Making a Difference
Through Environmental Projects pg 13

NSTA Reports
National Science Teachers Association

Sparking Students' Passions
In the Genius Hour pg 6

CONTENTS

Students Collaborate Worldwide on Science, Engineering

It's an international effort that may be unique: Students in the United States and Canada are working together to design 3D–printed, portable, battery-powered, rechargeable lanterns that students in Uganda and the Dominican Republic, who do not have reliable access to electricity, will field test. This isn't an act of charity, it's a "global collaboration to use kids' unique talents and technology to make the world a better place," says Tracey Winey, media specialist at Preston Middle School in Fort Collins, Colorado.

"The premise of the program is everybody has different talents," she continues. "It's not one group serving another. Each [group] is contributing unique talents to make a successful program. We have laid a foundation that everybody's voice is important."

The groups include students at Preston Middle School; Riverview High School in Moncton, New Brunswick, Canada; the Care and Hope through Adoption and Technology (CHAT) House in Uganda; the Dominican Republic; and Pheasey Park Farm Primary School and Children's Centre in Walsall, United Kingdom.

At Preston Middle School, students in the One Million Lights Club visit Winey's media center before and after school and during lunch to work on the project. Along with Winey and John Howe, the school's vice principal, they have Skyped with CHAT House students to learn more about their particular needs for the portable lights and shared their designs with the Riverview students. The CHAT House students also will field test the lights designed and built in Colorado. Winey says the CHAT House students will check the circuits to make sure they work and track how long the lights last, how many cranks are needed to charge the battery for how many minutes of light, whether the light is strong enough, how long batteries must be plugged into solar panels to be fully charged, and more. Their feedback will help the Preston students improve their designs.

HEIDI HOOD

A student at Preston Middle School in Fort Collins, Colorado, holds up a prototype rechargeable lantern for inspection by collaborating students at the CHAT House in Uganda via Skype.

"One byproduct [of the project] is light, but another is to foster global collaboration…[while] creating philanthropy in our kids," explains Winey. "Our kids learn so much content through this program. This isn't a class; my kids come before school, after school. Kids are motivated because they are curious and they know their work matters."

And it does. While speaking with the CHAT House students, Winey's students learned they wanted handheld lights so they would be able to identify predatory animals and other threats when they left the main CHAT House building to visit outhouses during the night. Her students also learned that while CHAT House has a generator for reliable light inside the orphanage, most of the surrounding village does not, which could lead to resentment. Sharing rechargeable lights with their neighbors would help build a stronger sense of community.

Collaboration, pg 4

NSTA Member Poll: School Use of Personal Electronics Increases PG 10

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COMMENTARY: **Tricia Shelton and Fred Ende**

Chatting Up a Deeper Understanding of *NGSS*

By Tricia Shelton and Fred Ende

Tricia Shelton

Fred Ende

The *Next Generation Science Standards* (*NGSS*) provide an opportunity for science educators across the nation to consider changing their practice to provide better learning for all. Wrapped within the three-dimensional nature of the standards is a framework for a coherent K–12 science education that prepares each and every student for college, career, and most importantly, life as an informed citizen with a focus on critical and creative thinking, collaboration, and communication.

The *NGSS* present challenges for science teachers as they learn about the standards, then apply them to instructional design, classroom teaching and learning, and assessment. Adapting teaching and learning can be a struggle for teachers—and in many circumstances, an isolated struggle. But it needn't be. Since the *NGSS* represent a series of standards meant to cross all boundaries, educators across the United States (and even the world) can use them to foster science success for all students.

Of course, the educational boundaries that the standards overcome don't necessarily erase the geographic boundaries that physically separate us from one another. The power of social media can help.

Over the last two years, we've built a professional learning network tied to the *NGSS* using Twitter. With its 140-character limit and quickly-shifting focus from one topic to another, you might wonder how a professional learning network built around the deep study of a set of standards could exist on such a medium.

Happily, Twitter can enable deep conversations through the use of what is commonly referred to as a Twitter chat. These chats operate through targeted tweets focused on a topic or area. To allow these chats to occur amid so much other tweeting, participants use a hashtag (#), allowing them to collate related tweets by searching for keywords or phrases preceded by #. Many chats focus on various education and science areas, including #edchat, #NYEDChat, #scistuchat, and #biochat.

This allowed us to create *#NGSS* chat, a biweekly synchronous chat that explores all things *NGSS,* from the research that went into the *A Framework K–12 for Science Education* to examples of implementation from states and districts already putting the standards into practice. During these chats, we serve as moderators, often coming up with questions based on interactions with other members of the *#NGSS* chat community, and sometimes being lucky enough to co-moderate with other organizations like NSTA, Achieve, and Teaching Channel.

The power of the chat isn't just that it explores the *NGSS* in depth, but rather that it serves as a resource to educators as they continue to contemplate how their practice needs to change. Whether an educator works in a state that has adopted, will adopt, or will adapt the standards, *#NGSS*chat serves as a boundary-breaking tool that fosters creative thinking, accesses resources, and encourages collaborations. *#NGSS*chat has an added bonus of enabling participants to pose their own questions, often to *NGSS* writers who have joined the chat on multiple occasions.

A system of national standards always has its advantages and challenges. With regard to the *NGSS*, one of the advantages is their national scope, as they provide an opportunity for science practices to "look the same" at a certain age level, regardless of where a student attends school. One of the disadvantages is also the national nature, as it can be hard to build connections with those who live hundreds or even thousands of miles away. *#NGSS*chat and the *#NGSS*chat professional learning network offer a means to recognize the geographic barriers for what they are: simply barriers that can be overcome with critical thinking and 140 characters.

