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Using Images From Space pg 12

NSTA Reports
National Science Teachers Association


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Teens Flock to Science Cafés

Science cafés—events held in casual, social venues where attendees can listen to and interact with scientists—have become common worldwide. Many U.S. science cafés are modeled after Café Scientifique, a United Kingdom–based grassroots network of science cafés organized by Duncan Dallas in 1998. When Michelle Hall and Michael Mayhew heard Dallas speak about Café Scientifique at a 2006 American Association for the Advancement of Science meeting, they wondered if the same model could provide "a way to have high school students challenge themselves about what they believe [about science] and why, and how science and technology are changing their lives," says Hall, a geophysicist, science educator, and president and chief executive officer of Science Education Solutions, a research and development company in Los Alamos, New Mexico.

Hall and Mayhew, a geophysicist who serves as senior research scientist for Science Education Solutions, also thought a Café Scientifique for teens would give them access to scientists and scientific research, help them see scientists as real human beings leading interesting lives, and encourage them to consider science, technology, engineering, and math (STEM) careers. In 2008, with National Science Foundation (NSF) funding, they established Café Scientifique New Mexico in four towns: Los Alamos, Albuquerque, Santa Fe, and Española. "These are very different communities, but the impact on the teens was the same in all of them: The teens enjoyed it," Mayhew reports.

By 2012, other organizations expressed interest in starting teen science cafés (TSCs). After obtaining additional NSF funds, Hall and Mayhew established the Teen Science Café Network (TSCN; see *http://bit.ly/2b6ltCG*) to spread the model nationwide. The network is active in 23 states, with 50 individual sites nationwide. TSCN offers free memberships to TSC coordinators, along with online training and a national onsite training event. New members can apply for a grant of up to $3,000 to help pay for food and materials for hands-on activities—essential elements of TSCs.

OPEN MINDS TEEN SCIENCE CAFE—RALEIGH

At the Open Minds Teen Science Café in Raleigh, North Carolina, David Roberts, assistant professor of computer science at North Carolina State University, and his dog Diesel demonstrate wearable technology that allows service dogs to communicate with their handlers.

Though adults, including some teachers, establish TSCs at venues like science centers, zoos, museums, aquariums, and libraries, Teen Leadership Teams at each site—guided by adult coordinators—"recommend the topics they're interested in, do the marketing, and coach the speakers," explains Hall. Adult coordinators often ask science teachers to recommend students for teen leader positions.

"We really want it to be teen-driven; it gives kids a voice and helps them learn skills and get comfortable with adults outside their families and schools," she maintains. "The scientists have to pitch their presentations to the teen leaders, and the teens give them feedback. This is a big role reversal for these kids, and the scientists take their words to heart." Presenters are asked to keep their talks briefer than they would at an adult café "because teens have lots of questions," she explains, adding that the program is intended to be a series of lively conversations among teens and presenters, not a lecture series.

The cafés allow students to learn more about concepts introduced in school. "What was abstract in school can become concrete," says Hall. It's also easier for scientists to attend an after-school or evening café than to visit schools during their workday, she points out.

Teen Science Cafés, pg 5

NSTA Member Poll: Science Educators Still Feel Budget Strain PG 6

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COMMENTARY: **Angela McMurry**

Collaborate to Incorporate Technical Writing

By Angela McMurry

Angela McMurry

Sir Richard Branson said it best: *"Complexity is your enemy. Any fool can make something complicated. It is hard to keep things simple."* Make no mistake: Good technical writing (or the lack thereof) regularly impacts our lives.

You experience technical writing daily, whether you are reading a scholarly journal or crying in a corner because you couldn't figure out *why* you have extra parts after assembling furniture. As communication with peers becomes more remote and reliant on web-based media and written instructions, we must emphasize the technical aspects of our writing to convey precise information.

My "aha moment" occurred two winters ago when my English Language Arts (ELA) colleague April Hoying and I huddled in a coffee shop, sketching out a model to encourage teachers to incorporate more technical writing into science and ELA classrooms. The previous year, I had worked with teachers statewide on Believe in Ohio, an Ohio Academy of Science (OAS) program. The premise was to write a well-designed plan based on a science, technology, engineering, and mathematics (STEM) entrepreneurial idea, then develop a prototype to illustrate that plan. Participating students competed for up to $20,000 in academic scholarships to a two- or four-year Ohio college.

April and I soon realized our students did not have the technical writing skills to compete in a program requiring a 12-page technically written paper. At the time, I was also organizing and facilitating science fair programs for multiple Ohio counties. Reviewing the student-submitted science research plans for these programs only confirmed that our students desperately needed technical writing support. In response, we surveyed our local science teachers and determined that many classes were simply not requiring extensive writing projects for three reasons:

1. They didn't have enough time;
2. Science teachers are not comfortable integrating ELA learning standards, which includes technical writing standards, into their classes because they lack confidence in their knowledge of the process; and
3. A dearth of collaboration with ELA colleagues leaves many feeling isolated in their efforts.

One teacher admitted that the short research paper her anatomy students completed at year-end was the only opportunity students had to do *any* research and technical writing during their four years in high school because her ELA colleagues had abandoned the long-term research project requirement. I cannot imagine surviving my undergraduate experience without multiple opportunities to research and write technically before graduating high school. After this interview, the dire status of technical writing education finally sunk in: Our teachers and students needed guidance on incorporating technical writing education into their classrooms.

What do we do next? We stay *accountable* to high-level student achievement in science as the NSTA Position Statement indicates (*http://bit.ly/2ay3UMs*).

We began to craft a manual that would not only introduce teachers to the process of technical writing, but also show them examples of classroom integration. The manual outlines five "sessions" offering teachers guidance as they navigate their students through

1. identifying reliable sources;
2. synthesizing ideas from multiple source articles;
3. using appropriate citations;
4. developing a plausible prototype (optional); and
5. presenting their ideas in a coherent manner.

These "sessions" can be integrated throughout year-long instructional plans in STEM and ELA classrooms. With these "sessions," teachers have the tools to make technical writing a reality in their classrooms.

OAS heard of our efforts and asked to distribute our completed manual to educators throughout the state, as well as publish it on an online platform for teachers outside of Ohio (*http://bit.ly/2ahseD4*).

So…why technical writing? Technical writing goes beyond the common lab report many science educators focus on. Technical writing includes writing resumes and cover letters, e-mails, proposals, memos, letters to clients/vendors, brochures, recipes, instructional manuals, PowerPoint presentations, and some argue (convincingly) Tweets or Facebook posts.

For students, the ability to write clearly and concisely is vital for everyday communication with peers, parents, and future employers. While American college students flock to business administration and management majors, many lack exposure to introductory technical writing courses in high school, increasing the need to incorporate technical writing in "core" content areas. Technical reading also is crucial for students in meeting the challenges of our modern world. Inevitably, students will want to open a bank account, apply for a credit card, buy a home or a car, request a raise, file taxes, read a legal notice, or plan a vacation. These milestones require technical reading and writing skills. Simply stated, *we owe it to our students to provide them as many opportunities as possible to master this technique.*

To truly encourage a deeper understanding and mastery of technical writing by our students, ELA, STEM, and business teachers must collaborate. Teachers can plan opportunities for students, developing cross-curricular rubrics and grading cooperatively. School administrators must carve out time during the school day, or at the very least, during professional learning opportunities. Only committed collaboration among content-area teachers will lead to better readers, writers, students, and neighbors. ●

Angela McMurry is a PreK–12 Science Curriculum Coordinator for the Darke County Educational Service Center and a science consultant for five counties in southwest Ohio. She serves as President-Elect of SECO (Science Education Council of Ohio), NSTA's Ohio State Chapter. Reach McMurry at angie.mcmurry@darkeesc.org *or on Twitter: @AngelaMcMurry1.*

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Teen Science Cafés, from pg 1

"Once we get [scientists] to become adept at communicating with teens, they're in a position to present effectively to other audiences [because] they get better at it," Mayhew contends.

Generally, parents don't attend TSCs because "teens might not ask questions with their parents there," says Hall, especially when topics like the effects of alcohol and drugs are being discussed.

"And we want all kids to come, not just the ones who claim to be already interested in science. We've been successful in that," observes Mayhew.

In North Carolina, Open Minds TSCs take place at the North Carolina Museum of Natural Sciences in Raleigh and at two other sites, funded by the Duke Energy Foundation. TSCs "are a way to connect teens to science careers," says Lynn Cross, head of youth programs at the Raleigh site. "Teens can ask a presenter what he or she studied in college and what his or her workday is like."

"Teens are typically not served in museums because it's hard to attract them," Kathryn Fromson, coordinator of youth programs in Raleigh, points out. "The café model is fun, relaxed, and social, and they like drop-in events [for which] you don't have to register, just show up," she reports.

Teens enjoy doing the hands-on activities, and "in this competitive setting, they enjoy being graded and winning prizes," she contends.

Some teachers will give students extra credit for their participation. "We're happy to have teachers use the café as a resource that way," Cross observes. "We have supportive local teachers who bring their families."

TSCs provide a way to "meet like-minded peers, people you don't go to school with…It's a free event that their parents approve of," she notes.

Rockville Science Center in Rockville, Maryland, holds Young Adult Science Cafés with funding from the American Society for Biochemistry and Molecular Biology. Program coordinator Katherine Perez says, "The café started out as a place where middle school, high school, and college students could come together to discuss science events and issues...Later, we started inviting speakers, professionals in science and health who could talk to kids about careers, college, and graduate school."

"Sometimes it's challenging to have that wide of an age range," she admits. "The middle school students tend to like doing the hands-on activities, but the older ones don't…Some topics attract more of one [particular] age group; [a topic like] 3D printing is interesting to all ages.

"Many students attend the cafés as part of their grade," she reports.

"We'd like to have more professionals in STEM fields giving talks adapted to younger kids. STEM fields can seem challenging to younger kids because there are not many mentorship opportunities, no push to join graduate programs, and many internships are unpaid…It's hard to get jobs in STEM fields," Perez contends.

"Presenters can serve as mentors or guide students to those who can help them," she concludes.

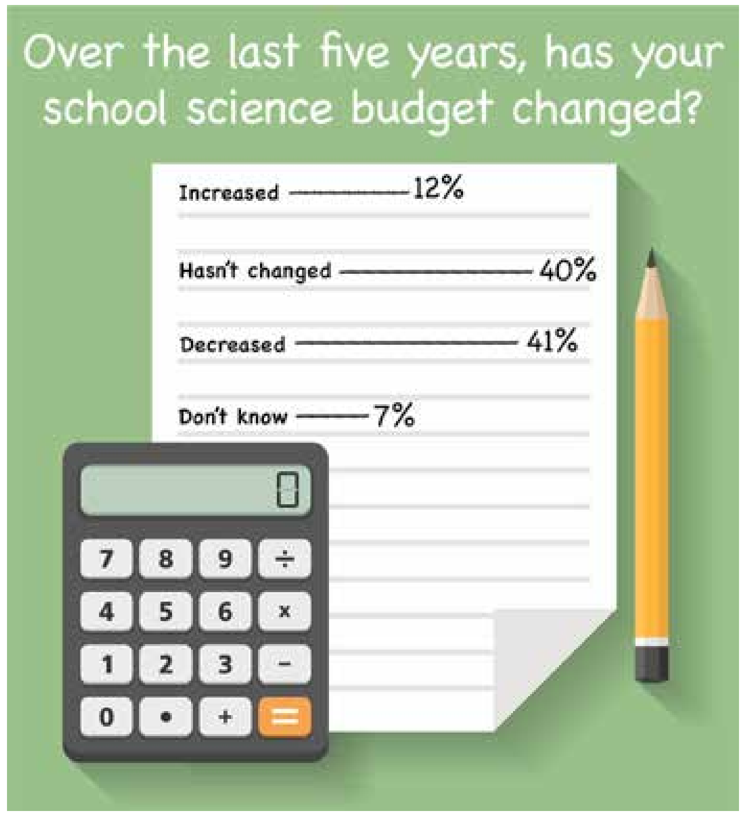
The TSC at the Pacific Science Center in Seattle, Washington, "grew out of...Discovery Corps, a [teen] job training program," says Tony Smith, program coordinator. "Discovery Corps teen members helped grow the program with guidance from adult staff.

"Our TSC Advisory Board has 20 to 25 teens," Smith explains. One committee interviews scientists and serves as event moderators. "The food committee arranges for pizza and snacks," he notes, while "the marketing committee does social media promotion."

The Advisory Board created "a database of Seattle-area STEM teachers, and they e-mail fliers to them, encouraging them to give extra credit" to students who attend the cafés, says Smith. "We've had a very positive response from teachers."

With speaker topics ranging from "health science to astrobiology to evolution and cooperation in species," the events have also received high marks from teens. "'I didn't know this field even existed' is what many of them say," he reports. ●

Science Educators Still Feel Budget Strain



Five years ago, 67% of science educators participating in an informal *NSTA Reports* poll reported their typical school budget for classroom supplies was less than $500, and 27% expected to spend more than $500 of their own money on classroom supplies. This summer, *Reports* again asked educators about their school budgets, and found only 12% report budget increases over the last five years, while 41% say budgets have decreased, 40% say they haven't changed, and 7% say they don't know. A majority (61%) say their typical annual school budget for classroom supplies is less than $500; 13% have budgets between $500 and $1,000; 10% between $1,001 and $1,500; and 16% have budgets that exceed $1,500. Only 25% of educators report their school budgets allow for breakage, upgrades, chemical disposal, and/or annual repairs and maintenance.

