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Partnering With Utilities for Hands-On STEM

WILLIAM RASOR

Granada High School's Interact Club students work with David Lunn of Friends of the Arroyo to measure water turbidity during the Tri-Valley Creeks to Bay Clean-up event.

Utility companies, hoping to inspire the next generation of employees, meet community outreach and other obligations, or both, are teaming up with educators to create innovative, hands-on learning opportunities.

Keri Randolph, director of innovation for Hamilton County Schools in Tennessee, has worked with two utility companies—the Tennessee Valley Authority (TVA) and the local electric power board (EPB)—to expand science, technology, engineering, and mathematics (STEM) offerings for Hamilton County students. TVA's Partners in Education program supports initiatives including robotics and energy-focused supports, such as donating solar arrays and other equipment.

Her work with the EPB grew out of a casual conversation with an EPB employee about the challenge of marketing a community solar energy program. That led to a meeting with EPB and K–12 teachers from six Hamilton County schools who brainstormed project-based learning ideas based on the program. Randolph reports that each grade level took a different approach, and in the end, "the kids had a whole package of solutions they presented to EPB." They included public service announcements created by kindergarten students and a solar power education kiosk designed by high school students.

"EPB has said they will take some ideas and implement them," she notes. "This has opened up more opportunities for us to partner [with EPB]… At our STEM high school, students do quarterly [projects. When EPB was designing] a new power grid in a new neighborhood, our kids came up with their own plan… that would reduce the number of transformers [needed] and save [EPB] money."

She says teachers have reported higher student engagement and are requesting more opportunities to partner with utilities and other companies, despite the extra planning time required. "It's a win-win on both sides," Randolph notes. "The project-based learning work…came out from casual conversation. I do that a lot more. I ask people if they've had kids work on problems; they are pleasantly surprised with the results [when they do]."

The Center for Mathematics, Science, and Technology at Illinois State University (CeMaST) is in its third year of support from the Illinois Science and Energy Innovation Foundation, funded primarily by Illinois power companies, to provide K–12 energy education.

"They were probably thinking three-ring binders and PowerPoint slides. We don't do that," declares Brad Christensen, CeMaST STEM specialist. Instead, they created a series of rooms—kitchen/dining room, utility room/garage, and bedroom/bathroom—contained in boxes that can be set up inside a school. In the kitchen, for example, students find all the appliances they would see in a typical kitchen, including a blender, toaster, stove, and refrigerator.

"Students plug things in to see the energy use and calculate the bill. Then they trade the standard [electricity] meter for a smart meter, and get real-time rate adjustments. They get to see what's most cost-effective, such as using the clothes dryer or oven at off-peak times. We have basically three of every appliance. Every appliance has an Energy Guide tag identifying its energy use as either a low-, middle-, or high-efficiency appliance. Students plug in different appliances with different tags, and see different usages," says Christensen.

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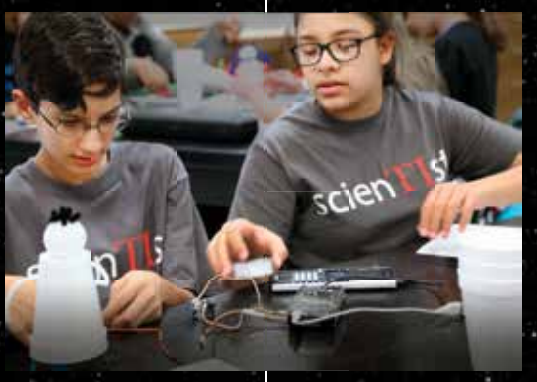
The only thing standing between an astronaut and energy depletion… two kids.



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TEXAS INSTRUMENTS

COMMENTARY: **Andrew Fraknoi and Dennis Schatz**

When the Sky Is Your Classroom: Teachable Moments From Natural Events

By Andrew Fraknoi and Dennis Schatz

Andrew Fraknoi

Dennis Schatz

Student motivation is a strong incentive for learning. Good teachers generally look for ways to align their lessons to current developments, and anticipated or unanticipated natural events provide the perfect opportunity to connect to what excites students. These events turn the news students see on their screens into a lesson on the principles governing the natural world.

When the volcano Mount Saint Helens erupted in 1980 and ash darkened the skies of the Northwest and spread debris across the United States, students wanted to understand what happened, which provided the perfect time for teachers to focus on plate tectonics and geologic structures on the Earth. When gravity waves were observed earlier this year, physical science teachers used the event to discuss waves, the nature of gravity, and the dramatic cosmic event that produced the gravity waves. When the Northern Lights (Aurora Borealis) are seen farther south than usual, it becomes a way to explore sunspots and solar flares and how charged particles streaming from the Sun cause the aurora. Much of the time, these events cannot be anticipated, and teachers must improvise lessons that capitalize on these teachable moments.

Sometimes, however, the teachable moments can be predicted far in advance. One of these will occur on August 21, 2017, when we will be treated to the first total eclipse of the Sun visible in the continental United States in almost 40 years. Because the total phase of the 2017 eclipse is *only* visible in the United States, it is already being called the "All–American Total Solar Eclipse" and is creating an unprecedented amount of interest among U.S. skywatchers.

The spectacular total eclipse will only be visible in a narrow band about 60 miles across the United States, stretching diagonally from a beach in Oregon to a beach in South Carolina. This band doesn't go through any of the largest cities in the country (although it will touch St. Louis and go over Nashville). The last time an eclipse went coast to coast in the United States was 1918, many generations of science teachers and students ago. Already many hotels and campgrounds in the path of the total eclipse are sold out to visitors who planned ahead.

Although the total eclipse will be restricted to a thin diagonal across our country, *everyone* in North America will see a partial solar eclipse, in which a good "bite" will be taken from the Sun. We estimate that roughly 500 million people will be in the eclipse zone, and may be alerted to it by the media—but perhaps only a few days before, by which time it may be too late to use the eclipse as a teachable moment.

August 21, 2017, will be a Monday, and informal surveys indicate that roughly half of U.S. school districts will be in session. And for many of those, the semester will just be starting. So the time to get students ready for this event is probably in spring 2017.

The expected media and social media flurry about the coming eclipse should foment students' curiosity about what causes eclipses and why they are so rare. To satisfy their interest, students need to understand the motions of the Moon and the Sun in our sky, starting with what causes the phases of the Moon, a phenomenon that is easy for most students to observe and chart, if you plan ahead. The cycle of the phases leads naturally to questions about why we don't get an eclipse every month when the new moon is in the same direction as the Sun from our vantage point on Earth.

The reason that eclipses are rare focuses students' attention on the idea that the monthly orbit of the Moon is tilted relative to the ecliptic (the circle the Sun appears to make in our sky as we go around it). The study of eclipses has a long and (pardon the pun) star-studded history in astronomy. The Sun's faint atmosphere was first discovered during eclipses, and the Sun's spectrum seen during an eclipse led us to the discovery of the element helium before it was ever detected on Earth.

To help educators incorporate this rare natural phenomenon into their curriculum, NSTA is hosting a virtual conference—The Total Solar Eclipse of 2017: Are You and Your Students Ready for the Sky Event of the Decade? (*http://bit.ly/2bbAwfo*)—on October 15. Virtual Conference participants will receive an electronic copy of *Solar Science: Exploring Sunspots, Seasons, Eclipses, and More*, published by NSTA Press, which includes classroom experiences for teaching about eclipses.

NSTA Press also offers a free booklet, excerpted from the book *Solar Science*, on the circumstances and safe viewing of the August 2017 eclipse at *http://bit.ly/2bkGSvA*.

We wish you a clear day on that Monday in August, and a sense of satisfaction in having prepared your students with a deeper understanding of what they will be seeing. ●

Andrew Fraknoi is chair of the Astronomy Department at Foothill College in California and the lead author of a free open-source textbook on astronomy published by OpenStax. Dennis Schatz is senior advisor at Pacific Science Center in Seattle, and has authored more than 20 children's books and kits on astronomy, dinosaurs, and other topics. They co-authored Solar Science: Exploring Sunspots, Seasons, Eclipses, and More *(*http://bit.ly/2b6SVJt*).*

NSTA Reports

National Science Teachers Association
1840 Wilson Boulevard
Arlington, Virginia 22201-3092
703-243-7100
nstareports@nsta.org

Lynn Petrinjak ..... *Managing Editor*
Debra Shapiro ..... *Associate Editor*
Will Thomas, Jr. ..... *Art Director*
Production Staff ..... Jack Parker
Catherine Lorrain
Kenneth Roberts .. *Asst. Exec. Dir. for Periodicals*
David Beacom ..... *Publisher*
David L. Evans ..... *Executive Director*
Advertising
Jason Sheldrake ..... *Director*
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NSTA National Science Teachers Association

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The program has expanded to include a construction set that challenges students to build a working power grid. The curriculum guides them through its construction just as the power grid itself evolved from a "chronological/historical perspective...Students connect various power plants, transformers, transmission and distribution lines, and meters to form a grid line. They can then combine grid lines to form a complex grid very similar to what we have today, including coal-fired plants, natural gas, renewable [hydroelectric] energy, nuclear, and most lately, a resurgence in wind and solar power," he explains.

Teachers "download curriculum [from *http://cemast.illinoisstate.edu*]. All of our curricula are written in a learning cycle format, so [they're] student-led… The students get the lesson plan and get started doing something immediately… This has really turned out to be good for all of us. Students really understand electrical power, the grid, and how the Smart Grid works," Christensen asserts.

"The curriculum is not aligned to *NGSS* [*Next Generation Science Standards*] or *Common Core,* but the teachers do [align with them]," he adds, noting the learning cycle "approach aligns with the philosophy of *NGSS.* I hope we're having some impact on pedagogy through their use of the learning cycle format."

When Laura Spence, K–12 STEM specialist for Pinellas County (Florida) Schools, took over the district's after-school STEM academies, she realized there wasn't enough funding for all the district schools. She looked at current district partners and ways to expand their collaborations. "I didn't want to just ask a business partner for money…I felt it was much more important for them to become a vested partner on many different levels," she recalls. The investment options included sponsoring STEM Family Nights and "teacher learning journeys" at company sites.

STEM Family Night events are opportunities for STEM Academy students and their families to work on engineering projects, now with the assistance from Duke Energy (DE) employees. "The employees work side by side with families and teachers on the engineering design projects, discussing [their role in the community and] their career path,…providing STEM expertise to families [on the project] while also sharing their long-term community goals with the Pinellas County School STEM Academies," Spence adds. DE also sponsors STEM Learning Journey professional development for STEM Academy teachers and participates in an annual STEM Expo.

"We started four years ago with 56 STEM academies. This year, we have 250 after-school STEM academies," Spence says. "Having half funded by the district and half funded by [DE], it's a win-win for our students to have as many STEM opportunities as possible."