*#NGSS*chat isn't the only option for cultivating an understanding of the *NGSS* and marrying them with tech tools. The *NGSS*@NSTA portal (*http://ngss.nsta.org*) provides access to a myriad of resources. The *NGSS* blog project (*http://ngssblogs.weebly.com*)—which started with the idea that sharing enhances the learning of the group as well as the individual—is compiling links to posts by practitioners who are happy to publicly reflect on their failures and successes with *NGSS*. Finally, collaboratively designed resource sites like *NGSS*PLN.com are allowing educators to create their own clearinghouses of tools to move science education forward.

New sets of standards require continuous conversation around professional learning strategies and implementation. Without these conversations, the implementation of these items is impossible. Twitter chats like *#NGSS* chat provide a subset of educators with an opportunity to inquire, argue, and share, all necessary parts of the collaboration that will allow the *NGSS* to have a positive impact on today's students and tomorrow's leaders. ●

#NGSSchat is held on the first and third Thursday of every month at 9 p.m. Eastern Time.

Tricia Shelton is a high school science teacher and teacher leader driven by a passion to help students develop critical and creative thinking skills. She has received a 2014 NSTA Distinguished Teaching Award for her contributions to and demonstrated excellence in science teaching. Find Shelton on Twitter @TdiShelton.

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Collaboration, from pg 1

At Riverview High School, science teacher Ian Fogarty shares the story of Maria and Hailey with his students. In August 2014, one of his students met the two girls in the Dominican Republic. They both dream of becoming doctors, but struggle to study after dark when their home only has electricity a few nights a week.

"Engineering seems to be a nice mix of purposeful science," Fogarty says. Instead of getting "lost in our science lab," he adds, philanthropic engineering projects provide concrete answers to why students learn about circuits. "Now they are learning to help somebody. I tell them, 'Here's their story, here's how we can help.' It gives content real-life purpose…The motivation is 'We're going to learn this to help somebody; if we don't learn, someone is going to suffer.' There is no middle ground; either it works or it doesn't."

Fogarty was able to add the light project to his existing curriculum. "It wasn't a big change in the classroom. It was a change of focus. We can do the same tests as before," he explains. His ninth-grade students do the same circuitry labs as in previous years, but do them with Maria and Hailey in mind. In his 10th-grade Broad Based Technology course, students use Google SketchUp to draw cases for the flashlights, while 11th- and 12th-grade physics students go into greater depths working with electronics and microprocessors. The Science 12 class, which "blends the borders [among] science, humanities, and language arts," also examines the role of the local culture, investigating how they will get the lights to Maria and Hailey (and other students in similar situations), he relates.

"Engineering is the last gender gap, I think," remarks Fogarty. "In this project, eight out of 12 students are girls. Three [female] students not in class are checking in weekly. They tell me, 'We're invested in it now. We want to see it through.' One of the goals is gender equity in science moving forward; this seems to be helping that out quite a bit."

The Fort Collins and Moncton students shared their designs with one another electronically. Winey explains the Moncton students knew more about circuitry than her middle school students did, and her students had more experience in virtual collaboration and 3D printing. In addition to collaborating on circuitry with Winey's students in Colorado, Fogarty's students worked across the Atlantic Ocean with Gareth Hancox's fourth-grade students at Pheasey Park Farm Primary.

"My students taught those students about circuits and sent them a design task [to create] cases. Each kid spent five [to] eight hours of [his or her] own time designing lights. They pitched their designs to us and really challenged what my high school kids were thinking…They've helped us with brainstorming design," says Fogarty. The elementary students' designs included glow-in-the-dark cases, dimmer switches, and options to make the lights wearable.

Hancox notes this "revolutionary approach to learning…between elementary and high school students on different continents has been a giant leap forward in learning. Both sets of students had interesting, sensible, and exciting ideas on how best to approach the problem of supplying light to students in the Dominican Republic. What happened next was true collaboration; the younger students presented their designs over a Skype video presentation with immediate feedback from Canada. Ideas however 'out of the box' were discussed, and certain elements were further developed until a final design was agreed upon by all the students." He adds that it has been incredibly important for his students "to work on a real project with definitive outcomes that will change the lives of others."