Science educators continue to dip into their own pockets to supply their classrooms and labs: 23% reported spending more than $500 of their own money, and another 21% spent between $301 and $500 last year. They believe that trend will continue, with 31% reporting they expect to spend between $301 and $500 in the current school year, and another 33% estimating they will likely spend $101–$300. Consumable lab supplies were the most common items bought (69%).

To extend budgets, 82% reported they share supplies and equipment with other teachers. In addition, 10% apply for grants at least once a semester, while 18% do so annually. About half (51%) of poll participants said they are able to receive donations of supplies or equipment from local businesses, hospitals, or universities, with 22% unsure if they could.

Educators most often turn to colleagues in the same school or district for budget-friendly ideas for labs (55%); social media such as Twitter and Facebook (53%); NSTA journals and books (37%); and other professional publications (34%). (Respondents could select multiple options.)

The tight budgets are affecting students' experience: 63% report dropping a planned lab at least once a year because supplies were not affordable. Only 11% of respondents said they have never done so.

Here's how science educators say they try to address budget shortfalls:

Beg, borrow, and plead!—*Administrator, Elementary, Colorado*

Unfortunately, it's to drop a lab. —*Educator, High School, Illinois*

Not my favorite, but the most effective is to ask for donations of everyday objects from students. Most of my parents want to help, but don't know what the classrooms need.—*Educator, Middle School, West Virginia*

[I offer] extra credit to students [who] bring in lab supplies that can be found within their homes.—*Educator, Middle School, Texas*

Using NSTA publications are the best resource for inexpensive lab ideas. —*Educator, High School, Institution of Higher Learning, Kentucky*

Teaching the kids that we can reuse many items [that] might otherwise be seen as consumables. Shopping sales.—*Educator, Elementary, Middle School, Illinois*

Buying some items with classroom supply list.—*Educator, Middle School, Indiana*

I love using Freecycle to ask for supplies.—*Educator, Middle School, High School, Colorado*

Microscale the labs, and sometimes just [doing] a demonstration (which is not my favorite strategy).—*Educator, High School, North Carolina*

Alas, it's not my favorite or preferred strategy, but not doing labs when I don't have the facilities, materials, and equipment.—*Educator, High School, Hawaii*

Request private donations from philanthropists.—*Educator, Middle School, Texas*

Donors Choose.—*Educator, Middle School, District of Columbia*

Reusable supplies.—*Educator, Middle School, Montana*

Calling supply companies to get discounts.—*Educator, High School, Michigan*

We ask students to pay a lab fee that helps us increase our budget by a substantial amount.—*Educator, Middle School, Kentucky*

Keeping a continual classroom wish list.—*Educator, Middle School, High School, Texas*

Reuse, recycle.—*Educator, Elementary, Georgia*

Try to pull consumable resources from other departments, such as food resources and office supplies from the office.—*Educator, Middle School, Florida*

Teams and groups sharing materials; cleaning and reusing; order once and copycat.—*Educator, High School, California*

Go as cheap as possible. Dollar store is visited frequently.—*Educator, Middle School, Texas*

Provide students "data" to work with had they been able to collect their own with [a] complete inquiry. Only complete one trial per lab group, and use each group's results as a trial with class data.—*Educator, Middle School, Florida*

Using labs that are reusable every year or only require household items. —*Educator, Middle School, High School, Oklahoma*

Pairing up and group work.—*Educator, High School, United Kingdom*

Do not order separately; all teachers together, and get a quote from the vendor; usually get free shipping and discounted items!—*Educator, High School, California*

Change the lesson to one that supports [the] idea, if not the experience. —*Educator, Elementary, New Jersey*

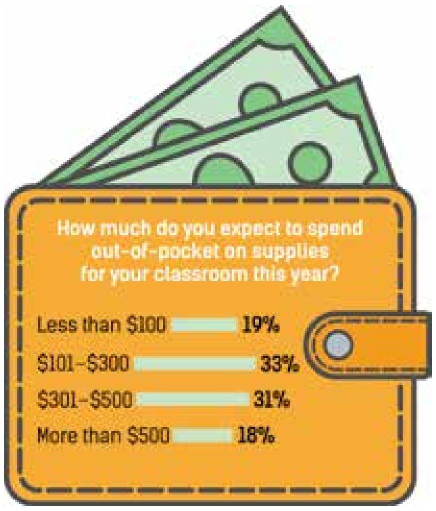
Buy more in bulk when possible to save on cost.—*Educator, High School, Virginia*

Planning ahead as much as I can, and asking others in my school or district for donations.—*Educator, Elementary, California*

Buy at secondhand stores and home improvement stores.—*Educator, High School, Washington*

Borrow supplies.—*Educator, Middle School, Oregon*

Demos or larger groups.—*Educator, High School, North Carolina*



We collaborate as a science team so we don't double-order materials we can all share.—*Educator, Middle School, Illinois*

Using [a] unit plan to prioritize equipment and supply needs.—*Educator, High School, Maryland*

I inherited a pencil machine and collect 25 cents for every pencil. I use this to buy consumables.—*Educator, Middle School, Colorado*

Larger groups and microscale labs. —*Educator, High School, Indiana*

Having kids work in groups (as opposed to pairs or threes) to make supplies last longer.—*Educator, Elementary, Middle School, Connecticut*

Collaborate with colleagues to use [one an]other's leftovers.—*Educator, High School, Michigan*

I look for activities and experiments that can be done with the same equipment.—*Educator, Middle School, Iowa*

Small quantit[ies] with large lab groups. No two-partner groups; typically 4–5 students for one small lab.—*Educator, High School, Georgia*

Taking a lab that uses an expensive chemical and finding a cheaper local alternative!—*Educator, High School, Michigan*

As a chemistry teacher, [I have] a simple way to connect my content to my students' daily lives: …to do labs with kitchen chemicals. They're usually cheap, and I always get kids who come in the next day and tell me they talked about (or did) the experiment again at home with their family.—*Educator, High School, Michigan*

Encouraging team members to apply for grants as they become available. —*Educator, High School, Texas* ●

Quotable

The very nature of science is discoveries, and the best of those discoveries are the ones you don't expect.

—Neil deGrasse Tyson, U.S. astrophysicist and science communicator

Extending Education Virtually

Virtual reality (VR) promises the world—and beyond—through immersive environments that extend through history and into outer space. With the development of apps that capitalize on the prevalence of smartphones and other devices to place 3D viewers within reach of much of the country, it's not surprising that teachers are experimenting with this new technology to see how—and if—it will be applicable in their classrooms.

"I'm really appreciative of the work Google did to bring [VR] into the classroom," says Christine Mytko, a seventh-grade science teacher and K–8 STEAM (science, technology, engineering, art, and mathematics) coordinator at Black Pine Circle School in Berkeley, California. "It's awesome to see the potential. Similar to 3D printing, it will be nice to get to the point where VR is just another tool in the classroom."

Last spring, Mytko participated in virtual field trips using Google Expeditions and Google Cardboards. She appreciated that she could monitor what area students focused on during VR sessions via a teacher iPad. In addition to preloaded points of interest, she or her students also could use the teacher's iPad to share their own points of interest with the class, "and then we can have whatever discussions we would have had" on a field trip in the real world. This addresses one of her big concerns with VR: that the experience can be isolating in the classroom. She adds, "The Google Expeditions are pretty plug-and-play. I think the average explorative classroom could pick it up and go."

The associated costs still present a significant hurdle. "Google Cardboard is affordable. But you either have to have a commitment as a school to buy the phones, or have kids download the apps [on their own devices], which creates equity issues [and raises questions about] responsibility for breakage," she states.

She also cautions teachers not to substitute VR for real-world experiences. "Google Expeditions gives us access to places we couldn't take our students. That's exciting to me, but I don't want teachers to take this and stop taking advantage of the real world around them."

Charity Nix, former science teacher and now a systems analyst at the University of South Carolina and a professional learning specialist with the Northwest Council for Computer Education, had an opportunity to experiment with VR at an event held by educational platform Lifeliqe in June. Using an HTC headset and glove controllers, she was "able to go inside the human heart and see blood flow… Looking at it from a former science teacher's perspective, I would have loved to have this enhancement in my classroom." Nix compared her VR experience with 2D computer simulations she had used, noting that VR was "more realistic and hands-on; you can control where you go." In the anatomy unit, for example, users "can actually walk and end up inside a human head and can see the anatomical structures [as they turn around]. There are some computer simulations that a user can move around…, [but] this is more lifelike. You're physically able to be inside [the human head]," she exclaims.

Nix said she could see the technology's potential use in courses such as life science, biology, advanced biology, physical education, kinesiology, and physiology, providing students with new perspectives on how the body moves and works.

Librarian Julie Hembree at Cougar Ridge Elementary School in Bellevue, Washington, tried out both VR and augmented reality (AR) technologies at the International Society for Technology in Education conference in June. She says she "found it to be a very engaging way to learn about topics. I've watched children and adults become absorbed in the PokemonGo app. If VR works in that context, it would really revolutionize classroom learning.

"One of the issues teachers face is that we have dwindling budgets, especially for field trips. As a librarian, I don't have the opportunity to take students anywhere. VR brings the outside into my classroom in a manner that is both educational and fascinating. With the Lifeliqe models, I can support grade-level curriculum and offer students a different way to learn about a topic. My hope is that the VR experience will be memorable: something close to being on a field trip or walking through Stonehenge without leaving the library."

Noting that she has a free trial license for Lifeliqe, Hembree plans to experiment further with the product as she weighs its potential benefits, while keeping in mind that "VR is a tool—one of many in a teacher's toolbox. Not every tool is perfect for every student."

Beyond Mere Consumers

Lisa Gottfried, head of the Digital Media Department at New Technology High School in Napa, California, asserts she is "always interested in the latest, greatest tech...I'm interested in what kinds of jobs will be out there for my students." While she has taken students on virtual field trips using the Nearpod app and Google Cardboard and other 3D viewers, Gottfried is hoping to create a VR production studio that will allow her students to become producers—not just consumers—of VR content. She would like her students to eventually be able to create immersive experiences as she encourages them to dream "about what's coming next, how they can be part of it…Even though I'm not a science teacher, I'm figuring out how to use gaming to [teach content and get students thinking about] 'How are we going to use this to educate [one another]?'"

Gottfried is collaborating with other teachers at her school to ensure students have access to technology and are considering its future uses. "By the time they get out of college, there will be a lot more jobs in the VR field. I've started asking them, 'How do you see people using this?…How can we put in more science content? Do you need to be a coder, an engineer?' They're going to be future creators of VR content, AR content."

Mytko also hopes to motivate students to become content producers. As Black Pine Circle School's Maker Club sponsor, she frequently has students work with new technologies in the club before implementing them in the classroom, and VR has been no exception. She likes to attend VR events in the Berkeley and San Francisco areas, often taking Maker Club students with her.

In Maker Club, the iterative process is frequently discussed, which has led Mytko and her students to consider creating virtual gallery walks of their projects' progress through their design process. "We already knew how to 3D scan, so we're exploring how hard it would be to get these models into the 3D space," she says.

"We have a 3D scanner that clips on an iPad. We'll scan projects at each step and use VR to show how the project has changed…and what [we] learned along the way," explains Mytko's former student, Sam Schickler.

Now in 10th grade, Schickler led the development of creating virtual models in the club. He took data model files initially intended for use in 3D printing and used Avizo software to analyze and process the data. When 3D printing, a file must be small enough for the machine to use, and this limits the printer's ability to render small details. In VR, the only limits are those of the viewing device, so Schickler had to weigh the importance of preserving minute details against how long a file took to load.

As he pursued the project, he also honed his communication skills. "I learned how to contact people to get access to these tools…It showed me the community of VR…I've started going to Meetups and meeting professionals. A lot of kids won't go [because the events are adult-oriented], but students are accepted at them because there's not a lot of very experienced people in VR; we're all new to this. The VR space is expanding right now. Nobody knows where it will be in five years, how it will expand or might evolve into something different."

Although she "doesn't think in VR yet," Mytko says an increasing number of apps have been created that would be "interesting to bring into school," including those from Google, Lifeliqe, Within, and Discovery VR. She observes that Google, Discovery, and Lifeliqe in particular are "already in the education space…I think the promise is there." ●

Quotable

Often we do a greater amount of good when we 'listen' to our students than when we 'teach' them.

—Robert John Meehan, U.S. educator, author

Teaching Science With Limited Resources

Teachers who win the Shell Science Lab Challenge are experts at stretching tight budgets as they teach science. The competition recognizes outstanding middle and high school teachers with exemplary approaches to science lab instruction using limited school and laboratory resources and awards a lab makeover support package valued at $20,000 to the grand-prize winner.

