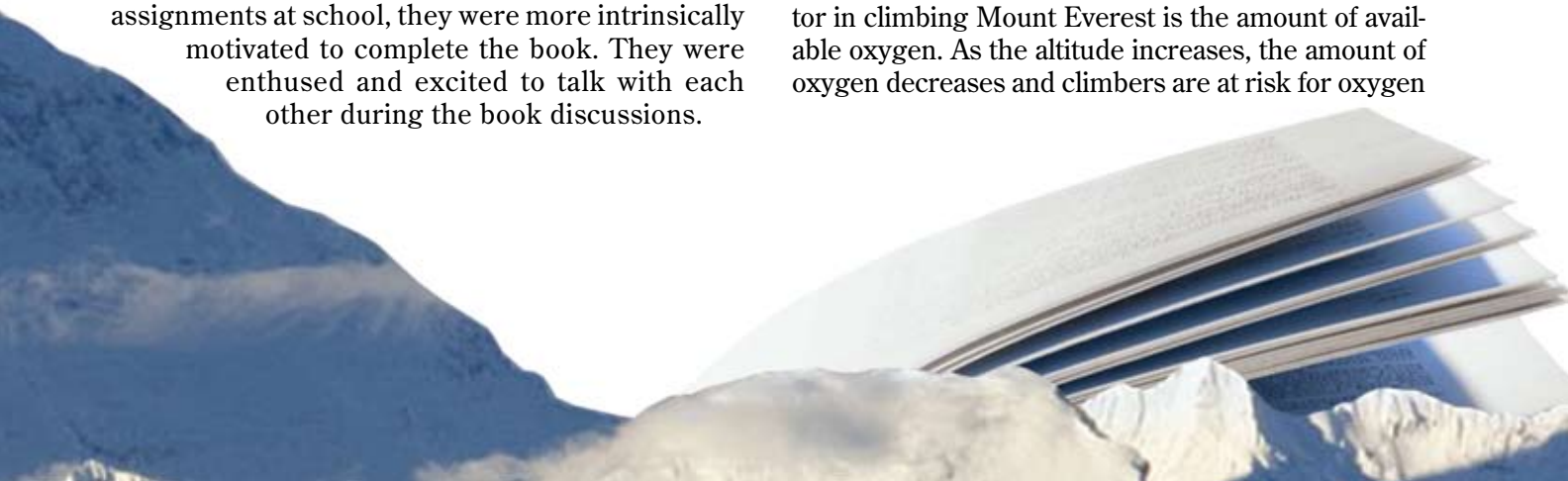
I like the science labs because they really gave an explanation of what was going on in the book.

—Jillian, sixth-grade student

Students spent eight, hour-long sessions working through several investigations with the science instructional coach. All of these investigations were designed to help students understand the unit’s core question—What would it be like to climb Mount Everest? These activities provided students with firsthand experience related to the science content in the texts they had read. This helped spark even more curiosity and interest in the readings, while also enabling students to make deeper connections. The real-world activity of climbing Mount Everest does not fit neatly into one strand of science. Instead, it provides a rich example of how the fields within science blend; as a result, the hands-on, minds-on investigations that were part of this unit incorporate aspects of science as inquiry, physical science, Earth science, and life science. Because this article focuses on the reading strategies used in the unit, only brief descriptions of the activities follow. Detailed activity descriptions can be found in the referenced websites (see Resources).

How can you stay warm? Keeping warm was a definite challenge for the people climbing Mount Everest. In this investigation, students built models of climbers from the book and used varied materials to examine how well common clothing fabrics insulate against the cold. Students gathered temperature data, organized and analyzed the data, and read supplementary articles on frostbite to help create a full picture of what it takes to be protected from the elements on Everest. This investigation helped students learn about scientific inquiry, as well as properties of materials and energy transfer (see the “Keeping Warm” activity in Resources).

Why is it hard to breathe? A very important factor in climbing Mount Everest is the amount of available oxygen. As the altitude increases, the amount of oxygen decreases and climbers are at risk for oxygen



deprivation. In order to help students think about the amount of oxygen in the air, this investigation had students determine the concentration of oxygen in the air at our own location by rusting steel wool. It was accompanied by readings about oxygen levels on Mount Everest. This investigation helped students learn about the atmosphere and human health (see the “O2 Factor” activity in Resources).