In California, Livermore Valley Joint Unified School District STEM Coordinator Regina Brinker has partnered with the City of Livermore's Water Resource Division (WRD) to clean trash from local waterways and monitor water quality around the area. On the third Saturday of September, students and their families can join the Tri-Valley Creeks to Bay Clean-up, part of the Adopt a Creek Spot program and Coastal Cleanup Day. WRD selects the cleanup sites, and employees share maps of the local watershed. WRD also provides water-quality test kits.

"We clean up [and quantify] trash… Adding the education component... has impacted students and adults there," Brinker says. "It brings an element of place-based learning…By working at the creek near our schoolyard, there is higher student engagement."

Adopt a Creek Spot helps WRD meet permit requirements from the Regional Water Quality Control Board, according to Lynna Allen, WRD water resources coordinator. In addition, the clean-up event is "getting more people involved and raises awareness," she says. Allen, with partners at the Livermore Area Recreation and Parks Department, Zone 7 Water Agency, and Friends of the Arroyos, also has worked with Brinker and other Livermore teachers to develop K–12 curricula focused on the watershed.

Livermore teachers borrow the water-testing kits from WRD throughout the year to use with their students. "People use test kits as part of World Water Monitoring Day. Kids can look at data worldwide. It fits nicely with *NGSS;* we look at local data and how does that compare internationally," Brinker asserts.

Analyzing Utility Data

Data analysis is central to many educator-utility collaborations. In Princeton, New Jersey, Sustainable New Jersey provided a grant to make energy usage data from the elementary, middle, and high schools available to students. The data is streamed online so students can compare power usage among the schools and monitor the impact of any changes, such as replacing windows with more energy-efficient models. In addition, the schools have worked with the Princeton University power plant on projects ranging from energy audits to field trips to the plant. According to Edward Cohen, supervisor of science preK–12 for Princeton Public Schools, "When doing an energy audit, the idea is to have kids present to the facilities committee on ways to reduce costs… Kids are seeing the data and asking questions about the data…Kids are using data to construct explanations and [find ways to] reduce energy usage."

However, schools don't need a local utility company willing to share data. The Solar4RSchools program is "leveraging utility-scale systems" to provide real-time, real-world data for students to analyze, according to Program Director Chaun MacQueen.

"More than 50% of utility [employees] will be retiring by [the time this year's freshman classes] graduate," says Parker Mullins, who works with MacQueen as program manager for energy education at the Bonneville Environmental Foundation in Portland, Oregon. "We need more students who know programming and software development, as well as engineering, science, finance, and marketing."

Educators can access solar energy data from schools across the country at *www.solar4rschools.org.* MacQueen notes, "Teachers and students can look up projects around the country and [track and] graph the data…There's so much opportunity [in this field, but there's] also inequity of access to that opportunity. We're working with teachers and school districts to expand access."

Solar4RSchools offers online instructions for its use, an online educator library with "classroom- and teacher-tested lesson plans," and professional development opportunities.●

Students Create Products for the Space Station

When asked about her experiences with NASA's High Schools United with NASA to Create Hardware (HUNCH; *www.nasahunch.com*) program, Ayla Grandpre, now a student at Rocky Mountain College in Billings, Montana, says, "Learning something new, [such as] programming and hardware, isn't always [easy]. But as you learn new ways to approach issues, you develop a sense of accomplishment. And the joy in finishing your final project is indescribable,…[e]specially knowing that what you [made will] be used by NASA."

HUNCH is a school-based program that partners NASA's Johnson Space Center (JSC), Marshall Space Flight Center, Langley Research Center, Glenn Research Center, Kennedy Space Center, and Ames Research Center with high schools nationwide. As a NASA engineer in 2003, Project Manager Stacy Hale founded HUNCH to give high school students an opportunity to create inexpensive astronaut training hardware with NASA's aid. Since then, HUNCH has expanded, and students now create goods from hardware to cuisine, and their products are used in flight and on the International Space Station (ISS).

"You learn real-world skills in the now. You don't have to wait till you are out of college; you can work for NASA as a high schooler, and it's a really cool feeling," Grandpre contends. As a participant, "I was involved in finishing up fluorescent light boards, air pressure release valve molds, and a marquee board. I mostly soldered, but was involved with coding and the molding processes as well.

"I [also] learned how to embrace my inner nerd. I was always considered a nerd, and it [usually has] a negative connotation. But when I told people I was making things for NASA, they thought it was really cool," she maintains.

As part of HUNCH's Build to Print project, "students are building parts for a single stowage locker," says NASA JSC HUNCH Mentor Florence Gold. "We have 10 of them certified [through] a rigorous inspection process…The kids have been succeeding at it," she asserts.

Design and Prototype projects include a tape dispenser, a toilet tissue dispenser, a zero-gravity scale, and a food preservation container that keeps produce fresh for longer than a week. "Everything becomes a lot more challenging in microgravity," Gold points out. "The astronauts don't have a refrigerator for food on the ISS."

FLORENCE GOLD

Culinary instructor Bruce Baker's students at York County School of Technology in York, Pennsylvania, prepare a recipe as part of NASA HUNCH's Culinary Challenge.

Typically astronauts make requests for items—either new products or replacements for items on the ISS with design flaws—and students from HUNCH schools work on their designs throughout the school year. They then present them to NASA, which reviews them and chooses what they think will work well. Then schools create prototypes for NASA review, often for multiple reviews. Many schools continue modifying designs and prototypes for several years, Gold notes. Astronauts attend the final review.

HUNCH students "are absolutely amazing. They excel at meeting our qualifications and going beyond them," she contends. "Communication skills are built into this program, so it makes kids ahead of the game in science communication."

In addition to Design and Prototype projects, "we've gone into fashion and consumer science classrooms," Gold reports. For example, students have designed and created cargo transfer bags to carry experiments to the ISS. "And we have students working on the HUNCH website; they make videos for us," such as five-minute documentaries about ISS experiments, she relates.

"We provide schools with all the materials, equipment, and mentors… It's a win-win: We're not paying for labor, which is the most expensive part [of creating products], and we're paying for materials," which schools can't afford, she observes.

"A lot of students will go into STEM [science, technology, engineering, and math] areas. Of more than 13,000 students, approximately 94% [pursue] STEM degrees [or enroll in] technical schools," she reports.

"We have a waiting list of 20-plus schools" to join HUNCH, and "a shortfall of mentors for schools," says Gold. "We're trying to partner with business and industry to obtain funding and mentors." (HUNCH's main funding comes from NASA JSC.)

High Expectations

Donna Himmelberg, chemistry teacher, and Gene Gordon, physics teacher at Fairport High School in Fairport, New York, ran HUNCH as an after-school club for a year, then successfully lobbied the school three years ago to make it a STEM credit-bearing course. "It's not like any other class. Because they're working for NASA, we have adult expectations for the students," says Himmelberg. The course has no curriculum or regular tests because "we're testing them all the time, working to solve problems that scientists living in space must do."

The students have "more opportunity to interact with one another because they work in teams, with roles and responsibilities, [which leads to] better interpersonal dynamics. It's hard to do this in a traditional science class," she contends. "We [communicate online] with NASA personnel who mentor students…We've partnered with local

companies and universities and work in their labs [to] get expert insights into the students' ideas."

The teachers even offer extended hours after school. "Forty minutes per day is not enough," explains Himmelberg. "The students amaze us with how dedicated they can be."

Students have worked on projects such as a wand that uses ultraviolet light to kill bacteria and slippers for the astronauts. "We're still awaiting feedback on them from NASA…The wand still has safety and wiring concerns," she notes. "This year, we have a list of 12 [Design and Prototype] projects that students can work on. If students choose their project, they're more invested, and their work ethic is better."

Robert Tabeek, culinary arts instructor at Passaic County Technical Institute in Wayne, New Jersey, is a former chef whose team of three sophomores won the HUNCH Culinary Challenge last year. "HUNCH decides the type of cuisine [to be produced] each year. It was a vegetarian entrée last year. We have to follow [NASA's] nutritional guidelines [and create] something that can work well in microgravity," he explains.

"We gave NASA four different recipes, and they chose one of them. The students had to write a term paper on what food production is like in microgravity and why [a recipe] is chosen. They make a video [of the preparation process]…The NASA folks came to our school and did a taste test, and we were chosen as one of 10 finalists to go to Houston," Tabeek relates.

One main challenge he and his students face is "we're production-based: We prepare food for the entire school every day; that's 3,500 students each day," he explains. Because of this, his HUNCH team "chose to participate before and after school and at lunch—on their own time."

Tabeek reports that "it was a very stressful time; meeting the requirements is a lot of work, and the students had to sharpen their teamwork and time-management skills…[But] it's very rewarding [because] the board of education recognized the students, there was an article [about them] on CNN's website, and they had a chance to go to Houston. And they can put all of this on their resumes." ●

Quotable

High achievement always takes place in the framework of high expectation.

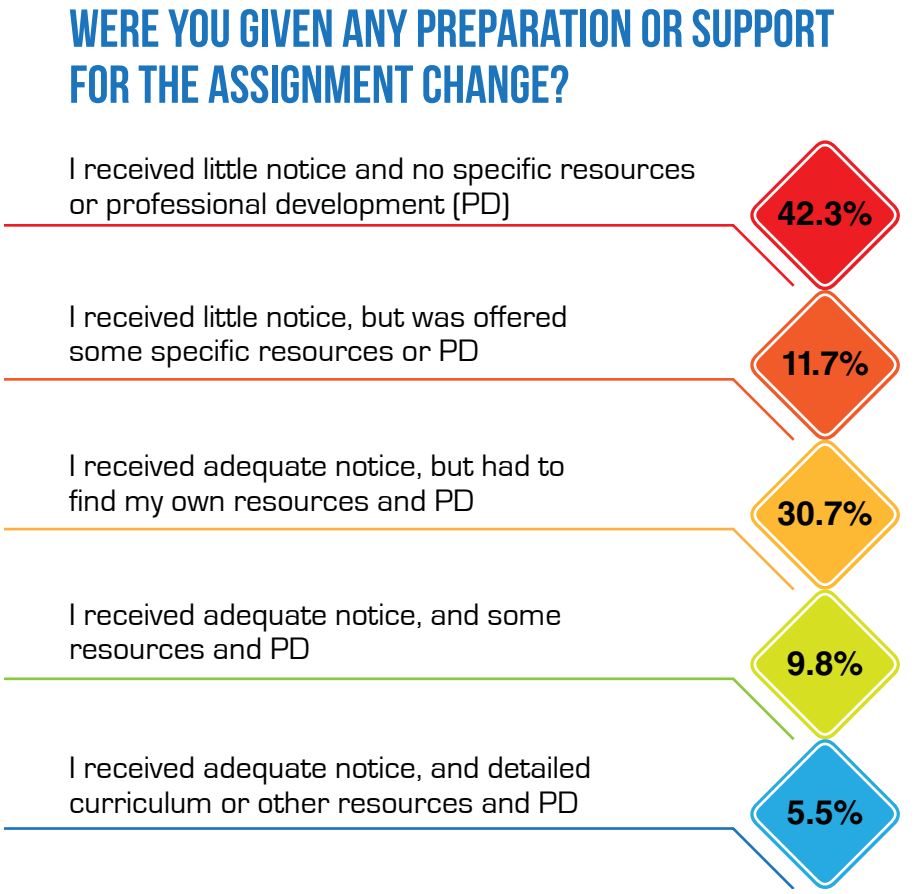
—Charles F. Kettering, U.S. inventor and engineer (1876–1958)

The Pros and Cons of Assignment Changes

NSTA Reports recently asked science educators if they have been asked to change the grade level or subject they teach. Nearly all (92.8%) reported they have been assigned to teach a new subject or grade level. Only 21% said they had an option to decline a change. For a significant number of teachers, it happens frequently, with 29% reporting their assignments/preps change every year and 39% reporting they change every two to three years. Only 5.5% reported receiving adequate notice and detailed curriculum or other resources and professional development (PD), while 30.7% said they get adequate notice, but had to find their own resources and PD, and another 42.3% reported receiving little notice and no specific resources or PD.