> ***"Don't be afraid to go to bat for the students you teach. Don't be afraid to apply for anything."***
>
> **—Alicia Conerly**

Before receiving that prize earlier this year, Alicia Conerly taught science in a laboratory lacking a functional ventilation hood, computer workstations, and sufficient preventive safety equipment. "We had equipment [dating] from World War II," she recalls.

Conerly's former school—South Pike High School in Magnolia, Mississippi—is a rural Title I public school with "mostly minority students, so it was hard to bridge the gaps to teach them," she explains. And she "couldn't count on a vast amount of parental involvement, although those who were willing to help did so by donating items," she notes. So she became skilled at "turning a little into much," using lesson plans and activities that could be done with "simple, cost-efficient items," such as "building atoms out of toothpicks and small colored marshmallows," she relates.

Without proper safety equipment, she taught lessons and activities "that wouldn't pose a danger to students," such as "virtual labs that could be done on iPads," she explains. The lab's chemicals were old and unusable, so she had students analyze chemicals by "looking up information about them online, such as what happens if you use more or less of a chemical."

She saved money on supplies by shopping at local "mom and pop stores" that offered discounts for rural schools. "I would go with other teachers and get there early to be first in line," she reports.

"Networking with teachers in neighboring schools and at conferences" helped Conerly "get ideas and materials [I] could use," she emphasizes. Through networking, she learned about the Shell Science Lab Challenge and was inspired to enter it.

Conerly now serves as science specialist for her new school district, Hazlehurst City School District. "I'm going to work with other schools with worse conditions than [South Pike High School]," she contends. "Whoever comes after me [at South Pike] will have everything they need" because they'll benefit from her grand-prize award.

She advises teachers, "Don't be afraid to go to bat for the students you teach. Don't be afraid to apply for anything."

'Viewing a Video Is Not Science'

National Finalist and Earth and environmental science teacher Catherine Krygeris says her school—Mardela Middle/High School (MMHS) in Mardela Springs, Maryland—"was constructed 40 years ago, and the school, including the science labs, has been updated little since. There is only one classroom that has the typical laboratory setup with benches, computers, and equipment storage. The other classrooms have tables that are converted to lab stations when necessary."

MMHS's six science teachers had to share supplies and equipment and take turns using the one classroom designed for labs. "We're all down the hall from [one another], and communication and scheduling could be done after school" and via an Excel spreadsheet on which teachers share their needs, she relates.

Because MMHS is too small to support six science classrooms, Krygeris, who was a first-year teacher, had to teach in two different classrooms, transporting lab materials and modifying lab management "based on which classroom I [was] assigned," she explains.

If an activity like an air pressure demonstration required hot plates, students had to work in larger lab groups or she had to do a demonstration because MMHS didn't have enough. "It would've been cool to let students do that on their own, if they had their own hot plates," she contends.

To address these issues, Krygeris says she enlisted help from older students "needing extra community-service hours; they were like teacher's aides because they were well-versed in safety [protocols]. These were seniors who had taken at least three science classes, and I prepared them to help me."

Another strategy was showing videos that depicted concepts like air pressure and temperature changes, but often students "didn't connect to them," she reports, adding that "viewing a video is not science…In science, even if on a small scale, it's better for them to do it themselves."

Krygeris obtained a grant from Pickering Creek Audubon Center—a

400-acre working farm situated next to the tidal Pickering Creek in Talbot County, Maryland—that paid for bus transportation for her environmental science students to come to the center and do water-quality studies there. The grant also funded a substitute teacher for students unable to take the trip. "I'd like to find a grant so we could do this every year," she asserts. "It improved students' attention in class; they felt more connected after we had done that."

To find ways to save money and funding sources, Krygeris turns to Pinterest and Twitter. She also uses free and inexpensive materials on the Educator Resource Center website of NASA's Wallops Island Flight Facility. And she points out that "local farmers may have soil and plants to donate—or even just insight [to share] about how farming works."

CATHERINE KRYGERIS

Catherine Krygeris of Mardela Middle/High School in Mardela Springs, Maryland, obtained a grant from Pickering Creek Audubon Center that enabled her environmental science students to do water-quality studies there. The grant paid for bus transportation and a substitute teacher for students who couldn't go.

'I Can Make $500 Last for a Year'

National Finalist Petra McCullough, a sixth-grade teacher at Sunset School in Oak View, California, says her Title I school lacks "[a] science lab on campus, limiting myself and other teachers to doing only experiments that are possible in our normal classrooms. My classroom is set up with two students to a desk, leaving minimal room for storage and their school supplies… We have one sink and no electrical outlets in the middle of the room where students' desks are, making it unsafe to bring many experiments requiring electrical appliances closer to the students.

"I have to do stations [with groups of students], and rotate groups so that we don't have electrical cords in the middle of the room…We make it work. I have to be really flexible and adjust, be as resilient as the students are and don't show that I'm stressed out," she confesses.

Regarding supplies, "we had some, but not nearly what we needed. With the new standards, there are so many engineering practices, but students can't do these activities with no materials…You have to get really creative and do hands-on activities that don't need a lot of materials." When her students were making solar boxes with aluminum foil to cook s'mores outdoors, for example, McCullough approached several pizzerias and asked them to donate boxes.

Because she teaches every subject including science, all of the textbooks must be stored in her classroom. With limited space, she has resorted to buying plastic containers and "being creative in how I stack things." The PTA provides "about $500 a year. I can make $500 last for a year," she explains, adding that a 15% discount from her local Michaels craft store has helped somewhat.

Relief has also come from the more than $10,000 in grant funding she has obtained over the last seven years from the Ventura Education Partnership (VEP), a community-based, nonprofit association that supports education in the Ventura Unified School District. "Most of my VEP grants [went toward funding] my art elective and filling our classroom library," she notes.

Turning Discards Into Science Supplies

National Finalist Rene Corrales—biology, chemistry, and physics teacher at STAR Academic Center in Tucson, Arizona—shares this strategy for working around a tight budget: "Instead of purchasing predetermined concentrations, I use available (recycled) plastic containers, which I collect, to create and store my own solutions of appropriate dilutions as needed for experiments. Thus, I am able to purchase a minimal amount of pure chemicals from which I make diluted solutions."

The solutions "don't have to be perfect, just close enough [so that students learn the concepts]…I'm careful to do experiments with the lowest amount of dilution; I lower the concentration as much as possible, especially with acids and bases, to reduce risks," he maintains. "I work hard not to contaminate the solutions students use so I can reuse them." He says he includes the dilution in the lesson "by asking students, 'How did the dilution affect the results?'"

For Corrales, saving money means using things others want to discard. When he needs flowers for his biology classes, he says the grocery store's flower shop "gives me stuff they were going to throw away." He has obtained scrap metal to use in electrodes, tiny solar panels discarded by people replacing their outdoor solar sidewalk lights, and LED lights that car dealers send in mass mailings to attract customers. "Learn to just ask…Be ready to give that 30-second elevator speech," he advises.

He discovered that his local food bank "can provide seeds and will send volunteers to help with designing a school garden," he relates. Universities can provide supplies and volunteers, as can energy companies, which "have tons of resources for middle school students," he asserts.

"Don't be afraid to look at your school cafeteria; develop a relationship with the cook," he counsels. Not only can cafeteria staff "be a great source of ice," he asserts, but they also can provide items typically discarded, like potato chips with expired dates, which Corrales uses in science activities.

Hospitals are often willing to part with leftover supplies that aren't contaminated, such as gloves, he notes. He also suggests visiting thrift shops. "They practically give things to you if you're from a school. You never know what you'll find," he observes.

And when dealing with vendors, "I always get estimates before buying. When you do that, they often give you better discounts and find ways to reduce shipping costs," he reports. ●

Teaching About Earth Using Images From Space

Over the summer, Bob Riddle—a science educator in Lee's Summit, Missouri, and editor of the Scope on the Skies astronomy column for *Science Scope,* NSTA's middle level journal—announced on NSTA's e-mail lists an opportunity for teachers to participate in the Sally Ride EarthKAM (Earth Knowledge Acquired by Middle school students) @ Space Camp program during July 12–16. EarthKAM, a NASA educational outreach program (see *www.earthkam.org*), enables students and teachers to learn about Earth from the unique perspective of space. During EarthKAM missions—periods when the EarthKAM digital camera on the International Space Station (ISS) is operational—middle school students worldwide can request images of specific locations on Earth.

"This is an exciting opportunity for our students, and it also opens many opportunities for us to integrate pictures of the Earth from orbit within our respective content areas," Riddle said in his e-mail. While EarthKAM and its online curriculum target middle school students, the program can be adapted to other grade levels, and Riddle says he hoped elementary and high school teachers would participate as well.

"[A]s teachers, we are perhaps more familiar with Earth Geography—places, surface features, etc.—than many of our students. So with this 'advanced' awareness, we should be able to select more specific locations that would suit our use of the pictures in the classroom…I spend possibly an inordinate amount of time following the orbital paths on the map, zooming in on places of interest and planning pictures. My academic background is actually [in] geology and physical geography, so I am really interested in pictures of landforms. My wife and I travel, so it is also kind of neat to be able to get satellite pictures of places we have visited," Riddle wrote.

KIM COMEIRO

An eighth grader in Barbara Ferri's Earth science class at John Glenn Middle School in Bedford, Massachusetts, uses the EarthKAM program to request images from space.

EarthKAM "is a lot of fun," Riddle asserts. "You can get images soon instead of waiting for [those from the astronauts aboard the ISS]. EarthKAM makes it a bit more personal because teachers can request images from specific places," he contends.

The entire collection of ISS EarthKAM images from past missions is available in a searchable archive, providing teachers with many choices of images to use in their classrooms. "I've helped teachers incorporate images into different activities," he relates, adding, "The EarthKAM website has lots of activities for teachers."

The first time he obtained images, Riddle says he compared the ones he received with the ones in the EarthKAM galleries. "You can see how areas are changing on Earth," he explains.

Image requests can be "like a box of chocolates," he maintains, because you can't "count on a perfect shot: It depends on whatever the ISS flies over" and what the weather is like there. "But when you zoom in, you can see a lot of details in the images, especially if it's a clear day," he points out. Teachers can use Google Earth or Google Maps to identify specific features like highways, lakes, and rivers and compare them with the EarthKAM images. "That's an exciting part of this, finding out what's in your picture," he observes.

Making ISS Science Tangible to Students

Teachers have used EarthKAM in subjects "all over the board," says Scott Harbour, EarthKAM program manager. "At the NSTA [National] Conference in Nashville, I met a second-grade teacher who uses it to teach geography. Others have used it to teach social studies, geology, and Earth science."

Teachers and students can use the images "to measure changes in the sizes of glaciers as part of a climate change experiment. They could use them with physics, to ascertain orbits. There's an orbital-mechanics activity on the website," he observes.

"On base level, it makes the science on the ISS tangible to students here on Earth. Students look at the ISS and say, 'It's a million miles away, and I can't relate.' But being able to use the camera to take an image on an orbit track can be an inspiration to STEM learning because they're not that far from NASA and the science being conducted there," he maintains. And when students receive their images, they "can physically touch something," he notes.

"We have undergraduate students who work on the program, and they act as a help desk and help teachers troubleshoot any problems. We don't have a lot of problems expressed by teachers…We make sure there are plenty of resources on the Help page," he asserts.

More activities are in development, along with "videos to help teachers," and eventually, same-day return of images, he says, adding, "We know that for teachers, it can't be time-consuming, and it has to be easy to use."

One Teacher's Experiences

When Barbara Ferri taught science at Parker Middle School in Chelmsford, Massachusetts, she used the EarthKAM image database with students. "I had my students choose a photo, identify features in it, and explain how they were related to Earth science concepts," she recalls.

After leaving that school to pursue a master's degree in science education, Ferri participated in professional development workshops at the Boston Museum of Science and the Massachusetts Association of Science Teachers conference and learned to "conduct students through EarthKAM missions," she relates. After earning her master's degree, she began teaching eighth-grade Earth science at John Glenn Middle School in Bedford, Massachusetts, where every year she interweaves EarthKAM missions with her curriculum.

"In the fall, when I'm teaching about maps, I use it to teach about latitude and longitude." she explains. "I have students use their knowledge about Greenwich Mean Time (GMT) by converting the time of the photo in

GMT to the local time at the photo's location." She adds, "Just to get an image they can identify as being in the Alps or the Himalayas is exciting to them."

Later in the year, she uses EarthKAM to teach about plate tectonics. "I give students a focus for the mission by having them look at a plate tectonics map and finding where the [ISS] is crossing a boundary," she explains. "For their end-of-year project, they have to explain what they learned about plate tectonics by stating the names of the plates, the types of crust, and what the physical features are, and explain how they formed." Some of the images show the effects of erosion, or changes in the coastline after a tsunami, for example.

"The EarthKAM database is huge now," Ferri notes. "I can access the photos from every mission my students have done."

If students' images are unclear, she uses the database to find clearer images of the desired area. She assures students that "some things are beyond your control, such as a problem with the camera."