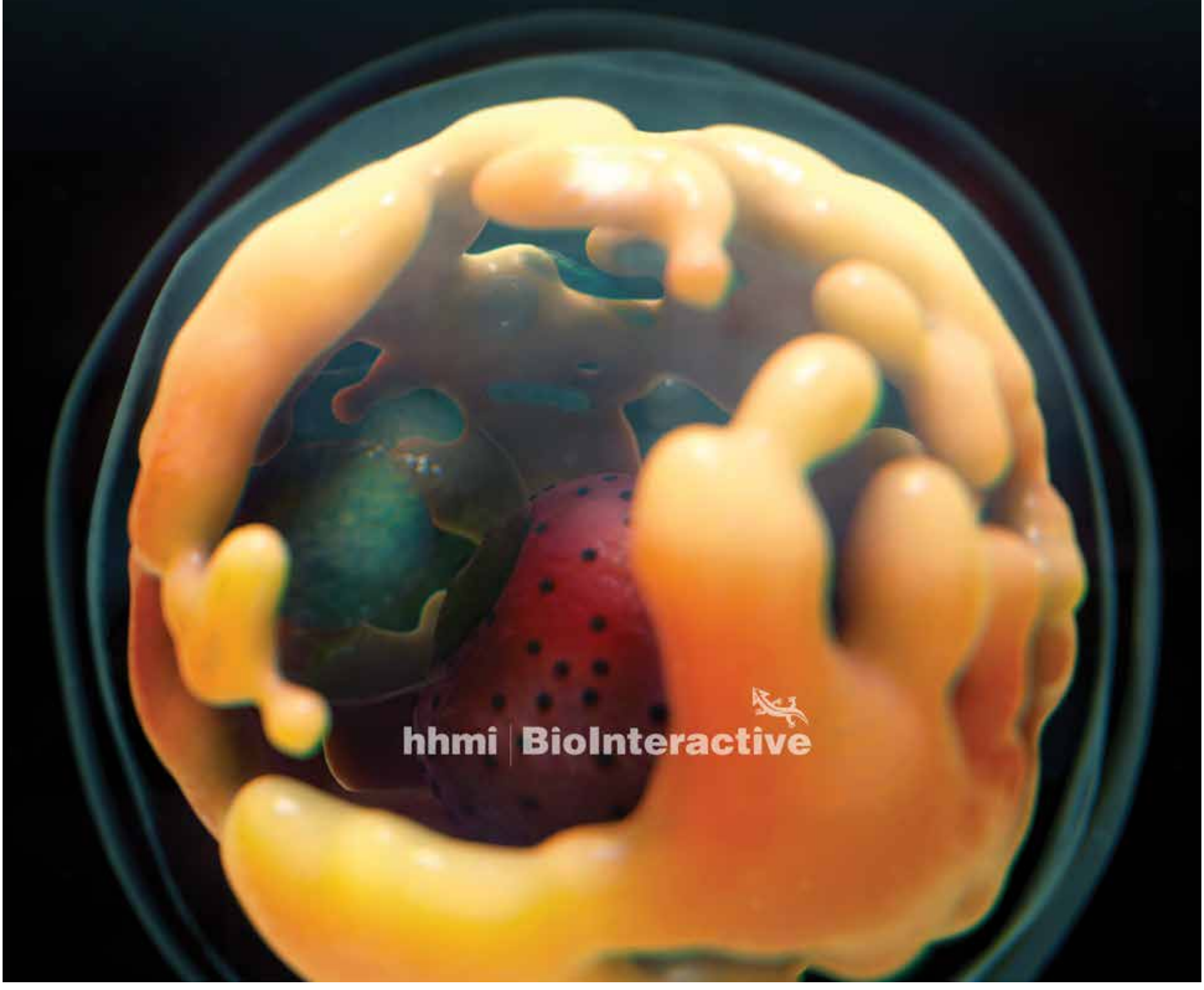
Fogarty and Winey also tapped into resources in their local communities. He has had an engineer "loaned" from a technology company check that the students were designing with safety in mind, and a university professor visit while students worked on circuit boards. Volunteers from Intel worked with Winey's students on soldering, and the school's computer science and electronics teacher checked students' circuits. "The beauty of it is that people who want to come, come. It's truly motivated by people…serving for the sake of serving," Winey says.

UNESCO has declared 2015 the Year of Light to raise awareness about light-based technologies and how they can be used to promote sustainable development and resolve energy, education, agriculture, and health challenges. Winey and Fogarty hope more educators will be inspired to make philanthropic engineering part of their curriculum.

With Howe, they launched a website, *www.philanthropic-engineering.org,* to share how they have made creating reliable light sources for others central to their students' learning experiences. Fogarty hopes to eventually add more philanthropic engineering materials—such as designs for an automated greenhouse a group of his students have been working on to support a community garden—to the site. ●

ZOOM INTO THE SECRET LIVES OF CORALS

www.biointeractive.org/coral-bleaching



Sparking Students' Passions in the Genius Hour

GREG STOCCO

A student in Greg Stocco's class at Thomas Middle School in Arlington Heights, Illinois, demonstrates a marble roller coaster as part of his Genius Hour project.

Genius Hour—also known as "20% time" or "passion projects"—was the name Google gave to an initiative that allowed employees to devote 20% of their work week to pursuing "pet projects" that could enhance the company. Though Google no longer offers this initiative, some teachers around the country have incorporated a Genius Hour in their classrooms, allowing students a specified time to work on projects that interest them.

"I have an Innovation Day (IDay) for my fifth graders [once a week]," says Dan Del Duca, lower school science teacher at The Shipley School in Bryn Mawr, Pennsylvania. He established IDay after observing students' enthusiasm when they were assigned to develop an invention related to U.S. history. "It was a popular topic. The students came in at lunch to work on it. The project didn't confine itself to class time," he recalls.

"I wanted to empower my students to learn on their own about things they are interested in," Del Duca explains. "I want to provide experiences that are more powerful than a lab [in which] everyone is doing the same thing and getting the same answer…It's neat to give kids a chance to build things using tools."

During IDay, "the room is transformed into a maker space. Lots of good learning happens each week, and students are motivated even when things don't go as planned," he reports. Student projects have ranged from building electronic circuits to making slime to creating lipsticks and jewelry, with Del Duca approving students' project choices.

His students use a Google Drive spreadsheet to reflect on what they learned on each IDay and how they overcame obstacles they encountered. "I want students to learn about resilience and perseverance. [They] learn they have to try again [when they fail]. It's an important part of science and life," he contends.

On IDay, a technology teacher assists Del Duca and mentors the students as they work on their projects, but he emphasizes that "students guide the whole process." If they make a mess on IDay, "it's their mess. They take responsibility," he maintains.

When she was assigned to teach sixth-grade English language arts (ELA) last year, Melissa Sleeper, science teacher at Sebastian River Middle School in Sebastian, Florida, established a Genius Hour every Friday because she "wanted to get more science into the language arts block…The term 'genius' meant they were a genius at whatever topic they chose to study," she explains. She obtained permission for Genius Hour when she showed her administrator "how the research and report writing covered many of our ELA benchmarks and helped prepare students for the state-mandated writing and reading tests."

Most student projects were science-based, Sleeper notes. "Even the guys who created computer games chose science-related themes, such as volcanos and earthquakes," she reports. "We brainstormed ideas about their interests and discussed what was feasible," such as using a kit to build a scale model of a car engine instead of building an actual engine, she relates.