What conditions cause hail to form? In *Into Thin Air*, climbers faced significant hail storms. This investigation helped students understand conditions needed for hail to form by having them follow a specific set of procedures (see “Hail in a Test Tube” activity in Resources). While following these steps, students naturally generated their own questions and we jumped from the teacher-guided activity into investigations that were much more student generated.

FIGURE 1

Sample of student reflection through journal writing.

Trash

The Sagarmatha Pollution Control Committee idea to pick up trash off of Mount Everest is great, after all it did fall into the category of one of the world's highest junkyards. I think it's nice that the Sherpas get paid more for everything that they carry off of the mountain. Some of the trash you might find on Everest is discarded oxygen canisters, waste, old tents, and other items like that. While I was reading this article I was thinking that people probably just walk and throw their trash down and think, “Hey, I’m just one person. It won’t hurt anything.” But if everyone did that then the whole world would be filled with trash. My belief is that the climbers should carry down what they bring up the mountain. I admire the people who respect the Earth enough to try to make a difference.

It sounds scary when the article said that you could find dead bodies of people just lying around in the junkyard too. I couldn’t imagine walking past the dead body of someone, especially one that is in a growing heap of trash. Scary!

I approve very much of this program and hope to be able to make a change myself. So thanks to the Sagarmatha Pollution Control Committee for making a difference to help Mount Everest. I hope they continue to do so and I wish them the best of luck with their project.

“What if we dropped something besides ice into the water?” “What if the water was not as cold?” Many of these wonderings were investigated through further hands-on activities and secondary research that included readings and web-based animations. Through this activity, students learned about both weather and scientific inquiry.

Reflection through journal writing

Students were required to write three open-ended journal entries in response to the “Into Thin Air” magazine article (see Resources) and four additional entries in response to the book and supplemental readings. Students were instructed to discuss their thoughts, reactions, and questions with clear instructions not to summarize the texts. In a manner similar to the interactive reading strategy, students learned to write journal entries through teacher modeling and guided practice. Although this particular group of students did not need additional assistance, we have worked with other students who have benefited from the creation of a chart with prompts, often called an anchor chart, to guide this kind of work. Prompts for this unit could include questions such as the following:

- What did you learn from this reading (that you did not know before) about what it is like to climb Mount Everest?
- What are you learning specifically about the natural world and science?
- Is there a specific passage that made an impression on you? Which passage? What was the impression?
- How would you describe the people in the text and why? What would you do if you were them?
- How does this make you feel and why?
- What connections are you making to your own life? To other texts? To the world?
- What confuses you about what you read?
- What do you want to know more about now?

The chart could be displayed in the classroom and also put into the student journals. For this assignment, each journal entry had to be a half page, minimum, although most students wrote an average of a page for each entry. Many of the journal entries show evidence of students’ deep thinking about *Into Thin Air* and also their synthesis of what was happening in the book with the supplemental articles and hands-on activities (see example in Figure 1).

Reflection through student-generated Paideia seminar

To help students pull together their understandings, the culminating event for our unit was a Paideia seminar. Paideia seminars are opportunities for formal, intellectual dialogue around a text that could be interpreted

in different ways. Asheville Middle School students participate in seminars approximately once a month. It takes practice for students to engage fully in these conversations, and an important piece is reflection and goal setting so that individual students and the class as a whole can improve over time.