Some students are impatient to receive their requested images. "Kids are used to immediate gratification, but it takes time to upload photos, and the astronauts may be busy with other things, I tell them. And the picture doesn't always look the way the student thinks it would look because the [ISS] is far above the Earth, higher than an airplane, so the view is different," she relates.

"It's a wonderful activity to do with students. It's real-life science, not a made-up activity, and the students are actually dealing with NASA," she maintains. "They appreciate that it's real-time science, and they are able to view a picture of their own. They have ownership." ●

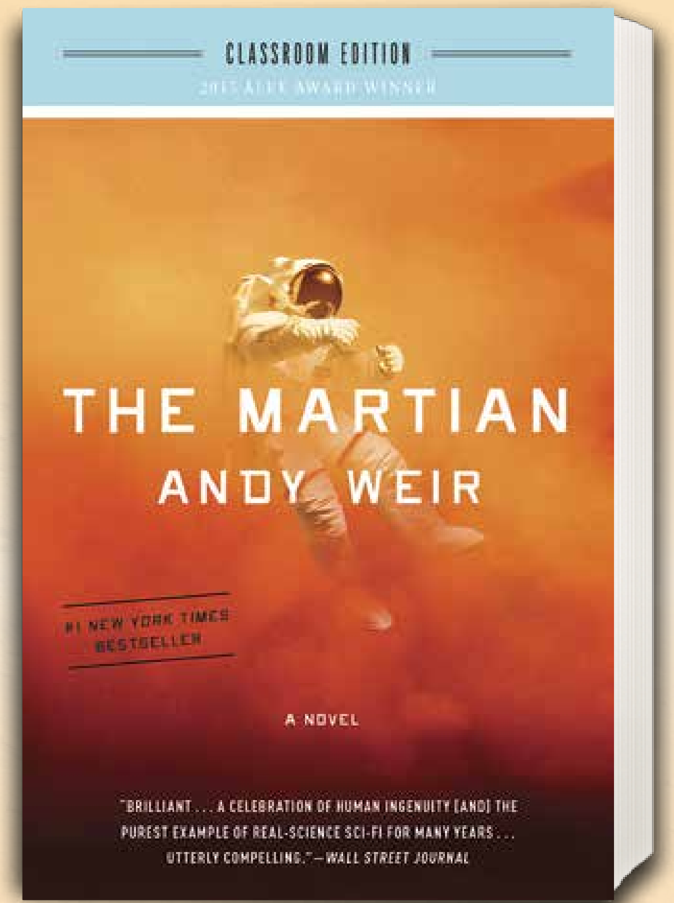
Quotable

If we did all the things we are capable of, we would literally astound ourselves.
—Thomas A. Edison, U.S. inventor (1847–1931)

NEW CLASSROOM EDITION

“*The Martian* should be required reading for all middle and high school students, and it should serve as a call to action for improving science education.”

—Jacqueline Miller, Ph.D., senior research scientist at Education Development Center (EDC) and Thomas Max Roberts, Ph.D., postdoctoral fellow in plasma physics at Dartmouth College



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B\D\W\Y

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by ANDY WEIR

Set in the not-so-distant future, *The Martian* tells the story of astronaut Mark Watney, who is stranded on Mars after a mission failure leads his crew and NASA to assume he is dead. Using his background in botany and engineering, Watney must find a way to survive until he can contact NASA and they can arrange a rescue mission. Once NASA realizes that Watney is, in fact, alive, a race begins to save his life.

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ANDY WEIR was first hired as a programmer for a national laboratory at age fifteen and has been working as a software engineer ever since. He is also a lifelong space nerd and a devoted hobbyist of subjects like relativistic physics, orbital mechanics, and the history of manned spaceflight. *The Martian* is his first novel. **www.AndyWeirAuthor.com**

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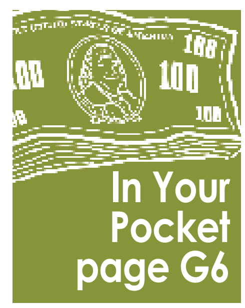


Freebies for Science Teachers

Careers in Environmental Science. H HE Wonder what it takes to be an environmental scientist? At *http://bit.ly/2auR3Oy,* high school and college students can learn about this exciting science, technology, engineering, and mathematics (STEM) career. Discover what an environmental scientist does, what education is required to become one, the types of jobs available to those with an environmental science degree, and the projected growth and salary information for individuals working in the profession. The site also features interviews with experts working in various areas of environmental science; video lectures on topics such as environmental management and renewable energy; and a job board.

Studying the Ocean Using Live Ocean Data. M H Challenge middle level and high school students to increase their knowledge of oceans by learning to analyze and interpret live ocean data. With this lesson plan based on the Argo project—an international ocean science research initiative employing a system of floats to gather data on ocean temperature, salinity, depth, and other properties—students use an interactive mapping tool to study the temperature of the ocean from the surface to a depth of 2,000 meters and investigate how salinity changes by geography as well as depth. Students then use graphing and printing tools to compare and contrast ocean data collected worldwide. Refer to *http://bit.ly/2b2Q4AR.*

WIKIOLO

ReadingFriend.com. E Access more than 500 animated, read-aloud stories, songs, poems, videos, and learning activities to enhance early childhood instruction (students ages 4–8) at this website. Science topics include animals, seasons, metamorphosis, planets, and rivers. Resources include DemBones, an animated song introducing students to the skeletal system; Bountiful Beetles, an online book about the insects that predated dinosaurs by millions of years; and I Like Birds, a nonfiction photo book about birds and their songs. The books also include supplementary materials such as lesson plans, interactive and read-aloud versions, and student worksheets. Visit *www.readingfriend.com.*

The Secret Life of Scientists and Engineers. M H This popular online science series from PBS *NOVA,* now in its fifth season, aims to change how we view scientists. Through short "humanizing" video profiles, viewers discover the personal stories of notable and charismatic scientists, including Danica McKellar, mathematician and television actress; Chris Hadfield, astronaut and rock star; Geoff Tabin, ophthalmologist and bungee pioneer; and Jessica Cail, addiction researcher and stuntwoman. The series shatters the stereotype of scientists as lab-bound nerds and reinforces the idea that scientists come from all backgrounds and have a diverse range of interests and talents. A Teachers Guide provides teaching tips and web resources for using the content in middle level and high school classrooms. Consult *http://to.pbs.org/2au3HrW.*

BirdSleuth Explorer's Guidebook. E Use this booklet to get students outdoors and exploring nature! Aligned with the federal initiative Every Kid in the Park, and written for the fourth-grade level, this step-by-step guide from the Cornell Lab of Ornithology enables families, school groups, and others to connect with nature while having fun. Try hands-on activities like going on a habitat scavenger hunt, creating a sound map, and identifying bird species. Download the booklet at *http://bit.ly/2auSqNh.*

The RCSB Protein Data Bank. H HE At *http://pdb101.rcsb.org,* high school and college teachers can access teaching materials to explore the three-dimensional world of proteins and nucleic acids. Resources are organized by theme: Molecule of the Month, which presents short accounts on selected molecules from the Protein Data Bank; Learn, which features paper molecule models (e.g, insulin and the Zika virus), interactive animations (e.g., The Structural Biology of HIV), videos (e.g., *What Is a Protein?*), and posters (e.g., "How Do Drugs Work?"); and Teach, which offers curricular models exploring Biomolecular Structures and Models, Molecular Immunology, and Molecular View of HIV/AIDS. The Geis image gallery is a digital collection of molecular art with interactive views of DNA, hemoglobin, and other molecules.

See Freebies, pg G2

E: Elementary M: Middle H: High HE: Higher Ed A: All K12: K–12

Freebies, from pg G1

Atomic Dating Game. M Readorium—an educational software company that designs programs to develop the nonfiction reading skills of students in grades 3–8—has a science–themed mini-game to increase reading comprehension skills while teaching students about atomic structure. Most appropriate for middle level students, the game challenges players to find the best match for a lonely Hydrogen atom. Will the best fit be the noble Helium, perky Hydrogen ion, or shy Deuterium? Students will learn facts about each of the "contestants" as they play. See *http://bit.ly/2aRLV6I.*

BOB NICHOLS, USDA NATURAL RESOURCES CONSERVATION SERVICE

Feed, Nourish, Thrive. H HE An initiative created by the STEM Food and Ag Council to address the challenge of feeding our planet in the future aims to inspire the next generation of innovators in food and agricultural production. To that end, the website at *http://feednourishthrive.org* features resources to encourage high school and college students to pursue careers in the diverse fields of food and agriculture. Students can read about developments in the blog and find food projects with which to get involved under Resources. The site also has video profiles featuring young professionals in the industry (click on Careers). Students can learn about careers such as food scientists, animal geneticists, plant breeders, flavor technologists, soil scientists, and sustainable agriculture conservationists.

***GotScience.org* Discussion Guide.** H This e-book from Science Connected has links to articles and follow-up questions to supplement and enrich high school instruction in astronomy, biology, environmental science, physics, technology, and other topics. Accompanying each article are comprehension questions to help learners understand the meaning of the text; discussion questions to spur whole-class conversations and thinking beyond the text; and projects in which groups of students do research and share findings in papers, multimedia presentations, oral presentations, or other formats. Download the book at *http://bit.ly/2auTeSf* (registration is required).

***Science* in the Classroom.** H HE Bring primary sources of scientific literature into your classroom with these annotated research papers from *Science* magazine. Most appropriate for high school and introductory college science courses, the papers explore key concepts of a study and place it within the larger body of research in a field, helping students to better understand scientific terminology and processes. The annotated papers address studies in biological and physical science; recent titles include *The Origins of Immunity, Curiosity Tells All About Mars' Radiation Enviroment,* and *Limb Regeneration: Fact or Fiction?* A teacher's guide—with background information, student discussion questions, and activities based on real data from the study—accompanies each paper. Refer to *http://bit.ly/2atfQhL.*

Understanding Ebola Virus Disease. H This interactive learning experience for high school students—produced by the Biological Sciences Curriculum Study (BSCS) in partnership with Oregon Public Broadcasting, with National Science Foundation funding—explores the factors contributing to the spread of Ebola infection and shows students how these factors interact to produce an epidemic. While the model focuses on Ebola virus disease, the same factors apply to many other viral infections, including those common in the United States. The interdisciplinary resource connects to concepts related to evolution, mathematics, and social sciences, and addresses selected disciplinary core ideas, science practices, and crosscutting concepts from the *Next Generation Science Standards.* Learn more at *http://ebola.bscs.org.*

SaveOnEnergy Infographic. M H Help students understand the science of electricity with this animated guide. Produced by SaveOnEnergy.com, the guide explains how electricity works, from atoms to power plants. Access it at *http://bit.ly/2aTM6ew.*

Engineering Activity Guides. E M Produced by the Take Our Daughters and Sons to Work Foundation and North Carolina State University, these guides introduce elementary and middle level students to the engineering design process and teach them to overcome obstacles through creativity and teamwork. Though the guides were created to use on Take Our Daughters and Sons to Work Day, teachers can also use the activities in the classroom. In the Level One Activity Guide (*http://bit.ly/2aA8g3L*), students complete team activities, such as constructing a castle with hula hoops and creating a human Rube Goldberg machine. In the Level Two Activity Guide (*http://bit.ly/2alGDuW*), students design an effective packaging system for a single potato chip and make ice cream. In the Level Three Activity Guide (*http://bit.ly/2aA9ITY*), students design a maze that a NanoBug can successfully navigate and build a rocket that can deliver the most air canisters (i.e., paper clips) to the International Space Station (i.e., the ceiling).

Stand Up for STEM. E *Teaching Tolerance* has created lessons for students in grades 3–5 to address the underrepresentation of women and people of color in STEM fields. Available at *http://bit.ly/2ay42wv,* the lessons can be used together or individually. Titles include Who, Me? A Scientist?, in which students connect with their "inner scientists," and STEM at Work, in which students explore the work of scientists, technology specialists, engineers, and mathematicians and discuss their common character traits. In STEM by the Numbers, students examine the representation of white, black, Asian, and Hispanic men and women in science and engineering careers; in STEM for All, students consider the advantages of a STEM career and plan activities to support STEM for all.

Teaching in Nature's Classroom: Core Principles of Garden-Based Education. E M Read this book to begin a school garden program and deepen elementary and middle level students' connection to nature, food, and learning. Colorfully illustrated and brimming with engaging stories from the field, the book highlights 15 principles and best practices for successful garden-based education programs. Teachers can also discuss their garden-based learning experiences in an online forum. Download the book at *http://bit.ly/2aLTJE2.*

STEVEN BROWN

Direct Measurement Videos. H HE Remember word problems from your high school physics class? For example, students are given a velocity at which a car drives down a road and the length of time it takes, and must find the distance the car will move. Now digital media offers a new and improved "word" problem: direct measurement videos. With this technique, students are given video clips with data to solve the problem instead of a verbal description or drawing and explicitly stated numerical information.

At *http://bit.ly/2ask7UC,* educators will find a library of video problems that teach introductory physics mechanics at the high school or college level. Problems explore forces and motion, rotation, impulse and momentum, energy, waves, sound, light, and other topics. The site also has student activities and tips for teaching with direct measurement videos.