Being knowledgeable about appropriate resources is important for passion projects. When one of Sleeper's students expressed an interest in auto racing, she says she "pointed him to a [National Science Foundation] website about NASCAR [at this URL: *http://1.usa.gov/1FdoyfR*], and he researched the science behind [it]. He learned a lot about physics, and [the project] enhanced what he was learning in science class about forces and motion."

Sleeper's students worked on their projects from September through March in class—"except when state- or district-mandated testing [was scheduled]"—and after school, she notes. "I had very few complaints about working on their projects. When I do science fair, I get lots of complaints," she reports.

Greg Stocco, eighth-grade science teacher at Thomas Middle School in Arlington Heights, Illinois, says, "I run one Genius Hour project during the first two quarters of the year and another in the second two quarters." The first project involves the engineering design process and scientific processes and requires graphing, data tables, and background research; the second "is more open-ended so students can incorporate art or writing," he explains. That project "lets me see who is succeeding and who isn't, who is on task and who isn't," he adds. Students develop their own grading scale for the second project.

Stocco reports that his students display "amazing productivity and time management…I have solid evidence that students do accomplish [a great deal]. It's absolutely well worth it!"

For the past two years, Jessica Anderson of Powell County High School in Deer Lodge, Montana, has held a Genius Hour with her ninth-grade Earth science students every Friday during the first semester. "[Ninth graders] don't get many chances to choose what courses they take, so this is a good opportunity for them," she maintains. "Genius Hour meets standards, but gives them the option of what they want to learn about."

This year, after her students chose their projects, they partnered virtually with students in a geography class in Canada whose teacher Anderson had connected with on Twitter. Both groups blogged about what they were working on. They could share related articles, videos, and podcasts, and they commented on one another's work. "The blog made it easy to communicate" and learn about "things outside their environment," she contends.

During Genius Hour, "you learn a lot about your students," says Anderson. "It helps you build relationships with them."

Genius projects typically culminate in presentations. Del Duca's students make presentations to students in their own grade or to younger students; Stocco "[sets] up the classroom as an exhibit hall" and has students take turns making and watching presentations. "They get to present more than once, so they get better at it," he notes. He also awards small prizes for the projects with the most reliable or best data.

Students' presentations "covered most of the benchmarks for writing," Sleeper relates. For example, a student who created duct-tape purses, jewelry, and desk accessories researched and developed a PowerPoint presentation about the history of duct tape. Students who made iMovies had to develop handouts containing step-by-step instructions for making iMovies and demonstrate the process. "The student audience was responsible for writing down questions and compliments for each presenter. This [also] helped them work on their listening skills," she notes.

Genius Hour Issues

Some educators have expressed skepticism about Genius Hour, believing that students should be self-directed and take ownership of their learning all the time. Stocco responds, "That would be okay for an elective class, but standardized tests make that hard

[in a core class]…I'm getting through the *Next Generation Science Standards* [during] the other four days of the week."

"I would like to do a genius project every semester or maybe quarterly," says Sleeper. "A unit might not be enough time to allow the students to do in-depth research. If we did one every unit, it would give the students [who] did not like that particular unit topic something to look forward to, since they enjoyed working on the projects they chose to complete."

For some students, Genius Hour "goes against the grain of traditional schooling," Del Duca contends. "A lot of students are used to the teacher telling them what to do."

"Students struggled with selecting their topics because they were not used to being able to choose what to study," Sleeper concurs. "They had to be directed away from superficial topics. It was hard for them to find information on some topics because they did not have good research skills. This project helped them develop those skills."

Stocco says he has a "small library of 15 to 20 books containing kid-friendly experiments" that he shares with students who need inspiration.

In addition, "the energy is a lot different with these projects," so "the teacher has to ensure safety and available resources, and make sure students have a plan and know what they need and what to do," Del Duca points out.

Just finding enough time for passion projects can be challenging. "Lunchtime or after school might be other possible times," he suggests.

Genius Hour Resources

"I learned a lot through Twitter," says Stocco. He cites the hashtags #GeniusHour and #20%time.

To help her students choose their projects, Anderson uses Flipboard (*https://flipboard.com*), which she describes as "an application that allows students to search for a variety of web-based resources and to curate these resources in a visually compelling and user-friendly way."

Resources for passion projects also are available through websites like Genius Hour (*www.geniushour.com*), which offers a free online course. ●

Quotable

One accurate measurement is worth a thousand expert opinions.

—Grace Hopper, U.S. Navy rear admiral, computer programmer (1906–1992)

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NSTA National Science Teachers Association