FIGURE 2 Grading sheet for “Into Thin Air” portfolio

Assignment topic	Specific assignment	Desired outcome	Points possible	Points earned
“Into Thin Air” magazine article	Interactive reading	Interactive reading should be visible. (Underlined sections, writing in the margin to clarify, questioning in the margins.)	5	
	Journal entry 1	Questions should be answered accurately and completely.	5	
	Journal entry 2		5	
	Journal entry 3		5	
Additional required supplemental reading responses	1. Birth of the Himalayas illustrations that follow the evolution of the Himalayas	A clear, well-thought out illustration that shows the different evolutionary stages of the Himalayas. Drawings should be neat, annotations should be accurate, and proper grammar and writing mechanics should be used.	5	
	2. “Atmospheric Pressure” article and questions	Interactive reading should be visible. Questions should be answered accurately and completely.	5	
	3. Anatomy of a glacier	Glacier anatomy should be accurate and complete. Drawings should be neat. Annotations should have correct grammar, spelling, and writing mechanics.	5	
Journal entries for book and supplemental readings of your choice	Journal entry 1	Journal entries should show clear understanding of the text and thoughtful reactions to it. Correct grammar, spelling, and writing mechanics should be used.	5	
	Journal entry 2		5	
	Journal entry 3		5	
	Journal entry 4		5	
Science investigations	Hail in a test tube	Completion of investigations including accurate and thorough recording sheets and journal entries (What did you do? What do you know now? What do you wonder now?)	10	
	O ₂ factor		15	
	Keeping warm		15	
Paideia seminar	Student-generated questions	Three questions that require thought and application of text to other texts, text to self and text to world.	5	
Total			100	

FIGURE 3**Sample of written response to a hands-on, minds-on science activity—Hail in a test tube****What I know**

I know that when making hail your test tube must be completely clean. One microscopic spec of dust could throw your results off. We did succeed the first time when doing this experiment. Since our test tube was so clean the water didn't freeze over. If there had been something for the water to make contact with it would have frozen over in the test tube before we took it out of the beaker, because hail is formed when cold, very clean water makes contact with another object. What happened was, when we took the tube out of the beaker we dropped a single piece of crushed ice into the tube. This gave the water something to make contact with, so the water immediately froze over, like what I just explained above. This was what was supposed to occur. The second time that we performed the experiment our tube wasn't clean enough, so while the test tube was in the beaker the water had something to make contact with so it froze over, probably a speck of dust.

What I did

I used a test tube, water, ice, a thermometer, and a beaker to make hail. First you clean the test tube with a paper towel (clean well!). Then you put water in the test tube and beaker. Next you place the thermometer and test tube in the beaker, and then stir for 10 minutes. Finally you take the test tube out of the beaker and drop a single piece of ice into the tube. Now you may take out a pencil and a piece of paper and observe! Here were my group's observations for the second time we did the experiment: Temperature was around $-10/-11^{\circ}\text{C}$. The bottom of the test tube was frozen this time when we took it out.

What I wonder

I wonder if our results would have been the same if we used warmer water? We may have the same results because there have been reports of hail falling in the summer or spring. I don't think there would be a difference but I would like to explore this. One way to explore this would be to have experiment at -15°C , and another at 20°C .

Before the Paideia seminar actually took place, each student generated at least three open-ended questions that could be used to guide the seminar. To do this, the teachers suggested that students pay careful attention to the bigger ideas that surfaced throughout the unit. The teachers reviewed students' ideas and chose several to focus the seminar, as described below.

On the day of the seminar, students moved their desks to form a circle. The teachers told students that the purpose of the seminar was to pull together their thinking and the bigger ideas from their *Into Thin Air* unit. They reminded students that their role was to listen carefully to each other, to be respectful, and to participate fully. They also reminded students that they did not have to raise their hands. Students chose individual goals, such as speaking three times or connecting what they said to what someone before them said. The seminar itself began with a question for all to answer, one at a time, around the circle: What is the one best word you would use to describe what it is like to climb Mount Everest? After a few moments to think, all students shared their thoughts. Moving into an open discussion, the teachers then asked students to explain their reasoning. The dialogue progressed, with students responding to each other and the teachers asking new questions when students seemed ready: Can you buy your way to the top of Everest? Who is ultimately responsible for the injuries and deaths? Why? Finally, to wrap up the conversation, the teachers asked a question to help students connect and apply what they had learned: How can learning about climbing Mount Everest help us even if we never intend to mountain climb ourselves? A metacognitive piece followed, in which students reflected on how the conversation went and how they progressed toward their individual goals. In all, the seminar and reflection lasted approximately 45 minutes.