Nearly three-quarters (73%) said they were given an explanation for the change. The most common reasons were staffing changes (63%) and course changes to meet student needs/interests (47%) [participants were allowed to choose more than one response to this question]. Respondents also commented, "Teachers are being reassigned to maximize test scores in heavily tested subjects;" "Principal said he wanted to keep everyone uncomfortable;" and "We are expected by the school/district to loop or change grades."

When asked whether they ever request a new assignment, respondents were nearly evenly divided: 49% said they had asked for a new subject or grade-level assignment, while 50% said they hadn't. Most who ask for new assignments say they do so rarely (66%); 17% say they make this request every two to three years; 11% say they do so every four to five years. Nearly half (48%) said they did because they wanted a new challenge. Twenty-two percent said they requested the change because they had been teaching outside their preferred subject area or grade.



Here's what science educators are saying about assignment changes:

The first year of a new assignment, the teacher is in survival mode, especially if [he or she] receives little to no help…It is difficult to teach the standard if you are learning it yourself the night before. The student suffers; the teacher feels inadequate; the result [is] a loss of passion for education from both sides.—*Educator, Middle School, California*

If it is done too frequently, changing assignments negatively affects both educators and students. It leads educators into a situation [in which] they are never able to fine-tune a course, and makes them become a "jack of all trades, but a master of none." Since teachers are never able to master their courses, students do not reap the benefits of having an experienced teacher.—*Educator, Middle School, High School, Vermont*

Totally depends on how the educator accepts the challenge. If he/she is willing to put in the extra effort to make sure he/she is able to meet student needs and catch up on any lagging skills/knowledge, then it is probably going to be a better learning experience for both students and teacher. —*Educator, High School, Georgia*

[It t]akes at least three years to master your content and polish your age-appropriate delivery. When I am asked to change every one to two years with little to no explanation, I don't have the opportunity to master the content and build a strong foundation of what needs to be learned at the grade level. Plus I begin to doubt my abilities. —*Educator, Elementary, Middle School, High School, Idaho*

I think sometimes a change in staff can bring fresh eyes and new life to a classroom/subject area. It's probably easy for teachers to settle in after [teaching a subject or grade level] so long and feel comfortable. I think students benefit from a staffing change when an educator comes in well-prepared and knowledgeable of his or her subject area, but if the change is poorly executed and the educator is not supported or prepared, then the students and the teacher suffer.—*Educator, Middle School, Tennessee*

Sometimes it works as a looping situation, and for most students and teachers, this is a really good thing. I don't think it directly affects students unless the person just doesn't want to [change assignments] and makes sure to make it an awful year for all involved. —*Educator, Middle School, Georgia*

It takes several years to really appreciate the misconceptions my students have about different topics, as well as to tweak labs and activities to where they fit in the time period I have.—*Educator, Middle School, New Hampshire*

In our school, it seems to keep teachers disconnected, and does not build strong teams. Some people are not prepared, and it ends in them performing poorly.—*Educator, Middle School, New Hampshire*

Changing preps every year meant I never got to "work the kinks out" from the previous year…I repeatedly requested to teach the same AP class two years in a row…I was refused because my administrator said teaching the same class twice in a row makes teachers complacent.—*Educator, High School, New York*

I never had time to prepare enough to teach to my own standards. Some years, I had as many as three new subjects, and every year, I had at least one. It wasn't due to any dissatisfaction with my teaching; all the teachers were treated this way.—*Educator, High School, Georgia*

This is my first experience in a change in grades, and I am looping from fourth to fifth grade with almost the same students. I think it is great because I know my students well, and have a great relationship started with them. I am nervous about teaching new curriculum, and hope I do not lose some effectiveness and impact on their learning because of my newness to the fifth-grade curriculum.—*Educator, Elementary, Wisconsin*

In the short term, it becomes a time management issue. Do I have enough time for a new prep? Long term, it improves my chances to continue to

be employed.—*Educator, High School, Kansas*

[It] keeps the teachers from getting into a rut with current courses. New assignments don't necessarily need to be extreme.—*Educator, Middle School, High School, Ohio*

It is stressful on both educators and students because in my district, it is always last minute and the educators are provided with little or no resources. —*Educator, Middle School, Massachusetts*

Short-term: It is stressful for the teacher, and the students generally do not learn as much as they would from a more experienced teacher. Long-term: It keeps the teacher challenged and striving to learn new things and improve [his/her] teaching.—*Educator, High School, Alabama*

Keeps things fresh, but [can result in a lack of] depth or experience. —*Educator, Middle School, High School, Maryland*

I think it increases a teacher's knowledge and helps keep a teacher refreshed. A teacher can become stale and in a rut teaching the same grade level and subject area. Change is good.—*Educator, Elementary, Arkansas*

It presents teachers with a positive new challenge when done with ample notice and resources. But the changes need to be long-term for a professional educator to master pedagogy for the new assignment.—*Educator, High School, Ohio*

With notice, it would keep things fresh. With no notice, it really messes up teaching.—*Educator, High School, Michigan*

Changing grade level and content area too often creates teacher burnout and a feeling of stress and disorganization. This trickles down to students, who are not receiving time-tested lessons, but instead are guinea pigs all year. The lessons become "good enough" instead of great.—*Educator, Middle School, Illinois*

Our school purchased a new science curriculum last year for sixth, seventh, and eighth grades. I taught seventh and eighth last year and finally got [the] hang of it in April. Recently, I found out that I would be teaching sixth[-grade] science, also a new curriculum. I'm doing the students a disservice if I'm teaching something new every year along with a new curriculum. —*Educator, Middle School, Illinois*

It can be beneficial. We switched around to give everyone the fewest number of total preps, so we are all able to give each course more devoted attention.—*Educator, High School, Illinois*

Short term, I felt that I was not as comfortable in the classroom, and my students at times noticed this lack of secure knowledge of each of the areas of science. Long term, adding to my science background and learning increased my ability to teach the subjects that I was already able to teach with depth.—*Educator, Middle School, New York*

This is the first year in four years [that] I haven't had a new prep. All of my classes are now outside my certification area. While I enjoy learning new things, it is difficult to provide high-quality instruction when constantly teaching something new. —*Educator, High School, Maryland*

That depends entirely on the context. Looping with students, or changing grade levels to increase coherence of education across grades is a good thing. Yearly changes for no other reason than the convenience of the principal ha[ve] serious negative consequences for the teacher, and thus the students. —*Other, Middle School, Institution of Higher Learning, Illinois*

With support from peers, the change is not so bad. Without it, the change can be daunting.—*Educator, High School, Illinois*

Teachers in my district are frequently told the day they return from summer [break] that their courses have changed. Students begin five days later…In my district and state, last-minute course and schedule changes are the norm. [Our state is] ranked 49th in the nation.—*Educator, High School, Louisiana* ●

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Science Boosters: Taking It to the Next Level

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Award-Winning Scientist, Writer,
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AINISSA G. RAMIREZ
Scientist, Educator,
and Science Evangelist

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#NSTA16

NSTA National Science Teachers Association

PULL-OUT SECTION

SCIENCE TEACHERS' GRAB BAG

Inside this Convenient Pull-Out Section you will find:

Freebies for Science Teachers

Campus Ties. H HE This site offers online science, technology, engineering, and math (STEM) learning for college and college-bound students. Developed collaboratively by educators at Michigan State University, Iowa State University, and Mississippi State University, these bite-sized lessons in biology, chemistry, botany, genetics, and other science fields introduce facts and information through multiple-choice and true/false questions. Students earn points as they move through the lesson "primers" and answer the questions correctly. Students who complete a series of primers (i.e., a course) can earn certificates for their portfolio. Learn more at *http://bit.ly/2c9x4Fk.*

The K12 Engineering Education Podcast. K12 Listen to engineering professionals "dish" on ideas for inspiring engineering thinking in K–12 students. Podcast topics include ways to combat institutional barriers to engineering in K–12 education, innovative ideas to teach engineering, equity in access to engineering, industry needs for engineers, educational technology solutions for K–12 classrooms, and research on how kids learn engineering knowledge and skills. Visit *www.k12engineering.net.*

Women in Science card game. M H Essentially a "female scientist" version of the popular card game Uno, this fun resource from luanagames.com introduces players to 44 remarkable women in science and offers inspiring role models for kids. Each card features an illustration of a female scientist and a brief summary of her primary contributions to her field. Scientists include primatologist Dian Fossey, astronomer Cecelia Payne, chemist and X-ray crystallographer Rosalind Franklin, anthropologist Margaret Mead, biologist Rachel Carson, engineer and astronaut Julie Payette, and computer scientist Rose Dieng-Kuntz. Access the cards and playing instructions at the following website: *http://bit.ly/2bO4TWJ.*

Julie Payette

Science and the Second World War. M H Looking to move beyond the textbook to help middle and high school students connect STEM to significant historical events? Two interdisciplinary activities from the American Battle Monuments Commission (ABMC)—"Advancement of Medical Technology During World War II" (for the high school level) and "I'll Huff and Puff and Blow Your Ships Up" (for the middle level)—help students build a deeper understanding of issues in the Second World War while learning science content. Teachers who created the lessons researched a fallen American hero buried in an ABMC cemetery. The resulting lesson plans—which present historical context along with learning objectives, materials and preparation steps, student procedures, assessments, extensions, and adaptations—keep memories of the soldiers alive and make history real for students. These and other activities can be found at the website *http://bit.ly/2ctvWeY.*

Generation Beyond. M Lockheed Martin's STEM education initiative for the middle level offers standards-based lesson plans, educator guides, and family activities to motivate students to learn about deep space exploration. The resources introduce a range of STEM-focused careers in space exploration, compare and contrast differences between life in space and on Earth, and illustrate challenges of a future Mars mission. NASA is working toward putting humans on Mars, and the first crew to visit the red planet is likely in middle school right now: They might just be your students! See *http://bit.ly/2bOp1Ni.*