BRAINSTARTER

FAUNANAUTS

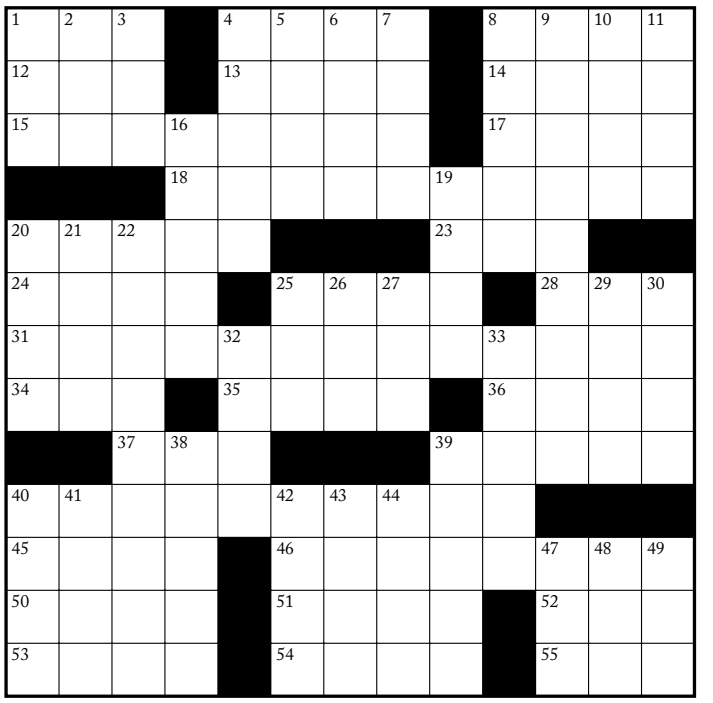
BY PATRICK MERRELL

ACROSS

1 Laika, the first animal to orbit Earth, e.g. (1957, USSR)
4 Rocket launch platforms
8 Middle Eastern country that sent a rodent, worms, and two turtles into space (2010)
12 Alkaloid suffix, generally
13 "Gold" collector of film
14 Prefix with graph or phone
15 Company that pioneered walkie-talkies and car radios
17 Highest cards
18 The first animals (insects) in space (1947, USA)
20 Autos seized for nonpayment
23 Internet connection co.
24 Shrinking sea of Asia
25 Gang's territory
28 Promise-to-pay note
31 Arabella and Anita, two "spinners" aboard Skylab 3 (1973, USA)
34 Govt. insurer of seniors
35 Proton's home
36 Without repeat
37 Preacher's talk (abbr.)
39 Legendary tales
40 Ham or Enos, launched into space in '61 and '62 (USA)
45 Jared of *Dallas Buyers Club*
46 Text following an asterisk
50 Landed
51 Paquin of *X-Men* films
52 T-___ (fearsome dino)
53 "Squeakers" sent into space by China (1964)
54 Fishing-line holder
55 Félicette, France's first animal in space, e.g. (1963)

DOWN

1 Like the light at dusk
2 Lennon's widow
3 Procure
4 Contented feline sounds
5 Matty or Moises of baseball
6 Sandwich shop
7 Ejection ___
8 Genera are usually written in them, briefly
9 One presented with an award
10 Away from the wind
11 Loch ___ monster
16 Days ___ (bygone times)
19 Stereotypical poodle name
20 Torn-up sheets, perhaps
21 Notable periods
22 Living off of another
25 $C_7H_5N_3O_6$ explosive
26 Troop-entertaining grp.
27 Engine-speed unit (abbr.)
29 Front theater section (abbr.)
30 Applications



32 Wyatt of the Old West
33 Senior member
38 Ham it up
39 Any element with an atomic number in the 20s
40 Supposedly happy bivalve
41 Prefix with port
42 Way off
43 Zero
44 The "Z" in ZIP code
47 *Lord of the Rings* bad guy
48 Brewed beverage
49 Call routing abbr.

ANSWER ON PAGE 22

School Use of Personal Electronics Increases

In 2013, *NSTA Reports* asked educators if and how students are allowed to use personal electronic devices at school. At that time, 65% of respondents indicated their school permitted the devices. Two years later, 92% of respondents to a recent informal *NSTA Reports* poll reported their schools allowed personal electronic devices.

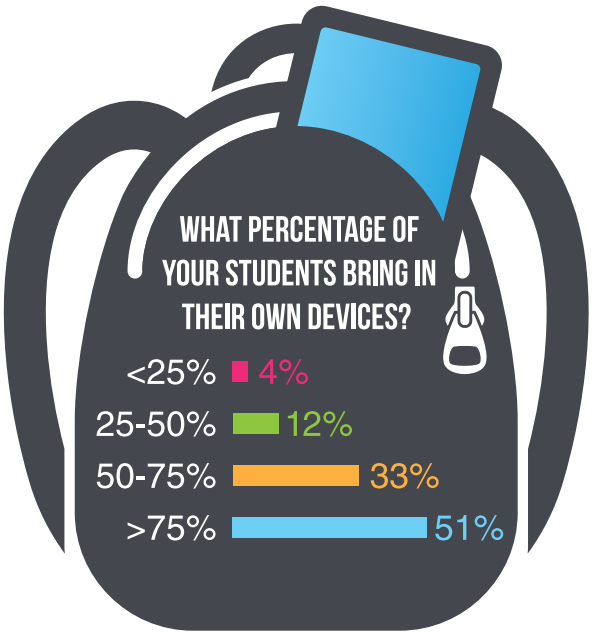
Most (86%) indicated their schools allowed students to connect personal devices to the school network, compared to 55% two years ago. Tablet computers (92%) are the most frequently approved device in 2015; cellphones (86%) and laptops (80%) also are common. (*Note: Educators could select all devices allowed by their schools.*) One educator noted, "They can use anything they have: We set up a BYOT [Bring Your Own Technology] network/server for this purpose, and the schools are wireless."

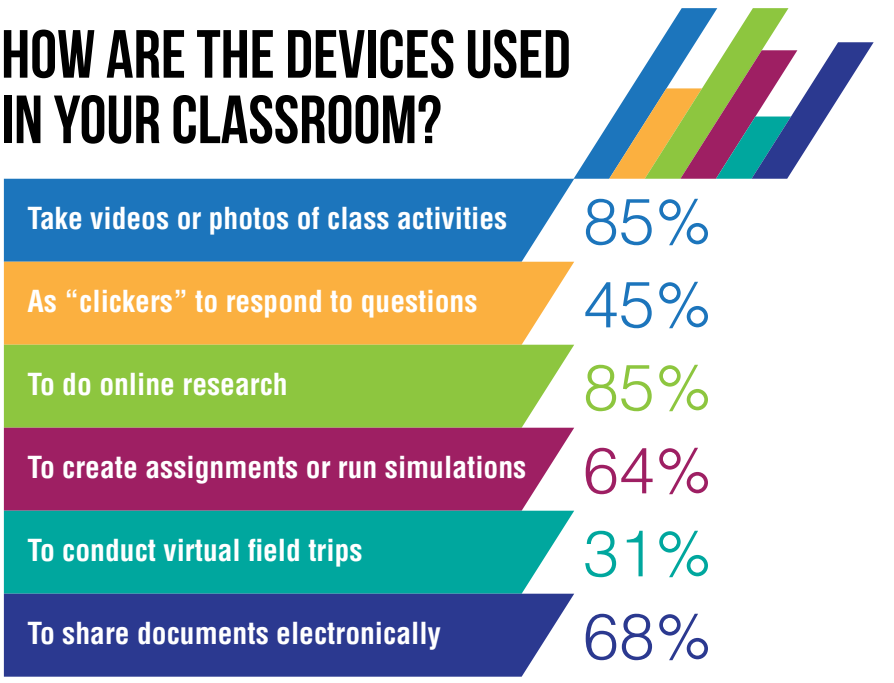
In 2015, personal electronic devices are most often used to take videos or photos of class activities (85%), do online research (85%), share documents electronically (68%), and create assignments or run simulations (64%). (*Respondents could select multiple uses.*) One educator reported students use their devices "in place of the planner—[to] keep track of due dates and manage time."