The Smithsonian Learning Lab. K12 The lab is about discovery, creation, and sharing. Teachers and students of all ages can create, annotate, and share customized collections culled from the museum's vast store of digitized resources: more than one million images, recordings, and texts. The lab offers opportunities to make discoveries across disciplines and create new connections. For ideas for integrating your customized collection in the classroom, read the *Getting Started Guide for Teachers.* (*Note:* Students younger than age 13 must have parental permission to use the Create and Share features.) Visit *http://s.si.edu/2askiz9.* ●

News Bits

- **Online learning may not benefit young students, according to research from Northwestern University.** M

High–achieving eighth graders taking Algebra 1 online performed worse than those who took the course in a traditional classroom, the study revealed. The online students also fared worse than those who waited an extra year to take the class in ninth grade.

Led by Northwestern University researchers, the study followed rural middle school students in North Carolina, which adopted a policy in 2011 to let advanced eighth graders take Algebra 1 online instead of waiting until ninth grade to take the course, as was the norm. The move helped advanced students gain access to high school courses that would otherwise be unavailable.

Study author Jennifer Heissel, a researcher at Northwestern's School of Education and Social Policy, allows that the eighth graders may not have been developmentally ready for a self-paced online course. But she points out that "[g]enerally, no matter what you throw at high achievers, they end up fine…If even the advanced students can't do well, why would we think it would work well for all?" Read more at *http://bit.ly/29XKvVY.*

- **Students can pursue both engineering and medicine through a new medical school track at Texas A&M University.** HE

In the program, sponsored by the university and Houston Methodist Hospital, students with engineering degrees will attend classes and see patients. But they'll also have to invent something "transformational" to graduate, like surgical robots or sensors that relay information from patients in one area to doctors in another, for example.

"[W]e have…an expectation of the students to change the world, to change healthcare through technology," Texas A&M Engineering Dean Katherine Banks told the *Houston Chronicle.* Students will have access to labs and commercialization experts to help them get patents for their inventions. The program plans to enroll 50 students for the fall 2017 semester. Read more at *http://bit.ly/29KaEZu.*

- **Fourth- and fifth-grade Girl Scouts who participated in a five-week intervention program called Girls Learning Environment and Energy (GLEE) increased their energy-saving behaviors—and so did their parents, says a study conducted by Oregon State University and Stanford University researchers.** E

Girls from 30 scout troops in California continued their energy conservation efforts for seven months after GLEE ended. Though they did not participate in the program, their parents did so for eight months afterward. Both groups were more likely to wash their clothes in cold water or turn off their power strips at night, for example.

"Children are a critical audience for environmental programs [like this], because their current behavior likely predicts future behavior," said Hilary Boudet, assistant professor of climate change and energy at Oregon State. Her study results are published in *Nature Energy.* Learn more at the website *http://bit.ly/29rxAwj.* ●

E: Elementary M: Middle H: High HE: Higher Ed A: All K12: K–12

What's New

FROM U.S. GOVERNMENT SOURCES

National Institutes of Health (NIH)

NEI for Kids Website E M

At the National Eye Institute's NEI for Kids website, upper-elementary and middle level students (and teachers) can learn about eye health and vision in an easily understandable way. The interactive website presents hands-on optical illusion images that can heighten students' understanding of how we see. In addition, students can watch video interviews with NEI scientists on topics such as color blindness, nearsightedness and farsightedness, and what happens to our eyes when we sleep. Other kid-friendly resources include a video explaining the visual system, a fact sheet describing the eyes' natural defenses, and eye diagrams. Visit *http://bit.ly/2aHluyV.*

Wild About Healthy Vision Agenda Book M

Targeted for the middle level, this NEI publication features eye-related myth busters and facts, an eye chart, eye safety tips, a glossary, word puzzles, and activities to help students learn about parts of the eye and how they work, healthy vision, eye diseases, and eye safety. Download the publication at *http://bit.ly/2ama3KO.*

U.S. Fish and Wildlife Service (FWS)

Migration Station A

At this web page from the FWS' Fish and Aquatic Conservation division, you can learn about the importance of open rivers and the role of migratory fish in nature. Appropriate for fish enthusiasts and nature lovers of all ages, the site contains Fish Facts handouts with background information on more than a dozen species of migratory fish including alligator gar, Chinook salmon, Lake sturgeon, and Pacific lamprey; a slideshow of cartoon-illustrated migratory fish; and a poster, "What Makes Migration Tough for Fish?" These resources and an animated video, *Did You Know? Fish Migrate Too!,* may be useful to incorporate into biology and environmental science lessons. See *http://bit.ly/2aq5Gjt.*

National Oceanic and Atmospheric Administration (NOAA)

Ocean Explorer Education M H

Ocean Explorer's Education Theme Pages present ocean science topics like Archaeology, the Arctic, Bioluminescence, Cold Seeps, Deep-Sea Corals, Seamounts, and Vents and Volcanoes. Each page has links to essays, lessons, multimedia interactive activities, career information, and associated past expeditions. See *http://1.usa.gov/1pSrw3Y.*

The Bioluminescence theme page, for example, features essays exploring topics like how living organisms produce light and the visual systems of deep-sea creatures, as well as lessons targeting middle and high school levels on topics like light, color, and camouflage in deep-ocean organisms and adaptations of deep-sea creatures. You'll also find videos and images of bioluminescent organisms and a video profile of a scientist who studies bioluminescence.

National Aeronautics and Space Administration (NASA)

NASA Women of STEM M H

Through their accomplishments and dedication to their jobs, women at NASA serve as important role models to young women interested in pursuing careers in science, technology, engineering, and mathematics (STEM) fields. At *http://go.nasa.gov/1sSFq7O,* read career profiles, watch inspirational videos, and find tips to motivate students to stay focused on STEM. It's not just girls who will be awed, however: With profiled careers as varied as instrument scientists, planetary geologists, research meterologists, space station payload operations directors, information technology managers, aerospace engineers, system engineers, and mathematicians, all students will recognize that STEM offers something for everyone.

NASA Next E M

NASA Next, an online space science magazine for students in grades 5–8, breaks down complex science to inform young readers about the latest news and research from NASA's Goddard Space Flight Center. Articles describe Goddard science, including studies of Earth, the Sun, our solar system, and the universe; most articles include links to other NASA web pages, allowing readers to learn more about the missions and technologies. The magazine also introduces students to careers in space science: A recent issue features a Q&A with Gina DiBraccio, a space research scientist at Goddard whose work focuses on how the Sun affects the space environment of Mars. Each issue also includes an Educator's Page with links to lesson plans to help teachers incorporate the issue's content into the classroom. Read a sample issue at *http://go.nasa.gov/2aoVJ8F.*

NASA Back-to-School Resources E M

K–8 teachers and space enthusiasts of all ages, start your school year off right with a Solar System Bulletin Board from the NASA/JPL Educator Resource Center. The resources include a poster of Saturn's Titan Moon, taken by NASA's Cassini mission, along with student activities for grades 1–8; a Solar System Lithograph Set depicting NASA images of planets, moons, asteroids, and comets, along with key facts about each celestial body; an Extreme Space Facts Lithograph, featuring a "family portrait" of our solar system along with 16 extreme space facts; and a lithograph, Saturn and Our Pale Blue Orb, which shows Earth as seen at Saturn and describes how the image was captured by NASA's Cassini mission at Saturn. Visit *http://go.nasa.gov/2aDal11.*

National Science Foundation (NSF)

Generation R (obotics) Starts Now! M H

Presented as part of a recent NSF report on robotics, this series of motivational posters from NSF's Engineering Directorate highlights some of the key factors central to advancement in robotics: Commitment, Empathy, Learn, Power, Independence, Communication, Vision, Sustainability, Strength, and Teamwork. Each poster includes a brief description of how the featured word relates to the field and to NSF robotics research. Share the posters with your middle and high school students to inspire the next generation of robotics innovators. Access the posters at *http://bit.ly/2aHjzKV.*

Science360 News Service A

Text, video, audio, or still image—what's your pleasure? Discover, share, and discuss current science news and research from around the world with NSF's comprehensive science news portal at *http://bit.ly/2atWsjv.* Daily (Monday through Friday) news stories feature a video, an audio podcast, an image of the day, and a Did You Know section. A searchable database also helps visitors find information on almost any STEM topic from reliable sources, including NSF, academia, peer-reviewed journals, science and engineering centers, and researchers themselves. In addition, Science360

E: Elementary M: Middle H: High HE: Higher Ed A: All K12: K–12

has a video library of more than 2,000 titles, 24/7 streaming radio, and iOS and Android apps. The content is refreshed every week, so there's always something new to explore.

National Park Service (NPS)

NPS Distance Learning Programs: Grand Canyon K12

Bring the Grand Canyon to your classroom using NPS distance learning programs. The programs cover a range of topics and grade levels: Ancient Life (fossils, grades 2–5), Ask a Ranger (geology, grades 4–8), Canyon Connections (plant/animal adaptations, grades 4–8), Condor's Flight (endangered species, grades 3–7), and Ranger Careers (park rangers in action, grades 5–12).

Registration for the 2016–2017 school year starts on October 5, 2016; requests are processed on a first-come, first-served basis. For more information, including distance learning equipment requirements, visit *http://bit.ly/2ap4z08*.

U.S. Environmental Protection Agency (EPA)

WaterSense Kids E M

This website teaches elementary and middle level students about the importance of water and why we need to conserve it. Test their knowledge of water conservation with the WaterSense game, or find simple suggestions for saving water, such as turning off the tap when brushing your teeth; taking showers instead of baths to use less water; and watering the yard in the early morning or late evening when it is cooler. Teachers can also access resources to help students promote water conservation at home, including student worksheets to track family water use and a Student and Family Pledge to Filter Out Bad Water Habits. Consult *http://bit.ly/2aX4qTt*.

Become a Watershed Sleuth K12

Produced by EPA and the National Environmental Education Foundation, the Watershed Sleuth program helps K–12 students and their families learn how to solve water-quality problems. Through online lessons and hands-on activities, students learn about their watershed: what it is, why it is important, and what can be done to protect it. Activities include building a model aquifer and taking an interactive quiz to find out where water wasters are. Students earn badges with each successive lesson completed, moving from Watershed Sleuth (i.e., knowledgeable about watershed basics) to Watershed Guardian (i.e., knowledgeable about improving water quality at home), to finally Watershed Hero (i.e., knowledgeable about safeguarding water quality in the community). See *http://bit.ly/2apMzTj*.

U.S. Department of Agriculture (USDA)

Healthy Eating Infographic A

Use the USDA's "MyPlate, MyWins: Make It Yours" mini-poster infographic to help students of all ages find their healthy eating style. In addition to easy-to-follow tips such as "vary your veggies," "switch to low-fat milk or yogurt," and "don't forget physical activity," the infographic provides target amounts to consume in each food group: fruits, vegetables, grains, dairy, and protein. The poster is available in both English and Spanish.

Other available resources include the 10 Tips Nutrition Education Series fact sheets, which provide guidance on how to Make Better Beverage Choices, Vary Your Protein Routine, Add More Vegetables to Your Day, and more. Refer to *http://bit.ly/2ambV6G*.

Library of Congress (LOC)

Science Student Discovery Sets K12

The LOC's science-themed Student Discovery Sets teach K–12 students about history and the nature of science through primary source materials: artifacts and one-of-a-kind documents created by the people who experienced the event. Available for Macs and iOS devices, the science sets address Scientific Data: Observing, Recording, and Communicating Information; Understanding the Cosmos: Changing Models of the Solar System and the Universe; and Weather Forecasting. Interactive tools enable students to zoom in for close examination, draw to highlight interesting details, and make notes about what they discover, providing opportunities for another generation of learners to find insight and inspiration from the materials. Read Thomas Jefferson's handwritten record of temperatures at Monticello, study the first recorded periodic table of chemical elements, zoom in on diagrams drawn by Isaac Newton, or circle details of early weather instruments!

A teacher's guide with background information, ideas for classroom instruction, and other resources is available for each set. And teachers can find more tips and resources on the Teaching With the Library of Congress Twitter feed, @TeachingLC. Refer to *http://bit.ly/2acuQ6n*.

CitizenScience.gov

CitizenScience.gov A

At CitizenScience.gov, K–college educators will find information, resources, and tools to get involved in citizen science and crowdsourcing projects. The site offers a searchable catalog of more than 300 federally supported citizen science projects, a toolkit to assist with designing and maintaining projects, and a gateway to the community of federal employees and practitioners involved in developing best practices for crowdsourcing and citizen science. Teachers can search the database by topic (e.g., Animals, Astronomy, Birds, Climate and Weather, Ecology, Food, Health and Medicine, Physics, Pollinators, and others), agency sponsor, and participant age (e.g., elementary, families, general public, middle level, and youth/teen) to narrow project choices to those of interest. A blog, Federal CITSCI, posts updates on the progress of various citizen science projects and highlights projects currently seeking participation from citizens, including students and teachers. Visit *http://bit.ly/2amcHQM*.