Discovering the Genome. H Developed by the University of Pennsylvania, this web-based curriculum provides basic to advanced genomics content for high school students. Focused on the human genome, the content is packaged into plug-and-play online modules ready for use, even by teachers with little genomics background. Module topics include Tour of the Genome, DNA Sequencing, Bioinformatics, and Browsing Genomes. Each module contains videos, activities, discussion questions, and links for additional resources. Use the materials to increase students' genomics literacy and explore the expanding role of genomics in the fields of healthcare, food production, species management of natural resources, and environmental conservation. Consult *http://discoveringthegenome.org.*

See Freebies, pg G2

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

Freebies, from pg G1

MICHAEL GÄBLER

The Missing Species Report (MSR) Project. P K12 This arts and science program is designed to raise awareness of severely endangered animals and plants and the importance of their conservation. Developed by the Endangered Species Coalition as part of the Vanishing: Ten Species Your Children May Never See campaign, the MSR curriculum (with versions for early elementary, elementary, middle, and high school grade levels) offers age-appropriate information and activities to learn about how species become endangered and what individuals can do to protect them, the Endangered Species Act, and related topics. After completing the curriculum activities, students can use templates to complete a Missing Species Report about a vanishing species or create and display a Missing Species Flyer about it. Teacher registration is required to access the materials at *www.missingspeciesreports.org.*

Launching Astronomy Standards and STEM Integration (LASSI) website. K12 Educators from the University of Wyoming's departments of Secondary Education and Physics and Astronomy culled a collection of teaching resources to enhance astronomy instruction and increase STEM integration in K–12 classrooms. Produced by participants from past LASSI workshops, the lessons address various content areas and grade levels. Lessons include Robot Turtles and Coding and Determining the Mystery Planet (elementary); Analyzing Sunspots and Fire Beetle Ecology (middle level); and Inverse Square Law With Lasers and Data Analysis for Finding Planets (high school). Accompanying Content Sheets for the topic areas addressed in the lessons (e.g., robotics, composition of the universe, sky motion, and others) list higher-, middle-, and lower-difficulty outcomes and offer connections to both the *Next Generation Science Standards* (*NGSS*) and *Common Core State Standards.* (Click on the Activities tab to access the topic Content Sheets.) Refer to *http://bit.ly/2chOpsy.*

Explore.org. K12 Watch grizzly bears catching and eating salmon in Katmai National Park in Alaska! See Beluga whales swimming in Canada's Churchill River estuary! At Explore.org, the Annenberg Foundation's multimedia animal education website, these and many other exciting animal sightings are just a click away. Targeted for K–12 teachers and animal lovers of all ages, the site offers access to dozens of live nature cams from national parks in the United States, Canada, and elsewhere, allowing students to observe an unfiltered glimpse of animals in their natural habitats. Along with the live cam feed, teachers can access photographs, videos, key facts about animal species, and "profiles" describing specific animals seen on camera. Visit *http://bit.ly/2ctwMZc.*

Outdoor Learning blog. K12 Make the most of K–12 outdoor learning spaces with articles and tips from the Cornell Laboratory of Ornithology's BirdSleuth Program. This blog presents everything from how-to articles on creating a successful outdoor classroom space to suggestions for using the space to attract birds and engage students in bird-related citizen science projects. Teachers can also find research articles supporting the importance of outdoor exploration for students. Visit *http://bit.ly/2caQwwQ.*

Chlorine Chemistry. M H This collection of resources developed by the American Chemistry Council and its partners explores the role of chlorine in our everyday lives. Primarily targeted for the middle and high school levels, the resources include lessons such as Water: No Dirt, No Germs, which explores the chemistry that makes drinking water safe, and Building Block Chemistry, which examines how chlorine and other elements combine to make everyday products such as soccer balls, tennis shoes, television sets, and vinyl siding. Other materials—such as activity books featuring Chlorin8tor and Little Hector, the Disinfector, and the Chlorine Compound Library (a listing of more than 40 chlorine-containing compounds and their uses)—offer chemistry content along with practical information. See *http://bit.ly/2chQWmw.*

Molecule Man's Making Science Make Sense Activity Book. E M Follow the adventures of chemistry-loving Molecule Man and Molecule Dog, and jump-start a chemistry investigation with elementary and middle level students. In this guide developed by Bayer Corporation, students learn facts about polymers and conduct experiments exploring chemical reactions (Martian Jelly), paper chromatography (Cool Colors), molecular properties (Strange Acting Goop), and plastics (Milk Magic). Additionally, puzzles, mazes, word searches, and activity pages reinforce students' chemistry understandings. Refer to *http://bit.ly/2bOsgnX.*

Exploring Infectious Diseases. H Targeted for the high school level, this website presents learning modules and online resources, including background stories and links, to deepen students' understanding of infectious diseases and their spread. The modules—About Infectious Disease, Seeking the Cause, Viruses Go Viral, and Treatment and Prevention—can be taught as a coherent unit or individually as separate topics. All of the resources incorporate an overarching storyline of recent Ebola and measles outbreaks, helping students to make real-world connections to the content. Consult *http://bit.ly/2caS2ij.*

SOLKOLL

The Fractal Foundation. K12 The foundation offers hands-on curriculum and "fractivities" for K–12 audiences that teach fractal concepts and combine science, math, and art learning in a fun way. Teachers can access fractal animations and hands-on activities such as Fractal Scavenger Hunt and Fractal Bingo (grades K–12), which challenge students to find examples of fractals in the natural world. Other activities develop model-building skills, such as Fractal Tetrahedrons (grades 1–7), in which students create a three-dimensional tetrahedron from mini-marshmallows and toothpicks. See *http://bit.ly/2cmtuYt.*

Brains On! E M This weekly science podcast series for kids ages 6–12, produced by Minnesota Public Radio and Southern California Public Radio, celebrates students who are "serious about being curious." Each episode tackles a puzzling, student-submitted science question such as these: Why are no two snowflakes the same? Why does tickling make you laugh? What makes paint stick? What are mosquitoes good for?

Experts from appropriate fields provide the answers; with its extensive range of question topics, the series introduces students to a variety of science professionals, including snake handlers, food scientists, and astronauts. Visit *www.brainson.org* to hear the podcasts, submit a question for a future episode, and find extras like interviews with scientists, experiment ideas, videos, and science songs.

Review Quiz, PacMan style. A "Gamify" your review sessions—and excite students of all ages about studying content—with a customized quiz game from ClassTools.net. Simply type in a series of questions and answers, click a button, and receive a link to a personalized quiz in the format of a "PacMan" game. The game runs like ordinary PacMan (i.e., PacMan travels through a maze eating dots and fruits, trying to avoid being eaten by a ghost), but with a twist. In the quiz version, when PacMan is eaten by a ghost, students must answer a series of multiple-choice questions from the database to gain an extra life and a chance to continue.

The computer generates the answers for the multiple-choice questions based on the other answers in the database, but teachers can choose to add alternative answers to the multiple-choice questions if they prefer. See *http://bit.ly/2bZTQub.* ●

News Bits

- **Two new Baton Rouge, Louisiana, schools are preparing their students for college and the workforce in innovative ways.** H

Students at Cristo Rey Baton Rouge Franciscan High School will take college prep classes and work one day a week in white-collar jobs. They'll be paid for the work, but the funds will go toward their tuition.

Cristo Rey is part of a network of 32 Catholic schools in 21 states that seek low-income students who can handle this combination of college prep and white-collar work. The Louisiana location, the first in the state, has partnered with 17 Baton Rouge–area employers and will give its students a second chance with another company if they get fired from their first job. After two terminations, however, students will be expelled. This formula has shown promise at Cristo Rey schools, as 90% of students enroll in college.

Students at the other new school, Lee High School, will earn college credits through one of three academies focused on engineering, biomedicine, and digital media. Each program supports the school's "computational thinking and big data" theme and will require students to learn coding. All students will get take-home laptops and attend classes in adaptive classrooms that can change with student and teacher needs. Each academy will also offer a "wow" space in which students can experiment, design, and build.

Read more at *http://bit.ly/2bYK0e7*.

- **The Dallas Independent School District (DISD) has added two new single-sex academies: the Young Men's Leadership Academy (YMLA) at Fred Florence Middle School and the Young Women's STEAM Academy at Balch Springs Middle School.** M

The hope is that both schools will give the DISD's students and parents more choices and aid some of the district's struggling schools. YMLA will focus on leadership and accept any student who lives in its feeder pattern of nine schools. The STEAM Academy will focus on science, technology, engineering, math, and art and design. Though research on single-gender education is mixed, YMLA leaders say they've seen evidence that suggests it can work, particularly at DISD's two existing single-sex schools.

"[Single-sex schools] have not been done on this scale," YMLA Principal Dawn Walker told the *Dallas Morning News,* referring to the 1,200 youths enrolled at the YMLA. Learn more at *http://bit.ly/2bZdFT0*.

- **Want to spice up a summer STEM class? Hold it in one of the country's largest hydroelectric plants.** M

Twenty at-risk middle school students from Niagara Falls and Lockport, New York, who participated in the "Power of STEM" pilot program last summer spent a week taking classes and doing hands-on activities among the interactive exhibits in the Power Vista, the visitor center at the Niagara Power Project.

"I can see a big difference this year. Having access to all the exhibits and all the information is animating their thinking," teacher Michael Radosta, a doctoral student in learning sciences at the University at Buffalo, told *The Buffalo News.* Sponsors of "Power of STEM" hope to expand the program next summer.

Read more at the following website: *http://bit.ly/2bPOSCE.* ●

What's New

FROM U.S. GOVERNMENT SOURCES

National Security Agency (NSA)

NSA Day of Cyber H

Celebrate National Cybersecurity Awareness Month in October with your students with NSA Day of Cyber, an online cybersecurity career exploration platform sponsored by NSA and powered by LifeJourney. Student users will sit virtually beside the NSA Cyber Threat Director and test drive a day in the life of six NSA cyber professionals. Students will participate in challenging real-life cyber scenarios, discover the skills and tools used by NSA cyber professionals, explore the vast number of careers in cybersecurity, and generate their "Cyber Resume."

The program contains approximately two hours of content that students can do during class or at home. (Preview it at *http://wi.st/2c3Xy93*.) No teacher training is required; students will only need a computer and internet access.

Teachers should register at *http://bit.ly/NSADayOfCyber-NSTA*. Once you have registered and activated your account, you will be taken to your Instructor Dashboard, where you will retrieve the Student Registration Key and URL to share with students. Access an Instructor Resource Guide at *http://bit.ly/2crbBqg*.

National Oceanic and Atmospheric Administration (NOAA)

Shipwreck Science M H

NOAA's Monitor National Marine Sanctuary offers science, technology, engineering, art, and math lesson plans for K–12 educators. For example, Mock Shipwreck: Mapping the Past, a lesson for students in grades 9–12, challenges teams of "divers" to create sectioned, scaled drawings of a mock shipwreck site. Student users develop skills in science, math, technology, and history and model the processes of how real scientists document the discovery of an actual shipwreck. The lesson plan includes learning objectives, teacher background information, student activities and discussion questions, extensions, vocabulary words, additional resources, and student handouts.