The use of personal electronics in the classroom has increased, with 50% of educators responding that 75% or more of their students use their own devices, compared to 36% in 2013. Only 22% of educators indicated that they permit students to take tests using personal electronic devices, although that is 9% more than those who did so in 2013.

Not all teachers have embraced the use of personal electronics in the classroom, noting students frequently use them for personal reasons during class time. One flatly stated, "I do not personally allow their use."

Allowing students to use their personal electronic devices raises some concerns, often regarding equal access for all students. In addition, students may not always remember to bring their devices with them.





Respondents could select multiple uses.

Here is what science educators are saying about personal device availability:

I have three tablets in my classroom to loan out. The tablets belong to me, not the school. I've [obtained] all three through small grants (local grants, Adopt a Classroom, etc.).—*Educator, Middle School, Georgia*

[Students] use a device that a classmate has with [him or her].—*Educator, Institution of Higher Learning, Indiana*

Our school requires them to have a laptop or tablet computer. If they do not have it and need it, then it is just like not having your pencil and paper or other needed supplies.—*Educator, High School, Texas*

Chromebooks are provided in the classroom (cannot be checked out).—*Educator, High School, Wisconsin*

Work in groups, get laptop cart, or let them borrow [a] teacher device.—*Educator, High School, Illinois*

We have a set of old laptops.—*Educator, High School, New Mexico*

We have laptops and iPads available for those [who] do not have their own.—*Educator, Middle School, Arkansas*

Let them access in-class computers.—*Educator, High School, California*

They share. I also have two personal devices I lend out.—*Educator, High School, Ohio*

The school has extra laptops that the students can check out at the library.—*Educator, High School, Kansas*

I'm flexible, and it helps that each floor of my school has a laptop cart. Most students are willing to share also.—*Educator, Middle School, Alberta, Canada*

I allow them to use classroom computers, use the computers in the media center, or share my classroom iPad.—*Educator, Middle School, South Carolina*

I have devices to share, and most work (aside from tests) [is] done in small groups. So sharing devices is scaffolded.—*Educator, High School, Institution of Higher Learning, Connecticut*

That's a problem…if other tech is available, then a student may use it.—*Educator, High School, Michigan*

Go to [the] lab.—*Educator, High School, Georgia*

Our school has issued Chromebooks to all students, so they all have a device to bring. When they show up without a device or if it is out of battery, I have them use my classroom computers (I

have 16 desktops).—*Educator, Middle School, California*

I let them borrow mine, or they partner up.—*Educator, Middle School, California*

We have them [available] to check out in the media center (laptops and tablets); some assignments are meaningful if the students share devices. I also have four desktop computers in my classroom.—*Educator, Middle School, High School, Institution of Higher Learning, Georgia*

Print paper copies.—*Educator, Middle School, Colorado*

Supply them with a form of technology that is on-site.—*Administrator, Elementary, Middle School, Alabama*

Our school provides a device for each student. [Ninth through 12th] grade ha[ve] Macbooks, [sixth through eighth grade have] iPads, and [third through fifth grade have] mini-iPads. While each of [these] students takes [his or her] devices home as well, preK–second [graders have] mini-iPads that are kept at school.—*Educator, High School, Tennessee*

We have iPads in our science department that are available as long as they are not being utilized with PASCO probes for chemistry or physics labs.—*Educator, High School, New Jersey*

All students have an iPad, but some still pull out their phones, which is [okay].—*Educator, Middle School, Texas*

[Make the devices an] annual gift or annual lend.—*Educator, Institution of Higher Learning, Connecticut*

Pair students up; allow them to use my personal devices; use computer lab as backup.—*Educator, High School, Georgia*

Use school-provided technology (very minimal at my school), or have students share.—*Educator, Middle School, Colorado*

One-to-One

Most of my students have an iPad since [our school is] 1:1. However, when a new student transfers in, [he or she] may not have one, so we have [extra] Chromebooks…that [he or she can] use. Otherwise, [he or she] can share with a peer since we mostly do group work in my classes.—*Educator, Middle School, High School, Kansas*

We are a one-to-one school [in which] each student is expected to have [a] district-issued device with [him or her] at all times.—*Educator, High School, Tennessee*

I have 1:1 Chromebooks. That is the preferred device during [students' time in] the classroom.—*Educator, High School, Ohio*

Don't Use

Not an issue since the device usage is not mandatory.—*Educator, High School, Maryland*

This was a problem a few years ago. It is also one of the reasons that we switched to a "no personal device" policy and asked to use the [Microsoft Surface tablets] that were no longer needed at the high school, because all students [in grades] 6–12 now have Chromebooks assigned to them. One other issue that occurred was that some students could access their own data networks through their cell phones, and we found our fifth graders to be immature in their understanding of what was appropriate school use of this technology.—*Educator, Elementary, Michigan*

We seldom use them in class.—*Educator, High School, West Virginia* ●

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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

Project Noah. Project Noah missions provide opportunities for students in grades 4–12 to participate in citizen science and share their observations and experiences with wildlife in a meaningful way. By contributing to Project Noah missions, students are not only learning about the environment, but also taking action to protect it. Teacher-tested lesson plans—e.g., Tracking Alien Species, Writing Goes Wild, and a Self-Guided Tree Tour—will help you get started with Project Noah in the classroom. Download these materials and learn more at the website *www.projectnoah.org/education*.