U.S. Department of Education (ED)

Indicators for Postsecondary Hispanic STEM Success K12

A Review of the Literature to Identify Leading Indicators Related to Hispanic Science, Technology, Engineering, and Mathematics Postsecondary Educational Outcomes, a new report from ED's Institute of Education Sciences, examined recent peer-reviewed studies to identify factors measured in K–12 settings related to students' postsecondary STEM success, particularly for Hispanic students. The review revealed that the number of high school science and mathematics courses taken and the level of those courses is a consistent predictor of postsecondary STEM outcomes for all student subgroups. However, the literature indicates that minority students, including Hispanics, were less likely to take the highest-level science and mathematics courses.

The reviewed research suggests that reducing disparities in science and mathematics preparation between Hispanic and white students and increasing the rates at which Hispanic students take high-level mathematics and science classes has promise for informing interventions designed to improve STEM outcomes. Download the report at *http://bit.ly/2aDbipZ*. ●

In Your Pocket

Editor's Note

Visit ***www.nsta.org/calendar*** *to learn about more grants, awards, fellowships, and competitions.*

September 30

Project Learning Tree GreenWorks! Grants K12

GreenWorks! grants of up to $1,000 fund environmental improvement projects that help students learn about the world around them through a mix of academic curriculum and community service. Previously funded projects have included school gardens, outdoor classrooms, habitat restorations, recycling programs, and energy conservation projects.

Applicants must have attended or be registered to attend a Project Learning Tree workshop; projects must secure at least 50% matched funds and involve at least one community partner. Apply by **September 30** at *www.greenworks.org.*

October 1–10

Pilcrow Foundation Children's Book Project Program Grants K12

The foundation provides a 2-to-1 match for rural public libraries that receive a grant through its Children's Book Project and contributes $200–$400 through local sponsors for the purchase of up to $1,200 worth of new, quality, hardcover children's books. The foundation provides a list of 500 such books libraries can choose from.

To qualify, libraries must be located in rural areas, have a limited operating budget and an active children's department, and raise $200–$400 through a local sponsor. Those with operating budgets of less than $50,000 receive priority, though town libraries with budgets of more than $150,000 and country libraries with budgets of more than $450,000 may also apply. Applications must be postmarked by **October 1.** Visit *http://bit.ly/2aeYINr.*

Donald Samull Classroom Herb Garden Grant E M

The Herb Society of America offers these grants to public and private school teachers of grades 3–6 with classes of at least 15 students. Ten schools will receive $200 "seed money" grants to establish indoor or outdoor herb gardens. Funds may be used for soil, plant trays, containers, or tools. Apply by **October 1** at *http://bit.ly/MpoSsc.*

Frances R. Dewing Foundation Grants E

These grants fund projects or programs focused on early childhood education. Of particular interest are those at new, untried, or unusual educational organizations that aim to introduce new methods for young children, ages 2 to 12. Grants range from $1,000 to $20,000, though the average is $5,000. Programs must be located in the United States and have tax-exempt status. Submit proposals by **October 1;** see *http://bit.ly/Nj43la.*

Target Field Trip Grants K12

Target provides these grants for K–12 schools within 100 miles of a Target store. Field trips should connect students' classroom curricula to out-of-school experiences and take place between January and the end of the school year. Grants of up to $700 are available. Apply by **October 1.** Visit *http://bit.ly/1M8lzai.*

Air Force Junior ROTC Grant H

The Air Force Association offers grants of up to $250 to promote aerospace education in classrooms and Junior ROTC units. Grants may be used for aerospace-related items, such as books, materials, or field trips to an aerospace museum, Air Force base, or other aerospace facility. Classrooms and units can apply every other academic year. Apply by **October 10;** see *http://bit.ly/18sWJ3p.*

October 15–21

Lorrie Otto Seeds for Education Grant Program K12

This program offers grants of between $100 and $500 to schools, nature centers, and other nonprofit organizations for environmental stewardship projects. Projects should focus on native plants and cultivate students' appreciation for nature. Successful projects might include wildflower gardens with habitat for pollinators or rainwater gardens that capture runoff.

Funds must be used to purchase native plants and seeds; recipients also can get discounts at Seeds for Education nursery partners. Apply by **October 15;** visit *http://bit.ly/1JSgWwc.*

Future City Competition M

In this competition, students in grades 6–8 use the engineering design process and work with one another, an educator, and an engineering mentor to design sustainable cities that will last 100 years. This year's "Waste Not, Want Not" theme requires students to include a waste management system for residential and business use. Students must consider issues such as collection, separation, processing, and energy efficiency, and present their designs, a 1,500-word description, scale model, and project plan to a panel of STEM professionals in their region in January.

The winning team in each region, along with its educator and mentor, will receive round-trip transportation and accommodations for the National Finals in Washington, D.C., February 18–21. The first-place winners get a cash award and a free trip to Space Camp. Register your team by **October 15;** visit *http://futurecity.org.*

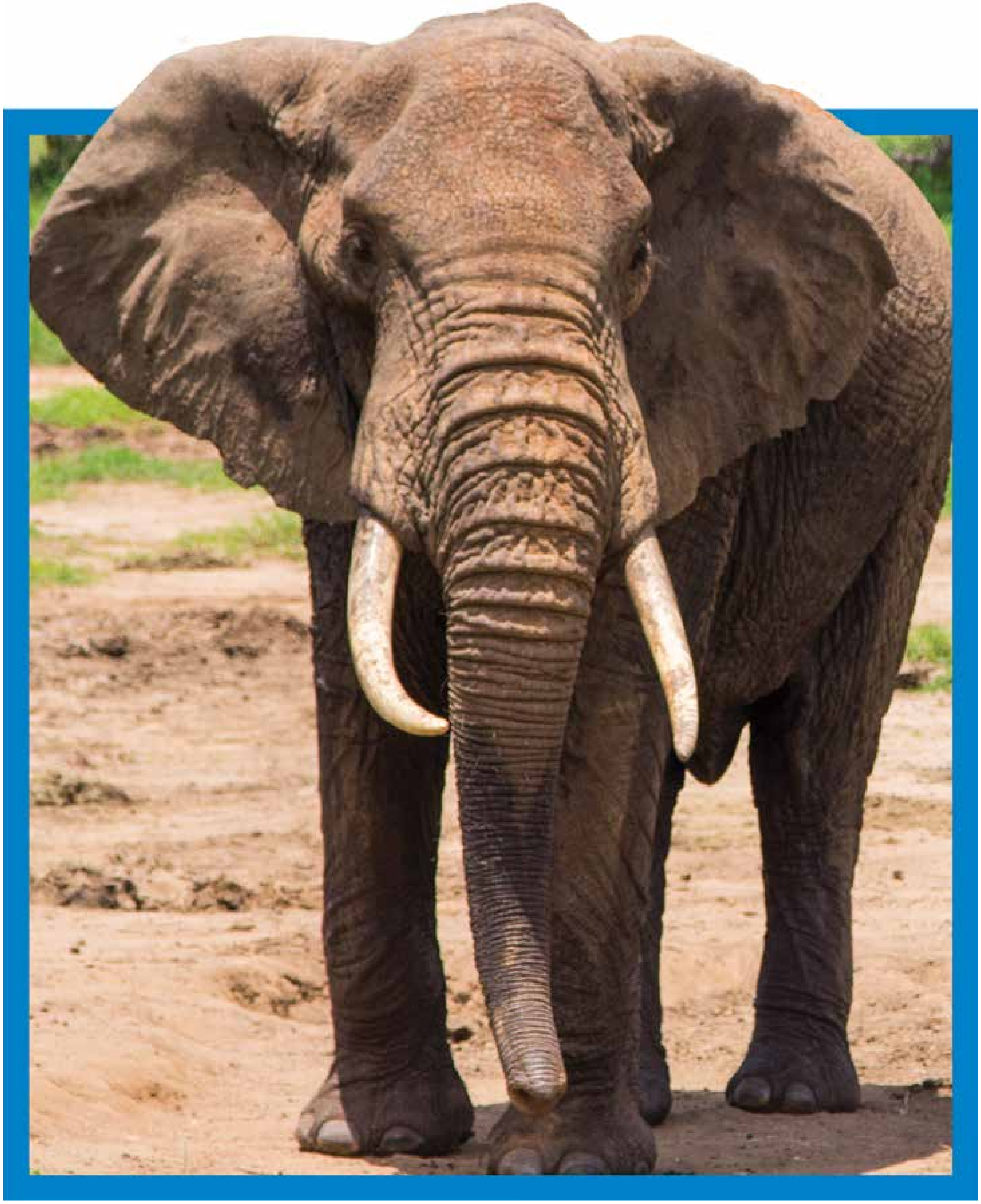
SaveOnEnergy Grants E M

These $500 grants go to teachers with the best lesson plans for helping K–8 students learn about energy or sustainability. Teachers from any subject area qualify, and lesson plans may vary in scope or topic. However, all submissions must

- encompass energy or sustainability knowledge;
- be appropriate for a grade level from kindergarten through eighth grade;
- include goals and how students' understanding will be measured;
- be created by one teacher without the use of existing prepared educational materials outside of those available on SaveOnEnergy.com; and
- encourage student development through participation opportunities.

Entries must state the time and materials the lesson requires. Six winners will receive $500 VisaRewards cards to help implement their submissions in the classroom, and their lessons will be cataloged on SaveOnEnergy.com as a resource for other teachers. Submit your best lesson plan by **October 21** at *http://bit.ly/29Zvf9i.* ●

E : Elementary M : Middle H : High HE : Higher Ed A : All K12 : K–12



Elephants never forget
to visit HHMI BioInteractive

www.BioInteractive.org/elephants

hhmi | BioInteractive

Summer Programs

Editor's Note

Visit www.nsta.org/calendar to learn about other summer professional development opportunities.

Save the Rainforest's Trips to Costa Rica, Belize, Panama H

High school teachers who want to learn more about rainforest ecology and conservation efforts in the tropics can apply for Take Flight fellowships for Save the Rainforest's summer trips to Costa Rica, Belize, and Panama. Fellows' food, travel, and lodging expenses will be covered, and teachers can earn up to three graduate credits from Edgewood College.

Apply by **October 1.** For more information, visit *www.saverfn.org.* To request an application, e-mail *saverfn@cybermesa.com.*

Earthwatch Teach Earth USA Fellowships K12

Earthwatch offers these fellowships to K–12 teachers of any subject area who are passionate about teaching and interested in environmental issues. Led by prominent researchers, 50 fellows will spend one to two weeks on expeditions, collecting data on climate change and sustainable resource management. These expeditions help teachers gain important research skills and content knowledge that can be translated into their classrooms. This year's expeditions include studying sea turtles in Costa Rica, endangered corals in Little Cayman, and climate change at the Arctic's edge or in Acadia National Park, Arizona, California, or Ecuador.

Fellowships cover meals, accommodations, and on-site transportation while on the expedition. Fellows also receive a travel award grant to offset out-of-pocket travel expenses to and from the expedition site.

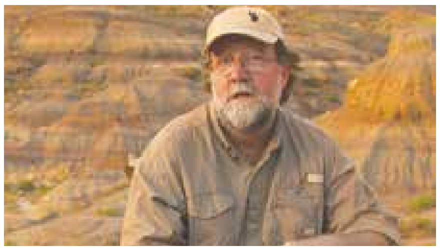
Teachers must complete and submit an online interest form to determine whether they meet the program's requirements. Those deemed "qualified" are invited to apply by **December 18.**

For more information and to access and complete the interest form, visit the website *http://bit.ly/29PCoI0.*

Birdsleuth in the Amazon K12

The Cornell Laboratory of Ornithology's BirdSleuth K–12 program, in partnership with Amazon Rainforest Workshops, aims to build science skills and inspire students to connect to local habitats, explore biodiversity, and engage in citizen science. BirdSleuth's trip to the Amazon, taking place July 9–18, 2017, in Peru, will help K–12 teachers learn more about the program's educational approaches and rainforest birds. Participants will visit the Amazon Conservatory for Tropical Studies Field Station, investigate the rainforest canopy, float the river, and participate in hands-on activities they can use in their classrooms. Learn more at *http://bit.ly/29X3Apw.* ●

NSTA Conferences Spread Professional Development Across the U.S.



Sean B. Carroll

Ainissa Ramirez

The first of NSTA's Fall Area Conferences on Science Education begins next month in Minneapolis, Minnesota, as science educators from around the region gather to Celebrate Science: 10,000 Connections, October 27–29.

The Minneapolis conference committee organized the event around three strands to help attendees focus their professional development efforts. The Teaching Science in a Connected World strand focuses on effective and responsible uses of digital resources and technologies in education. STEMify Instruction Through Collaboration Across the Curriculum will delve into science, technology, engineering, and mathematics (STEM) integration. Celebrating Elementary Science and Literacy Connections will offer strategies to unite science and literacy at the elementary level. Ainissa Ramirez, scientist, educator, and science evangelist, will discuss "Why We Need More People to Ask Why" and the importance of encouraging students to continue to ask questions in the general session on October 27.