In another lesson, Shipwrecks as Reefs: Biological Surveys, students in grades 6–8 model the real-world marine science practice of using a shipwreck site as an artificial reef. Students "dive" a mock shipwreck site (i.e., the artificial reef), conducting biological surveys of fish populations using the methods of visual census transects and stationary quadrats. Students practice data sampling, collection, and analysis techniques, observing similarities and differences between surveys and drawing conclusions from the data.

Access both lesson plans and their corresponding log sheets at *http://bit.ly/2cfL65V*.

National Institutes of Health (NIH)

Cell Day 2016 M H

"Cell"ebrate Cell Day 2016 with a web chat with scientists from NIH's National Institute of General Medical Sciences. On November 3, from 10 a.m. to 3 p.m. Eastern Time, scientists will answer middle and high school students' questions on cell biology, biochemistry, research careers, and related topics. To view past transcripts or register your class to participate, visit *http://bit.ly/2c67WwI*.

Library of Congress (LOC)

Biographies of Women Scientists: For Girls and Young Women K12

Science is for women, too! Share this list of books about famous and contemporary female scientists with the girls and young women in K–12 classrooms! Available from the LOC's Science Reference Services, the list presents books written in English within the past 20 years and offers titles appropriate for primary, intermediate, middle, and high school levels. The list also includes science book series and links for additional information. Access the list at *http://bit.ly/2bSbPFN*.

National Park Service (NPS)

Alaska: Biomes of the North E M H

Experience the unique biomes of northern Alaska from the comfort of your own classroom! Through this distance-learning program from the Gates of the Arctic National Park in Fairbanks, Alaska, students can meet an NPS ranger and learn about the diversity of Alaska's habitats. Targeted for students in grades 5–12, this 50-minute lesson explores the tundra and boreal forest biomes of Northern Alaska, particularly the nonliving factors that create these unique ecosystems and the animals that call these extreme environments home. For more information or to schedule a session, consult *http://bit.ly/2chR71m*.

Centennial Junior Ranger Activity Book E M

Happy 100th birthday to the National Park Service! Celebrate our country's majestic national parks with this interactive activity book for K–8 students at *http://bit.ly/2bRr2JN*. Through photographs, fun facts, games, puzzles, conservation tips, and activities, the 20-page book shows students what it means to be a Junior Ranger and what they can do to help preserve and protect national parks. Students who complete the activity book can turn it in at any national park visitor center to receive an official Junior Ranger Centennial Badge. Or students can mail the completed book to the National Park Service, Junior Ranger Centennial Program Coordinator, 1201 Eye St. NW, Eighth Floor, Washington, DC 20005. Students should include their mailing addresses to receive their badges.

Every Kid in a Park E

Sponsored by the National Park Foundation, the Every Kid in a Park initiative is again offering passes for free admission to national parks, national forests, and national wildlife refuges to fourth-grade students and their families. Why fourth grade? Research shows that kids ages 9 to 11 are beginning to learn about the world around them. At this age, students are open to new ideas, and they are likely to connect to nature and our history—a prime time to begin exploring our country's public lands and to begin building a foundation for future park stewardship.

The admission passes are good from September 1, 2016, through August 31, 2017. To access them and learn more, visit *http://bit.ly/2cmLihS*.

National Aeronautics and Space Administration (NASA)

NASA STARS en Español M H

A new monthly video chat—streamed live in Spanish from the NASA Kennedy Space Center—promotes awareness of NASA's diverse career opportunities for minority populations and highlights Hispanic professionals as role models working in science, technology, engineering, and math (STEM) fields. Produced by NASA's Digital Learning Network and Education Professional Development Collaborative, the program is targeted for Spanish-speaking middle and high school students, including those in STEM classes, Spanish classes, and Spanish clubs. To participate, students can watch the live stream and

tweet questions to #NASASTARS, or teachers can register their classes to participate as a remote live audience for an event. Upcoming program dates include November 10 and December 13, 2016, and January 26, February 23, and March 14, 2017. Visit *http://bit.ly/2bOaYmh*.

Wanted: Mars Explorers! A

Inspire the next generation of Mars exploration with these posters from NASA's Kennedy Space Center. Originally commissioned for a 2009 exhibit in the Space Center's Visitor's Complex, the posters remind us that Mars exploration encompasses a range of talents and interests: explorers, night owls, farmers, surveyors, teachers, technicians, and builders. Download the posters and join NASA in the Journey to Mars! See *http://go.nasa.gov/2chSgWF*.

The Solar System and Beyond: Kids Edition E M

Ready for liftoff? NASA has created a new playlist to excite elementary and middle level students about space science. Available on the YouTube Kids app for both iOS and Android platforms, the playlist features NASA videos that focus on our solar system and the instruments NASA uses to study the universe. Learn something new about your celestial neighborhood at *http://bit.ly/2bScQxk*.

U.S. Department of Agriculture (USDA)

MyPlate Food Group Quizzes A

Test your students' knowledge of the five food groups with these quizzes from the USDA Center for Nutrition Policy and MyPlate program. Designed to both teach and entertain, and appropriate for use with students and adults of all ages, the 10-question quizzes present practical facts and information about the dairy, protein, grains, fruit, and vegetable groups. The quizzes are comprised of multiple-choice and true/false questions, but each answer includes an explanatory note with additional information. You'll find the quizzes at *http://bit.ly/2bZWP5F*.

U.S. Geological Survey (USGS)

Tracking Change Over Time E M

The objective of the Tracking Change Over Time lesson plan is to get students excited about studying the changing Earth. Targeted for grades 5–8, the lesson plan contains four parts: Getting Started, Understanding Remote Sensing, Using MultiSpec to Interpret Satellite Imagery, and The Modules. The lesson guides teachers and students through the basics of remote sensing and how to use the MultiSpec software; students then apply what they've learned in two lesson modules exploring the uses of satellite data to track different types of landscape change over time. In the first module, students examine a series of satellite images from Phoenix, Arizona, taken over time, and use the data to investigate issues of urban land use. In the second module, students use satellite data to explore land changes resulting from natural occurrences such as a flood. Refer to *http://on.doi.gov/2cidDao*.

USGS Career Cards M H

Introduce middle and high school students to science and technical career opportunities at the USGS through this series of descriptive cards. Each card highlights a different job, describing the duties and education qualifications for the position and featuring a photograph of a scientist at work in the field. Profiled careers include ecologist, geographer, geologist, hydrologist, hydrologic technician, and physical scientist. Download the series at *http://on.doi.gov/2ck43Fe*.

U.S. Department of the Interior

American Bison: A National Mammal A

Get to know our national mammal, the American bison. Under the recently enacted law, the National Bison Legacy Act, the bison has joined the bald eagle as an official symbol of the United States. At this web page, educators of all grade levels can access 15 fun facts about the animal, covering everything from its biology and behaviors to its connection to Native American history. Did you know that baby bison are called red dogs, or that you can judge a bison's mood by its tail? Were you aware that bison have been integral to tribal culture, providing Native Americans with food, clothing, fuel, tools, shelter, and spiritual value? The website also includes photographs and links to more information. Consult *http://on.doi.gov/2bOf3Xi*.

Environmental Protection Agency (EPA)

Pack a Waste-Free Lunch E M H

EPA developed the Waste-Free Lunch activities to help students learn how to reduce, reuse, and recycle items in their school lunches. A Waste-Free Lunch Flyer discusses the importance of packing waste-free lunches. Other documents provide tips, a lunch-planning worksheet, and a lunch-evaluation worksheet. Use these materials to get your students interested in a waste-free lunch day at your school. See *http://bit.ly/2cRwjRS*.

U.S. Department of Education (ED)

Even Einstein Struggled: Effects of Learning About Great Scientists' Struggles on High School Students' Motivation to Learn Science H

This study from ED's Institute of Education Sciences What Works Clearinghouse examined whether students who read stories about the personal or intellectual struggles of famous scientists had higher science grades than students who read only about the scientists' achievements. The study authors randomly assigned students in four New York City high schools to three groups within the same science classrooms. One group of students was assigned to read about the personal struggles of Albert Einstein, Marie Curie, and Michael Faraday, while another read about their intellectual struggles. A third group was assigned to read about their achievements without mention of their struggles. The study authors reported that students who read stories about the scientists' personal or intellectual struggles had higher science grades than students who read about their achievements only. Learn more at *http://bit.ly/2ctCk2P*. ●

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– **Sharon Ruggieri**, past conference attendee

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NSTA National Science Teachers Association

In Your Pocket

Editor's Note

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

October 31

Whole Kids Foundation School Garden Grants K12

In partnership with FoodCorps, the foundation provides grants of $2,000 to support new or existing edible gardens on school grounds. Applicants must have the support of a specific partner organization in the community, such as a nonprofit, farm, local business, Whole Foods store, or garden club. K–12 public schools, nonprofit private or charter schools, and nonprofit organizations working with K–12 schools may apply by **October 31.** See *http://bit.ly/1pqsP7E.*

Whole Kids Foundation Extended Learning Garden Grant Program K12

The foundation awards this $2,000 grant to edible educational gardens that aren't located in a school setting. Nonprofit programs that support these gardens for K–12 students, such as boys and girls clubs, YMCAs/YWCAs, afterschool programs, educational farms, and children's museums or hospitals, may apply. Organizations must be located in the United States. Apply by **October 31.** Consult *http://bit.ly/2brFF5c.*

November 1–10

American Radio Relay League (ARRL) Education and Technology Program Grants K12

ARRL offers two types of Education and Technology (ETP) grants for teachers who currently use or want to use amateur radio in their classrooms. ETP School Station Grants provide $1,500 worth of equipment to those who plan to use amateur radio as part of an enrichment or in-class project; ETP Progress Grants of $500 go to teachers who already use amateur radio in the classroom and want to purchase license manuals and instructional guides, do station upkeep and maintenance, or need resources for wireless technology instruction. Grantees must seek funding from their local communities to help sustain their programs.

K–12 teachers in U.S. schools may apply by **November 1**. Visit *www.arrl.org/etp-grants.*

James Bryant Conant Award in High School Chemistry Teaching H

The American Chemical Society (ACS) and Thermo Fisher Scientific present this award to one outstanding high school chemistry teacher in the United States or its territories. Nominees should demonstrate quality of teaching, the ability to challenge and inspire students, extracurricular work that helps stimulate student interest in the field, and a willingness to stay current. The awardee will receive $5,000, an ACS certificate, and up to $2,500 in travel expenses to attend the ACS meeting at which the award is presented. Nominations are due **November 1;** see *http://bit.ly/15geLhb.*

Spencer Foundation's Small Research Grants A

These grants support education research projects with budgets of $50,000 or less. Proposed projects should improve education generally and sometimes fall within these specified areas of inquiry: education and social opportunity; organizational learning; purposes and values of education; teaching, learning, and instructional resources; and the new civics. Most proposals, however, support the foundation's general mission but not one of the specified inquiry areas; proposals in this category are called "field-initiated."