Ancient Technologies, New Tomorrows. Check out AntiquityNOW's blog for students in grades 3–8. This blog highlights ancient inventions and ideas and shows how influences and events from the past are shaping our lives today. Recent posts include Blowing Their Tops: The Destructive History and Amazing Science of Volcanoes; Ancient Weather, Modern Predictions; and the blog's number-one, most-read post, The Invention of the Wheel, which through its accessible content and follow-up student activities that reinforce understanding, both engages and educates. See *http://bit.ly/1EbeKQW*.

Training on Digital Dissection Software. Teachers can receive personalized interactive online training on computer-based animal dissection software. Sessions will cover educational efficacy, economic benefits, ethical considerations, and current laws and policies regarding the use of animals in science education. Participants will gain hands-on experience with popular digital dissection software programs. Training sessions are led by Samantha Suiter of People for the Ethical Treatment of Animals (PETA), who teaches biology at Trident Technical College in Charleston, South Carolina. To schedule a training session, contact Suiter at *SamanthaS@peta.org* or 843-771-2394.

VISITOR7

The National Agricultural Literacy Curriculum Matrix. This collection of classroom-ready educational resources for K–12 teachers aim to increase students' awareness and understanding of agriculture issues. Developed as part of the Agriculture in the Classroom website, the matrix includes standards and objectives, lesson plans, companion resources, and assessments on numerous agriculture topics, from identifying plant parts to knowing where food comes from to understanding our role in food safety. Teachers can search lesson plans by grade level, location, or content area (science, health/nutrition, or social studies); teachers also can submit their own successful agriculture lessons to the matrix at *http://bit.ly/1zx3YhV*.

STEM Jobs for the Classroom. A video series tackles the top challenges educators face in encouraging middle and high school students to pursue careers in science, technology, engineering, and math (STEM). These challenges include defining STEM in the classroom setting (*Flipping the Script on STEM*), addressing STEM-subject anxiety (*I Hate Math!!!*), and connecting STEM learning within the context of STEM careers (*Do What You Love!*). With plenty of action and practical advice for both students and teachers, each 15- to 20-minute video makes it clear that STEM fields are dynamic and suit diverse skills and interests. Teachers can also download the *STEM Teacher Guidebook,* which presents seven principles to follow to interest students in pursuing STEM careers. Consult *http://classroomseries.stemjobs.com*.

Fight BAC! Teach elementary and middle level students safe food-handling practices and how to avoid foodborne illnesses with games and activities from the Partnership for Food Safety. For example, in BAC Blaster, players clean, separate, cook, and chill foods to keep bacteria from contaminating their picnic feasts. In BAC Drop, students learn about core food safety practices and the "10 least wanted pathogens," then complete a story template to show what they know. Visit *http://bit.ly/1Fi0JDx*.

SciGirls. This public television series for students ages 8–12 highlights tween girls who are putting science and engineering to work in their everyday lives. Each 30-minute episode follows a different group of middle school girls as they solve their own design and engineering problems, such as how to design shoes for safer walking on icy streets and how to program and control the LED lights sewn into dresses at a local fashion show. The program's website offers hands-on activities related to the episodes, as well as tips and resources for teachers to spark girls' interest in STEM. Refer to *http://to.pbs.org/1Fi1A7a*.

See Freebies, pg G2

Freebies, from pg G1

STEM on TV. At *www.stemon.tv,* you'll find four STEM education video channels, each with a different focus to serve the complete K–12 learning community of students, teachers, and administrators. Channel One presents videos for teachers based on trainings from the National Center for the Advancement of STEM Education. Channel Two, The Science Center for Inquiry, features videos such as *Exploring Magnets, Some Cloudy Questions,* and *Gravity Car,* which get students excited about thinking and doing science. Channel Three, the Physics Pharm, offers an online learning adventure for anyone who can multiply and divide with decimals. Channel Four, named STEMon Episodes, highlights resources, demonstrations, and events of interest to STEM educators and learners everywhere.

GRONDIN

"What If There Were No Moon?" poster. Spark high school students' interest in STEM fields with this information-packed poster and lesson plan that highlight ways to use math, physics, and geology to calculate the mass of the Moon. Created by the Florida Institute of Technology, the poster emphasizes the interdisciplinary nature of STEM fields. Access this and other STEM-themed posters with student appeal—e.g., "Gridiron Science," which explores the math and physics of football, and "The Power of Math," which looks at the science and math behind speedboat design—at the website *www.fit.edu/stem-poster*.

Looking at Data and Education. Last year, the Education Development Center's Oceans of Data Institute convened a panel of experts to determine the skills and knowledge required of a big data–enabled specialist. The ability to think critically, apply statistical methods, and understand algorithms, as well as a desire to seek patterns, were among the key skills identified for success in the field. The blog at *http://bit.ly/1CtzgaA* examines the occupational profile and presents a vision for building K–16 students' abilities over the course of their schooling to achieve data literacy by the time they graduate.