Science educators will be Exploring Mountains: Guiding Science Teaching and Learning during the Portland, Oregon, conference, November 10–12. The conference strands (Base Camp: Collaborating to Integrate Elementary Science Instruction With Math and English Language Arts; The View From the Summit: Celebrating Science for All; and The View From All Angles: Connecting Three-Dimensional Science Instruction) highlight the need to create a strong foundation for science education during the elementary years, the importance of equity in education, and the ways the three dimensions of the *Next Generation Science Standards* work together to create high-quality science instruction. During the November 10 general session, Sean Carroll of the

Howard Hughes Medical Institute, author of *The Serengeti Rules,* will discuss how these ecological rules impact the density and diversity of the flora and fauna in a particular location and how they can be applied to wilderness restoration efforts.

Educators attending the Columbus Area Conference on Science Education, Champions of Science: A Game Plan for the Future!, can choose from three sports-themed strands. Those following the Training Camp: Strengthening Fundamentals in Elementary Education strand will hone their understanding of crosscutting concepts, science and engineering practices, and assessments of student learning. In the Game Time: Tackling Scientific Problems and Pitching Engineering Solutions strand, attendees will learn how students can take on real-world challenges such as renewable energy and water quality as they learn about and use science and engineering practices. The Science Boosters: Taking It to the Next Level strand will focus on how educational partnerships can extend science education beyond the classroom and enrich students' learning. Ramirez again joins NSTA in the December 1 general session, themed "STEM Heroes," and shares her insights on how educators can become "STEM heroes" as they guide students' developing STEM skills.

NSTA members receive discounted registration for the area conferences. This member rate also is available to members of the Minnesota Science Teachers Association for the Minneapolis conference; members of the Oregon Science Teachers Association and Washington Science Teachers Association for the Portland conference; and Science Education Council of Ohio members for the Columbus conference. American Association of Physics Teachers, American Chemical Society, and American Society for Engineering Education members may register for any of the area conferences at the member rate. Additional discounts are available for early registration (deadlines vary by conference). For more information on the NSTA Area Conferences and to register, go to *www.nsta.org/conferences*. ●

Quotable

Let me tell you the secret that has led to my goal: My strength lies solely in my tenacity.

—Louis Pasteur, French chemist and microbiologist (1822–1895)

C³ ***Connect. Collaborate. Celebrate. Teachers Are the Key

By Mary Gromko, NSTA President 2016–17

In NSTA's nearly seven decades, our purpose has remained just as concise and relevant since our start: We are a science teacher organization. Our purpose is to stimulate, improve, and coordinate science teaching at all levels of instruction. Our mission is to promote excellence and innovation in science teaching and learning for *all* students. These are powerful statements, and challenges abound.

NSTA continues to provide many opportunities for teachers to *connect***.** The excitement began this summer, when NSTA's leadership gathered in Denver, and as representatives of the Chapters and Associated Groups met during the National Congress on Science Education, continued through the STEM Forum & Expo in the same Rocky Mountain location. This fall, NSTA Area Conferences will offer three opportunities for teachers to *connect* in Minneapolis, Minnesota; Portland, Oregon; and Columbus, Ohio. These area conferences will be followed by the National Conference on Science Education in Los Angeles in spring 2017.

The NSTA Learning Center enhances science teaching and learning. It serves to connect teachers using available technologies.

Science educators must move beyond just connecting. Teachers also need opportunities to *collaborate*. The implementation of three-dimensional science instruction, embedded in the *Next Generation Science Standards* and *The Framework for K–12 Science Education*, and the importance of science, technology, engineering, and mathematics (STEM) programs in schools and districts were a prime focus for the STEM Forum and Expo. This conference provided more collaborative opportunities for teachers to participate, network, and connect with outreach programs and partnerships.

At area and national conferences, Professional Development Institutes will enhance the conference themes. The need to educate increasingly diverse student populations with different histories and cultural perspectives requires a strong focus on the understanding of how students learn based on their experiences and expectations. Equity and multicultural workshop strands during the conferences are vital to meeting this need. Through the Alliance of Affiliates, I am encouraging other science professional organizations to enhance their collaborative efforts with our members. All conferences provide research-based strategies focused on effective methods for teaching science, understanding of how students learn science, and helping teachers understand core scientific concepts and how they connect within the disciplines.

It is important to have ongoing conversations and discussions about the uniqueness of science teaching. NSTA supports policies, resources, and structures that make professional development a central focus to build the system capacity. We must show the public the value of teaching science and *celebrate* science teachers, who are responsible for the teaching and learning of what students need to know and do to be considered scientifically literate. Award programs, such as the Shell Science Teaching Awards, facilitated by NSTA, celebrate science teachers.

The public must also understand and support the effort it takes to make the vision of NSTA sustainable and a reality. Science educators are essential to the implementation of our vision in this country. Teachers are society's most valuable resource for improving science education and the most important agents of change in education. This is why we must *connect, collaborate,* and *celebrate***.** Teachers are the *key***.** ●

BLICK ON FLICKS

Ghostbusters Return With 21st-Century Look

by Jacob Clark Blickenstaff, PhD

Many of the films I grew up with have been re-imagined in the last five to 10 years. The latest is *Ghostbusters* (2016), which re-imagines the universe of two movies from the 1980s, *Ghostbusters* (1984) and *Ghostbusters II* (1989). The most noticeable updates in the new film are the vastly improved special effects and the transition of the Ghostbusters team from all male to all female.

The first two films starred Bill Murray, Dan Aykroyd, Harold Ramis, and Ernie Hudson as the Ghostbusters team; the latest installment stars Kristen Wiig, Melissa McCarthy, Leslie Jones, and Kate McKinnon. Chris Hemsworth as the receptionist for the new team also reverses a gender stereotype. This is the latest film from director Paul Feig, who has made several other comedies with women in all the lead roles, including *Spy* (2015), *The Heat* (2013), and *Bridesmaids* (2011).

It isn't really necessary to have seen either of the original *Ghostbusters* movies to enjoy this one, as the plot ignores the prior films entirely. However, the film does have a number of inside jokes for fans of the earlier movies, and the theme song is essentially unchanged. For my purposes, you just need to know that increasing levels of "paranormal activity" are happening in New York City, and the only people who can save humanity are the Ghostbusters: Dr. Abby Yates (McCarthy), Dr. Erin Gilbert (Wiig), Dr. Jillian Holtzmann (McKinnon), and Patty Tolan (Jones).

Gilbert is a physics professor at Columbia just up for tenure, while Yates and Holtzmann teach at a community college in New York City. Holtzmann is the team's engineer, developing most of the equipment to subdue and capture ghosts. Tolan is a Metro Transit employee who reports one of the early hauntings, then invites herself to join the team. She is a key member of the team, bringing a hearse for transportation and supplying the uniforms. It will come as no surprise that in the end, the team succeeds, allowing the the possibility for a sequel.

Given the subject matter, what may be surprising is that I think teachers can take advantage of some aspects of this film. Though *Ghostbusters* has a lot of scientific-sounding jargon that doesn't really make sense, like "total protonic reversal," and any understanding of the supernatural is by definition unscientific, teachers can still connect this movie to mathematics, physical science, and physiology in some fun ways. I also appreciate the clear message that female scientists and engineers can get the job done.

Mathematics

Early in the film, Holtzmann is distracted from a conversation by the Pringles potato chip she is eating. When the others glare at her, Holzmann replies, "Just try saying no to these salty parabolas." While describing the chips as parabolas isn't quite right, just mentioning the term could initiate a good conversation in a math or physics class. For example,

- What is a parabola? A curve (not a surface) defined by $y = ax^2 + bx + c$.
- Where do we find parabolas in nature? The path of a projectile through the air is an upside-down parabola if you view it from the side.
- How is the chip's shape similar to and different from an actual parabola?

The saddle shape of a Pringles chip is actually a surface (three-dimensional rather than a two-dimensional curve) known as a hyperbolic paraboloid. This shape is not commonly found in nature, but has been used by architects in a number of buildings around the world.

GLANE23

Pringles chips are made in this shape for ease of transportation during manufacturing and shipping, and also to make them immediately recognizable from other brands.

Physical Science

An homage to the original *Ghostbusters* film occurs when Gilbert is being forcibly removed from a formal meal after attempting to talk to the mayor of New York. As guards carry her from the room, she grabs a table, then the tablecloth, and pulls it out from under all the dishes on the table. Only one or two items remain unbroken on top of the table. This scene is very similar to an attempt by Peter Venkman (Murray) to do the tablecloth trick in the first film, with similarly poor results. (Though he proclaims, "And the flowers are still standing!")

Both movies are alluding to a classic physics demonstration of inertia. If the tablecloth is removed quickly enough (and with a bit of downward pull at the edge of the table), the inertia of the items on the table will keep them in place. A slow pull on the tablecloth will, of course, bring everything crashing to the floor. Gilbert's pull is certainly not quick enough to leave things on the table, as friction between the cloth and the dishes easily overcomes their inertia. (*Mythbusters* also explored this trick in the episode "Tablecloth Chaos.")

Physiology

At one of the early haunting events, the team notes that they feel their ears pop, and they attribute it to unusual activity. Certainly having your ears pop without a rapid change in elevation is unusual. But what is happening when your ears pop anyway?

Our hearing relies on the eardrum to vibrate when sound is received in our ears. Tiny bones transmit that vibration from the eardrum through the middle ear and to the cochlea in the inner ear. The eardrum is the membrane between the open atmosphere and the air-filled middle ear. When we change elevation quickly, by going up in an airplane or elevator, for example, the pressure on the outside of the eardrum decreases, causing a difference in pressure compared to the middle ear.

If the pressure isn't equalized, the higher pressure in the middle ear can burst your eardrum. When you yawn or chew gum, the auditory tube lets a bit of air out of the middle ear and into your throat, equalizing the pressure. You sense that as a "pop."

When the airplane or elevator goes back down, the auditory tube lets a bit of air back into the middle ear to compensate for the higher pressure of the atmosphere outside. I don't know how a ghost could change atmospheric pressure, but that's what the Ghostbusters were sensing.

Teachers can take advantage of some fun math and science in the latest *Ghostbusters* film, and can discuss the depictions of female scientists and engineers in the film.

Note: Ghostbusters *is rated PG-13 "for supernatural action and some crude humor."* ●

Jacob Clark Blickenstaff is the program director for Washington State Leadership and Assistance for Science Education Reform at the Pacific Science Center in Seattle. Read more Blick at http://bit.ly/amBgvm, *or e-mail him at* jclarkblickenstaff@pacsci.org.

MS. MENTOR, **Advice Column**

Starting a New Year Off Right

I'm moving to a different state to take a teaching position. I don't know anyone there, so where can I look for guidance on state standards and other resources that would be helpful in my new job?

—W., Pennsylvania

Congratulations on finding a job! I hope you will have a mentor or other colleagues who will help you adjust to a new school in a new state. In the meantime, I suggest the following:

Check out your state's Department of Education website for links to standards, resources, and professional certification requirements.

Familiarize yourself with your school district's science curriculum guide and the school handbook, and ask about the textbook or electronic resources used in the course and the type of technology available in your school. Browse websites for your new school and the community.

Connect with others in your state by posting state-specific questions or requests for information to the relevant NSTA e-mail list(s). Choose from various subject areas (chemistry, physics, biology, Earth science, general science), grade level you're teaching, or topics such as *Next Generation Science Standards* and pedagogy. As an NSTA member, you can subscribe to as many lists as you want through the NSTA website (*http://bit.ly/WG5naw*).

Post questions or requests and search previous posts on NSTA's Discussion Forums (*http://bit.ly/2aT3kel*).

Connect with your NSTA State Chapter or a relevant Associated Group (*http://bit.ly/1TjlhzK*). These organizations sponsor conferences and other events, post links to professional development opportunities, provide a calendar of events, and more.

Check the offerings of local science centers, parks, or museums. If you become a member, you can connect with other teachers at events, and add to a network of community resources.

Visit the public library to see what materials and resources are available.

See what local colleges or universities have to offer in terms of outreach projects with schools, graduate courses, lecture series, or guest speakers.

Many of these resources can be explored online. If possible, reserve some time before the first day to give yourself on-site opportunities to prepare yourself and your classroom/lab. During this time, your district may offer teacher workshops. Take advantage of these to meet other teachers and become familiar with the culture of your new school.

I meet with more than 100 students per day in my Earth science classes. As a relatively new teacher, I need suggestions for how to get to know them better, including learning their names and interests in a timely manner.

– L., Connecticut

Students like to know teachers care about and respect them. Knowing their names is important from the start. When I would call out names on the first day, I predictably mispronounced a few or used a full name rather than a preferred nickname. Although some students found this hilarious, it embarrassed me and other students. So I started asking the students to introduce themselves, allowing me to annotate my list with phonetic spellings and nicknames. Regardless of how you feel about seating charts, I found them helpful at the beginning of the year to connect names and faces.