To be eligible for these grants, the principal investigator (PI) and co-PIs must have a doctorate degree or equivalent experience in an education research–related profession.

Proposals are accepted from the United States and abroad but must be written in English and propose a grant amount in U.S. dollars. Apply online by **November 1** at *http://bit.ly/2bYjvq1.*

Dreyfus Foundation Educational Grants A

The Max and Victoria Dreyfus Foundation provides grants of between $1,000 and $20,000 to community-based nonprofit programs in the United States. Schools; museums; educational and skills training programs; environmental and wildlife protection activities; cultural and performing arts programs; and programs for youth, seniors, and the handicapped may apply. Proof of 501(c)(3) status is required. Applications must be postmarked by **November 10;** refer to *http://bit.ly/1KtIP3J.*

November 16–30

American Institute of Aeronautics and Astronautics (AIAA) Foundation Classroom Grants K12

These $250 grants go to K–12 teachers who incorporate innovative aerospace activities in their curriculum. Grants can be used for demonstration kits, science supplies, and other resources that will impact at least 25 students. Applicants must first register as AIAA Educator Associates, free of charge. Apply by **November 16;** visit the website *http://bit.ly/YGU1f7.*

Made By Milk™ Carton Construction Contest P K12

Winners can receive up to $5,000 by repurposing their school's milk cartons into a piece of art that fits this year's theme: "Inventions." Teams must use at least 100 milk cartons to enter and must submit photos of the art and a 200-word essay about what they would do with the prize money. Judges will choose the grand-prize winner; online voters will select People's Choice awardees to receive $2,500 and two additional prizes of $1,000 in each grade band (preK–5 and 6–12). Enter online by **November 16** at *http://bit.ly/2ckRuKn.*

Knowles Science Teaching Foundation Teaching Fellowship K12

These five-year fellowships help early-career science and math teachers become master teachers and leaders. Fellows receive stipends, funding for professional development, grants for teaching materials, and leadership and mentoring opportunities for the duration of the program. Educators with the potential to develop exemplary teaching methods and leadership skills, as well as the content knowledge needed for teaching, are excellent candidates.

Applicants should have earned a degree related to the math or science discipline they intend to teach and have obtained a valid state teaching credential, certificate, or license by September 2017. They must also be entering their first or second year of teaching during the 2017–2018 school year. Apply by **November 27;** see *www.kstf.org/fellowships.*

John C. Park Memorial Award for New Science Teachers M H

This award provides one secondary science teacher in his or her first five years of teaching with $1,000 to attend the NSTA National Conference on Science Education. The awardee will attend workshops and presentations for new teachers and will be honored at the Teacher Awards Banquet. NSTA members who have been teaching grades 6–12 full-time for fewer than five years are eligible. Apply by **November 30;** visit *http://bit.ly/2bpiOZh.* ●

Summer Programs

Editor's Note

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

National Oceanic and Atmospheric Administration (NOAA) Teacher at Sea Program A

This program sends preK–college teachers, museum and aquarium educators, and adult education teachers to sea aboard NOAA research and survey ships. Participants conduct fisheries research, oceanographic research, or hydrographic surveys under the tutelage of NOAA scientists. Following their voyages—which can last from one week to one month—teachers bring the research and knowledge they've gained back to their classrooms.

Most educators sail over the summer, though trips are available year-round. Applications will be available online on November 1 and must be submitted by **November 30.** For more details, visit *http://teacheratsea.noaa.gov.*

2017 National Astronomy Teaching Summit A

The summit will take place August 7–9 at Florida Gulf Coast University in Ft. Myers, Florida. Astronomy and planetary sciences enthusiasts and educators at all levels are invited.

Teachers can submit proposals and learn more at *www.caperteam.com/astro101summit*. Register by **May 15, 2017,** to receive a discounted rate.

Publicizing Your Summer Program A

Your summer professional development (PD) program for science educators could appear in this *Reports* column and/or in the Summer Programs section of *www.nsta.org/calendar,* our online calendar. E-mail the following to *nstareports@nsta.org:*

- program dates and application deadline,
- location,
- registration fees (if applicable),
- relevant websites, and
- grade levels/positions eligible to attend (i.e., elementary teachers, teachers of grades 7–12, science supervisors, etc.).

All summer PD announcements will be posted on the online calendar. To appear in *NSTA Reports,* a program must meet one of these conditions:

- offer a stipend for all participants,
- offer tuition-free credit to all,
- reimburse all participants for some expenses (such as travel costs), or
- be offered by/through a nonprofit group, government entity, or university.

If your program qualifies for publication in *Reports,* e-mail the information at least two months before the issue in which you want the announcement to appear (remaining issues are November 2016 and January 2017 through May 2017). Announcements in *Reports'* Summer Programs column will be published one time only on a space-available basis.

Get even more visibility for your program by advertising it in NSTA publications. Learn more at *www.nsta.org/exhibitsadv.* ●

BLICK ON TV

Summer Olympics: Higher, Faster, Farther

By Jacob Clark Blickenstaff, PhD

In 2014, I wrote a column on the Winter Olympics (*http://bit.ly/2bZXvKs*); now that the 2016 Rio games are a recent memory, it seems appropriate to turn my attention to the Summer Games. With more than 300 different events spanning 28 different sports, Olympic athletes demonstrated a huge range of physical and technical skills. The physical stature of athletes also varies widely, as anyone who saw the photo of Simone Biles standing next to Michael Phelps noticed.

So how can teachers use Summer Olympic events to engage students with science and engineering topics? The physics of rotation is huge in both gymnastics and diving; in many events, the distinction between velocity and acceleration is key; and the widely covered practice of "cupping" is an interesting application of gas pressure.

Rotating Bodies

I have to start with a definition: *moment of inertia* is the rotational version of mass. It is a measure of how far away the mass of an object is from the point of rotation. If you rotate a hammer by holding the handle, it will have a larger moment of inertia than if you hold onto the head of the hammer and rotate the handle. That's because *more mass is farther away* from the axis of rotation when you swing the hammer in the usual way. It is harder to rotate something with a larger moment of inertia, so divers and gymnasts can't spin as many times with their bodies outstretched as they can with their arms and legs tucked in. Also, since momentum is conserved (it doesn't change without an outside force), if a diver starts rotating in a tucked position, his or her rotation will slow down when he or she stretches his/her arms and legs out.

Velocity and Acceleration

Many terms to describe motion that are used interchangeably in everyday conversation have very specific meanings in physics. Speed, velocity, and acceleration are three that often cause confusion. Speed is simply how fast an object is moving. Jamaican Elaine Thompson completed the women's 100 meters in 10.71 seconds, so her average speed was 9.3 m/s (100m/10.71s). In the women's 400 meters, Bahamian Shaunae Miller finished in 49.44 seconds, which means her average speed was about 8.1 m/s.

Speed doesn't tell the full story, because velocity and acceleration in the two races differ. Velocity is how fast something moves, and which way it is going. The 100 meters is run in a straight line, so Thompson's velocity was increasing over the run. Since Miller ran all the way around the track, her speed and direction were both changing. In the end, she was back where she started, so her average velocity was just about zero. Any change in velocity (speeding up, slowing down, or turning a corner) is acceleration, and an outside force is required for an object to accelerate.

Cupping and the Gas Laws

During the swimming events, observers commented on red welts on the backs and shoulders of many athletes. These marks were left after the athletes used "cupping" as a recovery aid. Cupping is a part of traditional Chinese medicine. In its current form, cups are placed on the skin and a partial vacuum created under the cup. This draws the skin up into the cup, away from underlying tissue, and bursts capillaries in the skin. This causes the red welts. Athletes believe the increased blood flow in the area aids muscle recovery. With many swimming events determined by a few one-hundredths of a second, any advantage, even a psychological one, is worth maximizing.

So how does the Ideal Gas Law ($PV=nRT$) relate? P is pressure, V is volume, n is the number of gas molecules, and T is temperature. PV is proportional to nT. (If either n or T increases, then P and/or V will also increase.) To make the relationship an equation, the constant R is included, and it just makes all the units come out equal on both sides.

In cupping, you can make the partial vacuum in two ways: Use a pump (reducing n), or heat the air inside the cup and let it cool on the skin (reducing T). Either one makes the other side of the equation (PV) smaller. The skin will bulge up into the cup, decreasing V, and the pressure will go down, as shown by the burst capillaries.

Recalling the excitement of August's Summer Games in Rio can ignite curiosity about rotational motion, speed, and velocity, and even the Ideal Gas Law.

Jacob Clark Blickenstaff is Director of K–12 Engagement at the Pacific Science Center in Seattle. Read more Blick at http://bit.ly/amBgvm, *or e-mail him at* jclarkblickenstaff@pacsci.org.

Real-World Project Inspires Young Inventors

How did sixth-graders at Erie Intermediate School in Ashtabula, Ohio, invent an artificial coral reef that companies are interested in producing? It all began when Aaron Chamberlain, sixth-grade science teacher, and Lindsay Zannelli, sixth-grade math and social studies teacher, wanted their students to do Problem-Based Learning, "take a real-world problem and solve it," says Chamberlain. "We were [also] looking for a way to replace the science fair."

"Students who have resources usually win [at science fairs]. With the economic level we face here, [students tend to get little support for their science projects from their parents]," Zannelli explains.

"We wanted a way for everyone to do science, math, and language arts [and be recognized]," Chamberlain adds.

Chamberlain turned to the Ashtabula Community Advisory Panel (CAP), which provides a discussion forum for local chemical companies and nearby residents. CAPs are part of the U.S. chemical industry's public outreach efforts. "We sponsor teachers to attend Ohio Chemistry Technology Council's Teachers, Industry, and the Environment (TIE) conference," which provides teachers with science experiments and classroom tools, says Sherry Wilber, human resources and community relations supervisor at Cristal, an Ashtabula CAP member company. After attending TIE, teachers "can apply for mini-grants. Aaron went to TIE and applied for and received a mini-grant," she reports.

"Aaron attended our meetings," recalls Ashtabula CAP Facilitator Marta Stone. "He e-mailed me and said that science fairs were a setup for failure unless there was strong parental involvement. He wanted to work with the CAP chemical companies to try something different."

When she relayed his request to CAP members, Tyce Workman, plant manager at Gabriel Performance Products, "suggested addressing a real problem that a company was having," says Stone.

Workman told Rachel Roberts, quality supervisor at Pentair Water Quality Systems in Chardon, Ohio, about Chamberlain's request. "We happened to have a batch of about 700 tanks [circular wound fiberglass pressure vessels] that were off-color," says Roberts. "We're always looking for ways to repurpose, so I suggested bringing some tanks to his students and having them come up with ways to repurpose them," she relates.