Assessment

The major form of summative assessment for the *Into Thin Air* unit was a student portfolio that included artifacts from language arts as well as science. Students and teachers met at the onset of the unit to discuss expectations. A grading sheet was developed to help guide students toward desired results (see Figure 2). When thinking specifically about the hands-on science activities, we focused on two written products for each investigation. The first was a series of lab questions developed specifically for the activity. The second product was answers to general questions

we consistently used: What did you do? What do you know now? What do you wonder? (see example in Figure 3). If desired, separate grading sheets or rubrics could be used for each of the science investigations. Students were also asked to fill out a survey after completing the unit.

Students demonstrated learning about a range of science topics, including extreme weather conditions, atmospheric composition, geology, and human health. These strong readers had a relatively rare experience when they were challenged by a high-level text and needed to use varied reading strategies in order to fully comprehend. Students demonstrated growth in their knowledge of geography and the people who live in Nepal, and engaged in high-level conversations about values and ethics. Perhaps most importantly, students and teachers were highly motivated.

Reflection

This partnership between the science/mathematics instructional coach and the language arts teacher reinforced our understandings about interdisciplinary teaching and learning. Simply put, students benefit from connections. Cross-curricular opportunities such as the *Into Thin Air* unit combined with small group settings, challenging projects, and high standards can lead to high levels of student engagement and true desire to learn. We see this unit as a model for additional ones that link quality books with the science curriculum and believe that there is great potential for students at all levels to benefit, not just gifted students. Teachers could work together with their middle-level teams to set up similar units appropriate to the ability level of all students. In writing this article, we are also reminded of the power of collaborative efforts that include a diverse group of professionals working together to meet the needs of students. When we take the time to think together, we are all stronger educators and our students benefit. ■

Acknowledgments

The authors are grateful to be part of a team working at Asheville Middle School that has been supported by two NC QUEST grants focused on teacher professional development designed to raise student achievement. Our team includes sixth-grade teacher Nadeen Rolfe, science/mathematics instructional coach Nick Rogowski, literacy coach Melissa Hedt, and Western Carolina University teacher education faculty Patricia Bricker and David Strahan.

Reference

Tovani, C. 2000. *I read it but I don't get it: Comprehension strategies for adolescent readers*. Portland, ME: Stenhouse.

Resources

Selected texts

Anatomy of a glacier—www.pbs.org/wgbh/nova/everest/earth/glacier.html

Atmospheric pressure—www.pbs.org/wgbh/nova/everest/exposure/pressure.html

Birth of the Himalaya—www.pbs.org/wgbh/nova/everest/earth/birth.html

Boukreev, A., and G.W. Dewalt. 1999. *The climb*. New York: St. Martin's Griffin.

Chester, J. 2002. *The young adventurer's guide to Everest: From avalanche to zopkio*. Berkeley, CA: Tricycle Press.

Everest maps—www.pbs.org/wgbh/nova/everest/earth/maps.html

Hail fact sheet—www.ucar.edu/communications/fact-sheets/Hail.html

Krakauer, J. September, 1996. Into thin air. *Outside Magazine*. http://outside.away.com/outside/destinations/199609/199609_into_thin_air_1.html

Krakauer, J. 1999. *Into thin air: A personal account of the Mt. Everest disaster*. New York: Anchor Books.

Multimedia

How hail is formed—www.statesman.com/weather/content/weather/sm_interactive/hail.html

Science activities

Everest—The death zone classroom activity: The O₂ factor—www.pbs.org/wgbh/nova/teachers/activities/2506_everest.html

Hail in a test tube—<http://teacherpages.edgewoodhs.org/depart/science/Shannon/pdf%20files/EScipdf/Hail%20In%20A%20Test%20Tube.pdf>

Lost on Everest classroom activity: Keeping warm—www.pbs.org/wgbh/nova/teachers/activities/2702_everest.html

The National Paideia Center—www.paideia.org

Patricia Bricker (bricker@email.wcu.edu) is an assistant professor of science education in the Department of Elementary and Middle Grades Education at Western Carolina University in Cullowhee, North Carolina. **Nick Rogowski** and **Melissa Hedt** are instructional coaches and **Nadeen Rolfe** is a sixth-grade teacher at Asheville Middle School in Asheville, North Carolina.