Identifying their interests can help personalize the science class. During the first week of school, ask students to write information about themselves on index cards: name, birthday, nickname, interests/hobbies, school-related activities, out-of-school activities, and other conversation-starters. I used a different color for each class, and each day I chose a card and made a point to talk to that student informally. Here are some ideas from our colleagues:

- Steve Olenchek created a "Sciencebook" page (*http://bit.ly/2ah3JFT*), similar to a Facebook page, for students to share information about themselves.
- Darci Sosa collects similar information in an online Google Docs survey (*http:/bit.ly/2arQnc9*). She sorts results in a spreadsheet and uses information to group students with similar responses.

I just took a fifth-grade position. My classroom is in a brand-new building, and has nothing—just the student tables, bare bulletin boards, empty bookshelves, and a teacher desk. What can I do in a short time and with a small budget?

—A., California

New teachers should realize the displays and bulletin boards in the classrooms of veteran teachers are the result of many years of experience and collecting. But starting with a blank space can be good. Imagine how you want the room to look and feel. Remember that less is more. Students should be able to focus on their work, and clutter can be distracting.

For science, you can do some things to make the classroom attractive and conducive to learning:

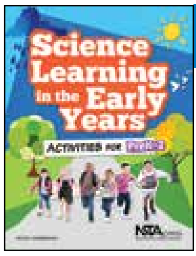
- Create a classroom library with books on a variety of nonfiction topics and reading levels. Start with books from the school library and supplement with books from yard sales or children's book sales.
- Designate one area as a "science center," supplied with materials for activities related to what they are currently learning. It could have objects or materials for students to explore (e.g., shell collections, weather maps, simple machines). Change the materials with each unit of study. Any science-specific safety equipment could be here.
- Find out what technology will be in the classroom: laptops, tablets, etc. You'll need to store these near outlets for recharging.
- Set up a study center for students doing make-up work and independent study or for those who need fewer distractions.
- Purchase plastic tubs to organize and store materials.
- Find out what safety equipment and science materials will be in the classroom.

You can spend time and money on elaborate bulletin boards, but that isn't necessary! I found the most effective bulletin boards were created with student materials (or by the students themselves) and had content that served an instructional purpose:

- Include a "word wall" with the key vocabulary for each subject. As you introduce a new term, ask a student to create a card with the word and post it on the wall. Refer to it often during class discussions or writing assignments. The cards can be used during review games.
- Safety rules should be posted in a prominent, permanent place.
- Reserve space for student work.
- Maps cover a lot of bulletin board territory. A state map can fit into science, social studies, and math activities.
- Set up a photo gallery. Display your own photographs related to a topic, and encourage students to share their photos or bring in related pictures or news articles. Post photos of students engaged in class activities.

I know experienced teachers who start each year with blank walls or bulletin boards. As the year progresses, students add their own artifacts to the classroom.●

Check out more of Ms. Mentor's advice on diverse topics or ask a question at www.nsta.org/msmentor.



NSTA PRESS: *Science Learning in the Early Years: Activities for PreK–2*

Water Leaves 'Footprints'

Editor's Note

NSTA Press publishes high-quality resources for science educators. This series features just a few of the books recently released. The following excerpt is from Science Learning in the Early Years: Activities for PreK–2, *by Peggy Ashbrook, edited for publication here. To download the full text of this chapter, go to* http://bit.ly/29Raoog. *NSTA Press publications are available online through the NSTA Science Store at* www.nsta.org/store.

Before You Begin This Activity

Remember that each activity is not a stand-alone science or engineering curriculum. Activities are small steps in a journey of science inquiry. Your students will learn more about this concept and about the nature of science if you use this activity as part of an ongoing exploration of a question, a concept, or a topic being investigated by your class. Ask yourself, "What should come before this and what should come after?"

One morning, after a heavy rain, the preschool sandbox crowd noticed a row of small cone-shaped holes about 2–6 cm in diameter in the wet sand. "Hey, look!" The discussion began on what could have made those holes. The children thought it might have been an animal walking or digging. "Have you ever seen footprints like these before?" I asked, trying to get them to refer to prior experiences. I noticed the holes lined up under the edge of the awning that covers most of the sandbox. In my prior experience, water dripping off a roof makes holes in the ground below. I could have shared this experience with the children, but they could also discover it themselves, over time, through additional experiences.

Early childhood science focuses on providing experiences for young children to broaden their hands-on understanding of the natural world. Looking for and describing evidence to support ideas about natural events are part of the crosscutting concepts and the science and engineering practices described in *A Framework for K–12 Science Education* (*Framework*; NRC 2012); these practices include Planning and Carrying Out Investigations, Constructing Explanations, and Engaging in Argument From Evidence. Supporting students in science discussions during which they share and argue about their evidence for their ideas begins in early childhood, when their experiences and any documentation and collected data are their evidence.

Teachers introduce science concepts such as learning about how water shapes the Earth's surface to build student understanding toward the *Next Generation Science Standards* (*NGSS*) grade 2 performance expectation 2-ESS1-1: "Use information from several sources to provide evidence that Earth events can occur quickly or slowly" (*NGSS* Lead States 2013). The *Framework* and *NGSS* begin with kindergarten, but prekindergarten teachers can see what lies ahead for their students or use early childhood learning standards such as the *Head Start Early Learning Outcomes Framework: Ages Birth to Five* as a guide (U.S. DHHS, ACF, Office of Head Start 2015).

By working with sand and pouring water, children can discover how water moves sand to create different shapes in sand. They can control and vary the water stream direction, amount, and speed. Being able to directly explore the materials over time, and make the changes themselves, helps children build their understanding of science concepts (Chalufour and Worth 2006).

Activity: Sand Movers

Objectives

- To explore how water can move sand
- To use evidence to back up children's scientific claims

Materials

- Sandbox, sensory table, or large watertight box
- Sand
- Water
- A variety of tools and containers to move water and create water flow such as watering cans, droppers, turkey basters, and empty condiment containers
- Bucket for wastewater (if activity is indoors)
- Indirectly vented chemical-splash goggles
- Drawing or writing materials
- Camera (optional)
- Towels or mop for cleanup (optional)
- Smocks (optional)

Procedure

1. Draw children's attention to where rainwater or another source of water has moved sand or soil, if you can find such a location. This might occur on a dirt hillside or athletic field after a rain, along a stream bank, in a garden bed, or in a sandbox. You might say, "This curving pattern of soil looks like it was moved here somehow" or "I wonder why the sand is lower here?" to begin a discussion.
2. As children make guesses about how the sand or soil shape was formed, note comments about prior experience. Plan to provide materials that will build on what they have already experienced.
3. Provide a box of sand that can be used with water indoors, or use an outdoor sandbox. Match the size of the sandbox with the size of the containers the children will use to add water so water will not build up too quickly in the box. Wet sand can clog a sink, so if it is not possible to do this activity outside, provide a bucket to carry wastewater outside. *CAUTION: Have children wear indirectly vented chemical-splash goggles, and provide smocks if the children must stay dry.* Tell the children that you would like them to use just water to move the sand. (Encourage water-only movement of sand, but expect and accept it if children begin using their hands and the tools on the sand.)
4. Allow children to explore the sand and water tools together for a long period of child-directed play, one hour or more a week depending on the interests of the children.
5. As children use the tools with water to move the sand and create shapes, ask open-ended questions to help them focus on how the force of moving water moves the sand, such as "What happens to the sand when you do ____?"
6. Have children draw or photograph the shapes they make in the sand, and write or dictate a description of what tool(s) they used and how they made the shape.
7. Tell the children that the group is going to share what they know about the question, "Can water move sand?" Have children share their drawings and photos and talk in turns about their observations and experiences. If they disagree with a statement, say, "Scientists don't always agree with one another. We can learn from one another. What evidence do you have? Can you show what you drew or wrote?"

Children may want to demonstrate their actions. Keep the water and sandbox available for further exploration as long as the children are interested. ●

Mark Your Calendar
NSTA Dates to Remember

(All dates are deadlines unless otherwise specified.)

September 30—Register by today to maximize your savings on registration for the **NSTA Portland Area Conference on Science Education. Exploring Mountains: Guiding Science Teaching and Learning,** to be held November 10–12 in Portland, Oregon, features three strands: Base Camp: Collaborating to Integrate Elementary Science Instruction With Math and ELA; The View From the Summit: Celebrating Science for All; and The View From All Angles: Connecting Three-Dimensional Science Instruction. Earlybird NSTA member registration costs $180; on-site member registration, $225. For more information or to register, visit the website *www.nsta.org/portland*.

October 1—***The Science Teacher*** (*TST*), NSTA's peer-reviewed high school journal, needs your manuscript on how you teach about astronomical events for the **"Eclipse!"** issue. *TST* also accepts articles unrelated to a theme at any time. For more information on writing for *TST*, issue themes, and more, go to *http://bit.ly/1saSncP*.

October 1—The total solar eclipse that will occur on August 21, 2017, is a rare opportunity for educators to explore the intersection of astronomy, mathematics, and mythology with their students. Help your fellow middle level educators prepare for this event by sharing how you meet this *Next Generation Science Standards* performance expectation—Develop and use a model of the Earth-Sun-Moon system to describe the cyclic patterns of lunar phases, eclipses of the Sun and Moon, and seasons—in the March 2017 issue of ***Science Scope***, themed **"Our Sun and Beyond the Solar System."** General-interest manuscripts, commentaries, and column submissions are always accepted. Read the call for papers and access submission guidelines at *http://bit.ly/1OfgnF0*.

October 7—Register by today to save on registration fees for the **NSTA Minneapolis Area Conference on Science Education, Celebrate Science: 10,000 Connections.** The conference will be held October 27–29 in Minneapolis, Minnesota, featuring three strands: Teaching Science in a Connected World, STEMify Instruction Through Collaboration Across the Curriculum, and Celebrating Elementary Science and Literacy Connections. "Science evangelist" Ainissa Ramirez is the general session speaker. Advance NSTA member registration costs $190; on-site member registration, $225. For more information or to register, visit *www.nsta.org/minneapolis*.

October 14—Register today for the best deal on your registration for the **NSTA Columbus Area Conference on Science Education**, **Champions of Science: A Game Plan for the Future!** The general session features "science evangelist" Ainissa Ramirez. The conference offers three strands (Training Camp: Strengthening Fundamentals in Elementary Education; Game Time: Tackling Scientific Problems and Pitching Engineering Solutions; and Science Boosters: Taking It to the Next Level) and will take place December 1–3. Earlybird NSTA member registration costs $180; on-site member registration, $225. For more information or to register, visit *www.nsta.org/columbus*.

October 19—**Submit your application** now to join **NSTA's Board and Council**. NSTA is accepting applicants for the offices of President, Multicultural/Equity in Science Education Director, Preservice Teacher Preparation Director, Research in Science Education Director, and District Directors for Districts I, VI, VII, XII, XIII, and XVIII. For more information or to download an application, visit the website at *http://bit.ly/cp5xZC*.

November 1—*TST* seeks articles on teaching **"Science for All"** for the April/May 2017 issue. *TST* also accepts articles unrelated to a theme at any time. For more information on writing for *TST*, issue themes, and more, go to *http://bit.ly/1saSncP*.

November 16—PreK–16 science educators can win up to $10,000 for their outstanding efforts through the NSTA Teacher Awards program. Learn how to craft a strong application during **Developing a Competitive Teacher Award Application, a free NSTA Web Seminar** with Sheila Smith, chair of the NSTA Teacher Awards and Recognition Committee. The session will run from 6:30 to 8 p.m. Eastern Time. For more information on NSTA Web Seminars or to register, see the website *http://bit.ly/1Iwpg4w*. ●

Write for NSTA Journals

Have you shared an effective teaching strategy with teachers at your school? Developed a unique approach to a unit that you think could help more students learn the content? Share your successes with a wider audience of educators through NSTA's peer-reviewed journals.

NSTA journals are among the most valued benefits of membership, but educators' contributions are essential. Several issues of the grade-level journals focus on specific themes, but manuscripts on any topic can be submitted at any time. In addition, the journals accept submissions for their various columns on subjects from engineering to technology to low-cost activities and more. Read the journals' call for papers online for more information on how you can contribute to the professional knowledge of your fellow educators.

- *Science and Children* (elementary school, *http://bit.ly/2aN9rA9*)
- *Science Scope* (middle school, *http://bit.ly/25yWUEN*)
- *The Science Teacher* (high school, *http://bit.ly/1saSncP*)
- *Journal of College Science Teaching* (college/university, *http://bit.ly/2aljqcc*) ●

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NSTA Reports: Working for You!

In our June *NSTA Reports* readers survey, more than 1,300 NSTA members shared your thoughts about this newspaper as we work to keep you informed on the latest in science education. Much that we learned was gratifying (93% of readers rate information in *Reports* as either "good" or "excellent" and say it is a valuable member benefit).

We also received some ideas for making *Reports* even more user-friendly. In this issue, we implemented the first idea: visual "tags" to items in the Science Teachers' Grab Bag pull-out section to help readers quickly locate information by grade band. We're exploring other improvements, too.

Thank you to all of our readers who participated in the survey, and congratulations to the six winners of the random drawing for $50 to spend in the NSTA Science Store: Nina Fujimoto, Diane Kablik, Tracy Mailloux, Angela Marshall, Kirsten Matsumoto, and Martin Stauffer. ●