Incinerating the defective canisters or discarding

MARTA STONE

Sixth graders from Erie Intermediate School in Ashtabula, Ohio, and engineers from Pentair Water Quality Systems in Chardon, Ohio, examine the engineers' prototypes of the students' ideas for repurposing defective Pentair tanks.

them in landfills "would cost seven times as much, so rather than throwing them out, [Pentair was] hoping the students could do better than that," Chamberlain observes.

Chamberlain and Zannelli divided the sixth-graders into 15 teams of eight to 10 students per team. "Each [sixth-grade] teacher was in charge of two teams, and Lindsay and I were in charge of three teams…Each team had kids from all six classrooms," Chamberlain explains.

Stone arranged for engineers from CAP companies to lead the teams. "We brought in librarians and community volunteers to help with tasks such as making their drawings and preparing their presentations," she notes.

The engineers "helped students divide up tasks, decide on ideas, kept them focused, and helped them with their drawings, presentations, and cost analysis," reports Chamberlain. Because of safety hazards associated with cutting the fiberglass canisters, "the students made their prototypes from two-liter pop bottles," he points out. They then presented them to Roberts and her Pentair colleagues.

Ideas ranged from bird feeders, lamps, "disco" balls, emergency supply cars, solar-powered clocks, and waterproof speakers. One team decided to bolt several canisters together to create an artificial coral reef. "That team found tons of data about the depletion of coral reefs," says Zannelli.

Pentair college interns used the students' prototypes, drawings, and data to create prototypes using the canisters, and accompanied by Pentair staff, brought them to the school and presented them to the sixth graders. "We wanted to give each team feedback and tell them which ideas were most viable," says Roberts. "The interns asked the students if [the canister prototype] was what they had imagined and talked about issues they faced in building the prototypes."

"They really knocked the kids' socks off," Chamberlain asserts. "They were so respectful of the students…It was a great discussion."

The Pentair staff awarded student teams for best presentations, most creative ideas, or ideas that could actually be manufactured. In addition, Cristal donated $500 to the school, and Pentair donated $100 to each classroom. "For the students, the prototype was their prize," says Zannelli.

The grand prize was awarded to the team that designed the artificial coral reef. Pentair "knew of one or two companies interested in [producing] the artificial coral reef," reports Chamberlain. "They told the students, 'The company might be able to make and sell what you designed for a profit.'"

Of the student on the winning team who conceived the idea for the artificial reef, he says, "This is a kid who would not typically have come up with something to win the science fair...[Projects like this] can inspire kids to be engineers and problem-solvers. The students received a huge boost of confidence [because] they did a lot that they didn't think they could do."

"The partnering of schools with real companies on challenges is a win-win," Stone concludes. "What is amazing about this is that it's just sixth graders from an inner-city school. These teams were a mixed bag of kids. They worked hard, and all had a sense of pride to have their ideas appreciated and validated."●

MS. MENTOR, **Advice Column**

Surveying Perceptions, Managing Expectations, Teaching Engineering

I want to study my middle school students' perceptions of what and how they are learning in science. Do you have any suggestions other than a traditional survey?

—R., Ohio

I found some research on the topic at Drawn to Science: Studying Science Teaching and Learning Through Drawings (*www.drawntoscience.org*). The authors examined "how the science teaching identity of the teacher interns/teachers changed over time" based on their experiences. Rather than a traditional questionnaire, this study used drawings as evidence. Periodically, the teacher-participants responded to two prompts:

- Draw yourself teaching science.
- Draw your students learning science.

The methodology and the scoring rubric are on the website. It's interesting to examine how drawings represent a teacher's self-image of the teaching and learning processes and the perceived roles of teachers and students in these processes.

Another part of the website targets educators, offering

- Lesson plans with suggestions for asking students to draw their interpretations of science learning. Follow-up discussion questions are included.
- A description of the action research process and how drawings can be a data tool.

These lessons could be used several times throughout the year, perhaps with student notebooks, to monitor how students' perceptions change over time and reflect on how student perceptions align with yours. It might be interesting to draw something yourself to compare to the students' work.

But I wouldn't exclude traditional surveys. Although paper-and-pencil surveys are time-consuming to analyze, online tools (such as Google Docs) can efficiently survey students and aggregate the results into a spreadsheet document. The same survey can be used for different classes and at multiple times during the year to track student responses for your analysis and reflection.

I'm a first-year middle school life science teacher. After a few weeks, I am really stressed with all of the planning and paperwork. Any resources or words of encouragement?

—L., New York

Welcome to science teaching! Every teacher has gone through what you're experiencing. Fortunately, there are resources to help.

NSTA's e-mail lists and discussion forums have timely advice on

specific questions concerning content, the *Next Generation Science Standards* (*NGSS*), safety, and more. NSTA journals have lessons that you can adapt. Other NSTA publications, such as Tips for the First Day of School on the NSTA blog at *http://bit.ly/2cIpAcB,* also address your concerns.

It's easy to get consumed by the details of lesson planning and evaluating student work, but remember to consider the big picture. A higher education blog post described What Every Incoming Science Student Should Know (*http://bit.ly/2c1JcEV*). The author's suggestions can be modified for first-year science teachers:

- Decide what you want your students to gain from your class. They'll remember if you fostered a love of learning and an appreciation for science, and if you respected them and gave them choices.
- Help students become independent learners. Teach notetaking skills. Encourage students to ask (and answer) their own questions. Recognize creativity and curiosity.
- Whenever possible, help students make the connections among science, the "real world," and their own interests.
- Don't neglect your health. Have a support group of mentors and other first-year teachers.
- Understand that real teaching is hard. Allow yourself to make mistakes (but not when it comes to student safety!). Reflect on, learn from, then let go of the mistakes.

Think about your successes every day: You'll have many! Good luck!

In my elementary schedule, I barely have time for science, and now I'm concerned about teaching engineering, too. I've never studied engineering. Can you suggest some resources?

—T., New Jersey

You might feel a little more confident after reading "The *Next Generation Science Standards* and Engineering for Young Learners: Beyond Bridges and Egg Drops" (*http://bit.ly/2cdU0mC*) from the October 2013 issue of NSTA's elementary journal, *Science and Children* (*S&C*). The article has a chart comparing science and engineering practices, and you can see the overlaps and similarities. It seems that the thinking involved in inquiry and problem solving are similar, whether students are investigating natural phenomena (science) or applying their knowledge to design products or processes to solve a problem or need (engineering).

Peggy Ashbrook examines the engineering skills that even our youngest students already have in her blog post, Early Education in Engineering and Design (*http://bit.ly/2c8mlIs*). She provides insights, resources, and suggestions for building on these.

S&C's Engineering Encounters column (*http://bit.ly/2caHEtO*) includes strategies that integrate engineering with science, support teaching children how to design solutions, and explore the ways engineers conduct their work.

Other *S&C* articles describe lessons with engineering components, too, and most lessons include a chart showing the connections to science and engineering practices in the *NGSS*.

You're not alone in your concern. Most science teachers don't have a background in engineering per se, so have fun with your young engineers and learn along with them!

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

The NSTA Learning Center

High quality interactive content for K–12 science teachers

Earn graduate credits and advanced degrees

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American Museum of Natural History

Seminars on science, six-week online graduate courses in the life, Earth, and physical sciences, incorporate the museum's resources plus interaction with scientists and educators. CEUs and graduate credits.

California University of Pennsylvania

Designed for elementary and middle level teachers, Cal U's online masters degree focuses on teaching inquiry across the STEM disciplines. Each course in the 30-credit program also develops your teacher leadership skills so you can take your career to the next level.

Montana State University – Bozeman

Online graduate credit courses for K–12 science teachers through National Teachers Enhancement Network, as well as online offerings for Masters of Science in Science Education.

University of Maryland

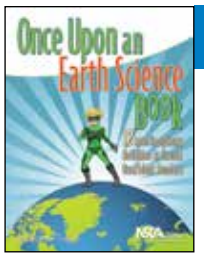
Designed for science teachers, the Master of Chemical and Life Sciences is a 30-credit, online, interdisciplinary master's degree offering concentrations in biology and chemistry.

NSTA Virtual Conferences

A day-long series of live web sessions delivered via an interactive distance-learning tool. Each conference features content and/or pedagogy from experts in a particular topic. Participants can log on from anywhere with an internet connection and interact with presenters and educators from across the country.

http://learningcenter.nsta.org/onlinecourses

National Science Teachers Association



NSTA PRESS: *Once Upon an Earth Science Book*

Fury in the Water

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 Once Upon an Earth Science Book, *by Jodi Wheeler-Toppen, edited for publication here. To download the full text of this chapter, go to* http://bit.ly/2bQZazp. *NSTA Press publications are available online through the NSTA Science Store at* www.nsta.org/store.

Topics

- Specific heat of water
- Wind
- Hurricanes

Reading Strategy

- Identifying text signals for comparisons and contrasts

Lesson Objectives: Connecting to National Standards

The following list shows the *Next Generation Science Standards* (*NGSS*) and *Common Core State Standards* (*CCSS*) supported by this activity.

NGSS: Science and Engineering Practice

- Engaging in Argument From Evidence

NGSS: Disciplinary Core Idea

- **ESS2.D.** Weather and Climate

NGSS: Crosscutting Concept

- Systems and System Models

CCSS: Literacy in Science and Technical Subjects

- ***CCSS*.ELA-Literacy.RST.6-8.1.** Cite specific textual evidence to support analysis of science and technical texts.
- ***CCSS*.ELA-Literacy.RST.6-8.9.** Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.
- ***CCSS*.ELA-Literacy.WHST.6-8.1.** Write arguments focused on discipline-specific content.

Background

The Sun is the ultimate power source for many of the processes on Earth, and water serves as a battery, storing and releasing the Sun's power. These ideas are important for students to understand because they form the basis of weather. In this chapter, students will discover how the power of the Sun and the heat capacity of water produce wind and hurricanes.

Materials

For the first demonstration

- Two identical lamps with incandescent or heat lamp bulbs
- Identical containers that hold at least 1/3 cup
- Two mercury-free thermometers
- 1/3 cup sand
- Water

For the second demonstration

- Candle in a candle stand
- Lighter or matches
- Two balloons
- Funnel
- Water
- Sanitized safety glasses or goggles

SAFETY NOTE: Heat lamp and incandescent bulbs get extremely hot. Students who have spent their lives around light-emitting diode (LED) and compact fluorescent light (CFL) bulbs may not be aware of how hot light bulbs can get. Be sure to warn them not to touch the bulbs.

Student Pages

- Pop! Lab (lab sheet)
- "The Fury in the Water" (article)
- Breezy Beaches (thinking visually)

Exploration/Pre-Reading

This lab has two parts. The first activity models Sun shining on the beach and the ocean. For best results, allow the lamps to heat the water and sand for at least 40 minutes, which means it is preferable to do this portion of the lab at the beginning and ending of class the day before doing the second half of the lab. Alternatively, the students can take the starting temperature before doing the group activity and then complete the first section of the lab about 20 minutes later. With the shorter time period, it is best to use a heat lamp or locate a 100-watt incandescent bulb.

For the second demonstration, blow up a balloon and tie it. Set a candle on a lab table and hold the balloon just above—but not touching—the flame. Have students count to 10 while you hold the balloon in the heat. It will pop, usually long before 10. Next, fill a second balloon with as much water as it will hold without expanding. Then blow it up the rest of the way with air and tie it. Repeat the process of holding it over (but not in!) the flame as students count to 10. You can ham this up by acting like you think the water balloon will pop and make a mess. Students will be surprised when the second balloon does not pop. It is best to use new, high-quality balloons because older and cheaper balloons are more likely to pop. Have students summarize what they observed on their data sheet.

Introduce the Reading. Tell students they are going to read an article that will explain some ways that the high heat capacity of water affects things that happen on Earth.

SAFETY NOTE: Be sure to wipe up any spilled water to prevent slip or fall hazards. Keep water away from electrical equipment to prevent shock. Only use ground fault interrupter–protected electrical circuits for lamps. Wash hands with soap and water upon completing the activity.

SAFETY NOTE: This demonstration will need to be conducted with latex balloons. Do not perform it if you have a latex allergy. Dispose of latex balloon parts carefully, and wash your hands with soap and water to protect students who may have a latex allergy.

SAFETY NOTE: Model good safety practices. Wear sanitized safety glasses or goggles meeting the American National Standards Institute (ANSI) Z87.1 standard during the setup, demonstration, and takedown.

Reading Strategy: Recognizing Signal Words for Compare and Contrast

Display the following sentence from the reading, with blanks as shown:

In the same way that sand heats up quickly, it cools _____. The air over the sand also cools.

Remind students that certain words are signals for what the text is about to say. See if anyone can predict what word might go in the blank. If they need a hint, underline the signal words *in the same way*. Otherwise, ask which words helped them fill in the blank. *In the same way* is a signal that two things are being compared. When they come across signal words for comparisons, they should ask themselves two questions: (1) What things are being compared? And (2) how are they alike? Ask students to list other words that might signal a comparison (*likewise, just like, just as, also, too*).

Now add this sentence beneath the previous sentence, with blanks as shown:

In contrast, water heats _____, but it also cools _____.

Ask students to predict what might go in the blank (slowly), and point out that *in contrast* indicated that water would be different from sand. *In contrast* signals that the new information is going to be different from, or contrast with, earlier information. When students come across contrast signal words, they should ask themselves what things are being contrasted, and how they are different. Ask students what other words might signal a contrast (*however, on the other hand, conversely, whereas, but, yet*, and *while* sometimes indicate a contrast).

Journal Question

Imagine that a friend asks you what a signal word is. What would you tell your friend? What signal words would you recommend he or she look for? ●

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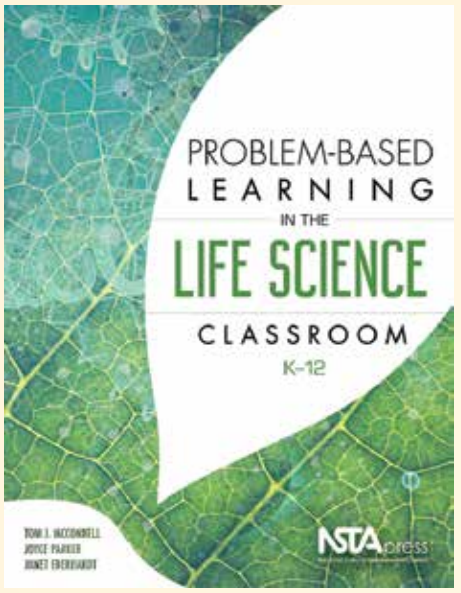

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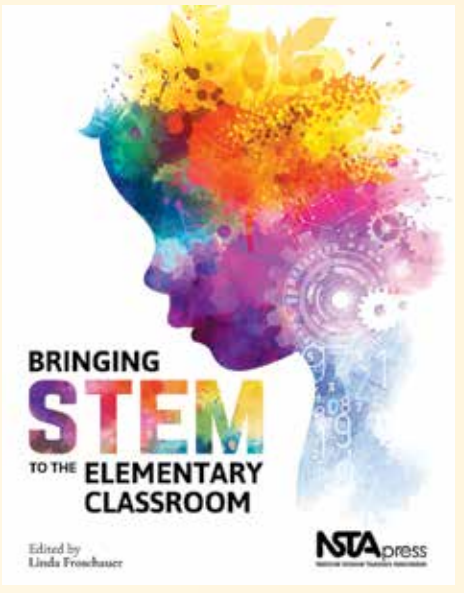

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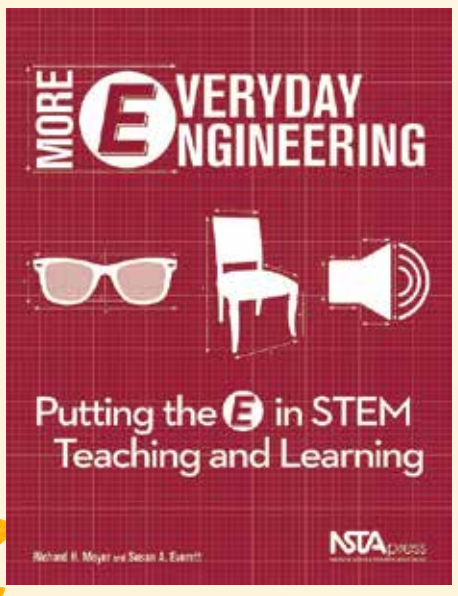

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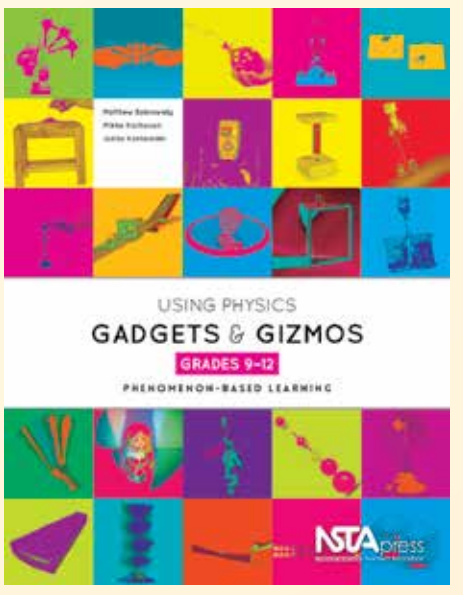

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NSTA National Science Teachers Association

(All dates are deadlines unless otherwise specified.)

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 *http://bit.ly/cp5xZC.*

October 27—The **NSTA Minneapolis Area Conference on Science Education, Celebrate Science: 10,000 Connections,** opens today! The conference will run through October 29 and feature 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. On-site member registration costs $225. For more information or to register, visit *www.nsta.org/minneapolis.*

November 1—*The Science Teacher* (*TST*), NSTA's peer-reviewed high school–level journal, 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 10—NSTA's Portland Area Conference on Science Education, Exploring Mountains: Guiding Science Teaching and Learning, opens today. Taking place in Portland, Oregon, the conference 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. On-site member registration costs $225. For more information or to register, visit *www.nsta.org/portland.*

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 (ET). For more information on NSTA Web Seminars or to register, visit *http://bit.ly/1Iwpg4w.*

December 1—***Science and Children*** (*S&C*), NSTA's peer-reviewed journal for elementary science education, wants your **manuscripts on "Preservice and Inservice Experiences: Enhancing Science Teachers' Repertoires"** for the September 2017 issue. General-interest manuscripts are always accepted. Read the call for papers at *http://bit.ly/1XjHRvr.*

December 1—Have you found a way to excite your high school students about engineering? Share your insight and experience in an article for the Summer 2017 issue of ***TST,*** themed **"Science and Engineering."** *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.*

December 1—Submit your manuscript on **"Innovative Teaching"** for consideration for the Summer 2017 issue of ***Science Scope***, NSTA's peer-reviewed journal for middle level science teachers. General-interest manuscripts, commentaries, and column submissions are always accepted. Read the call for papers and access submission guidelines at *http://bit.ly/1OfgnF0.*

December 7—The Shell Science Teaching Award recognizes innovative science teachers with a $10,000 award, but you can't win if you don't submit a strong application. Learn how to do so from Peggy Carlisle, chair of the Shell Science Teaching Award Judging Panel, during **Developing a Competitive Application for the Shell Science Teaching Award, a free NSTA Web Seminar**. The session will run from 6:30 to 8 p.m. ET. For more information on NSTA Web Seminars or to register, visit *http://bit.ly/1Iwpg4w.*

December 15—Are you a middle or high school science teacher dreaming of a lab makeover for your school? Don't miss **Developing a Competitive Application for the Shell Science Lab Challenge, a free NSTA Web Seminar**. Learn about the application process and tips for creating a strong application from Ruth Ruud, judging chair for the Shell Science Lab Challenge. The session will run from 6:30 to 8 p.m. ET. For more information on NSTA Web Seminars or to register, visit *http://bit.ly/1Iwpg4w.*

January 1, 2017—*Science* Scope wants to share how you "**Integrate STEM"** in the September 2017 issue. Submit manuscripts on this theme by today. General-interest manuscripts, commentaries, and column submissions are always accepted. Read the call for papers and access submission guidelines at *http://bit.ly/1OfgnF0.*

February 1—*S&C* is accepting manuscripts on the theme **"Early Childhood: Life Science"** for the October issue. Share how you use local resources, provide problem-solving opportunities, and more with your fellow early childhood educators. General-interest manuscripts are always accepted. Read the call for papers at *http://bit.ly/1XjHRvr.*

February 1—Submit your manuscript on teaching about "Climate Change" for the October issue of *Science Scope* now! General-interest manuscripts, commentaries, and column submissions are always accepted. Read the call for papers and access submission guidelines at *http://bit.ly/1OfgnF0.* ●

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Science Teachers 'Speak Up' on Tech

Science teachers are turning to digital resources to meet the diverse needs of their students, according to the 2015 Speak Up survey. More than 3,000 science teachers, along with students, parents, and other educators, responded to this survey on the use of instructional technology in the classroom. Participants who self-identified as science teachers were asked targeted questions about their use of technology.

The survey found 82% of science teachers incorporate digital presentation tools and 80% use online videos in their classroom. Seventy-one percent also reported using online video in their personal learning endeavors, and 81% found information online when preparing or delivering a lesson.

"The vast majority—71% of science teachers and 65% of other teachers—use online video to enhance their personal learning," points out Al Byers, PhD, associate executive director of Strategic Development and Research at NSTA. "This underscores the need for blended on-site and online teacher professional learning, particularly when you consider 63% of teachers said they need more planning time to work with colleagues to make digital content, tools, and resources a part of their daily instruction."

NSTA partnered with Project Tomorrow for the 2015 Speak Up (*http://bit.ly/2cexYyc*) survey of parents, students, and teachers to find out more about how technology supports student learning. Read more at *http://bit.ly/2cDMIsP*.●