BookMentors. Connecting teachers, librarians, and students in need of books with donors supporting literacy, reading, and education, BookMentors uses *micropatronage* (i.e., directly supporting the work of others by making donations via the internet) to solve book access problems in high-poverty schools. At the site, educators from all levels and disciplines request books they need. Donors can select a request to fulfill or create an "offer page" highlighting the book or books they want to donate. A site feature called virtual book drives allows teachers, parents, and community organizations to request and donate books, using leaderboards as a charitable gamification incentive. Learn more at *www.bookmentors.org.*

Rising Stargirls. This site offers *Universe: More Than Meets the Eye,* an interactive astronomy workshop for middle school girls (grades 6–8) from traditionally underrepresented groups in science. The National Science Foundation–funded workshop integrates creative strategies such as theater and writing to connect students' individual life experiences to the universe they learn about. The workshop explores constellations in the night sky, planets in and outside of our solar system, and the universe's unseen mysteries. It can complement an existing curriculum or be completed in an after-school program. Learn more at the website *www.risingstargirls.org/news,* or e-mail program founder Aomawa Shields at *ashields@astro.ucla.edu.*

Hank Green, Internet Guy. Need some "zip" for your middle and high school science lessons? Check out the Green Brothers' educational video-based platforms on YouTube: SciShow (see *http://bit.ly/1DLOg5l,* grades 5–8) and Crash Course (*http://bit.ly/1fgbch0*, grades 7–11). These high-energy educators have created and posted hundreds of videos on science, history, and other topics. The videos, which range anywhere from 2 to 15 minutes in length, exemplify the motto "learning should be fun," and are meant to be incorporated into lessons or viewed at home to reinforce classroom learning. Titles include *Do Plants Get Cancer?, How Do Fingerprints Form?,* and *A Brief History of Robotics* (SciShow) and *Water: Liquid Awesome, The Periodic Table,* and *Cycles in the Sky* (Crash Course).

STEM Connections. The International Technology and Engineering Educators Association's (ITEEA) monthly electronic newsletter (formerly known as *Inside TIDE)* features news, professional development opportunities, information about legislative efforts, and networking opportunities for K–college educators that highlight the importance of a STEM education for all students. ITEEA seeks to increase students' technological literacy and help schools include technology and engineering education to fully prepare today's students for the 21st-century workplace. Register to receive the newsletter, or read archived issues at *http://bit.ly/1PflW3P.*

The Wolfram Demonstrations Project. This database of interactive applets created in 2007 is the largest open repository of professionally vetted, instructional interactive content online. With more than 10,000 demonstrations representing a wide variety of grade levels and disciplines—from elementary math counting games to medical image processing and more—the site has something for every educator, K–12. Teachers can search the resources by topic or by Common Core–supported learning standard; registered teachers can join the Demonstrations Project and submit their own interactive resources to the site. Visit the website *http://demonstrations.wolfram.com.*

MALTAGC

Global Competency Lessons. View and download lessons designed to develop students' global competency skills. The interdisciplinary lessons were created by National Education Association (NEA) Global Learning Fellows and offer numerous possibilities for integration with science, social studies, and language arts classes. Lessons are available for all levels along the K–12 spectrum. Selected titles include Environmental Portraits: More than Face Value! (elementary); Lifeboat Earth, a Global Perspective (middle); and Magnetic Levitation Train (high school). An annotated list of all the lessons can also be found at this website: *http://bit.ly/1I41RqA*.

Teaching With Documentaries. High school educators and film aficionados of every level can access a large collection of nonfiction films in science, the environment, and other teaching disciplines. Uniquely browsable—i.e., teachers can search the resources by topic but also by "featured" picks, highest rated, most shared—the website encourages educators to rate and share comments about the films. Set aside time to peruse the site; a search of science categories turned up numerous titles of interest, such as *Space Station Tour; Tesla: Master of Lightning; Cancer: The Forbidden Cures;* and *Living Among the Gorillas*, to name a few. Watch them at *http://topdocumentaryfilms.com.* ●

News Bits

CANON AT ENGLISH WIKIPEDIA

- **More than 120 U.S. engineering schools have committed to preparing students specifically trained to tackle the "Grand Engineering Challenges" of the 21st century. These challenges have been identified as the most pressing of our time by the White House, the National Academy of Engineering, and the United Nations.**

The challenges include engineering better medicines, providing cheaper forms of solar energy, creating stronger personalized learning tools, and establishing a safer cyber environment. The engineering schools signed a letter of commitment to President Obama, promising to graduate 20 students annually who are ready to tackle these problems.

"We're poised to transform the landscape of engineering higher education," says Tom Katsouleas, dean of Duke University's Pratt School of Engineering, one of the schools that signed the letter, and a co-leader of the initiative. "The tremendous response suggests we've tapped into something powerful—the very human element connecting engineering with students who want to make a real difference. I think we're going to see these Grand Challenge Engineers do just that."

Students prepared to meet these Grand Challenges will experience five common learning goals: complete a project focused on one of the Grand Challenges; interact with real-world clients and mentors; experience entrepreneurship and innovation firsthand; gain global perspectives on the challenges; and participate in service learning. "Teaching engineering fundamentals in the classroom is important, but it's not enough," says Richard Miller of Olin College, another project co-leader whose school also signed the letter. "Solving our planet's Grand Challenges requires engineering expertise, but they won't be solved by engineers alone.

"Doubling down on even more hard sciences and math will not help," he adds. "Instead, we need to incorporate new elements into engineering students' education to give them both the skill set and the mindset needed to become leaders in addressing societal challenges." Read more at this website: *http://bit.ly/1BQJt1J.*

- **Meet Nalini Nadkarni's Treetop Barbie: She wears field clothes, has a science notebook, and rocks a safety helmet and crossbow to help her shoot rope for tree climbing. And she comes with a handy 12-page booklet about canopy plants and wildlife.**

Nadkarni, who is often called the "Queen of Forest Canopy Research," created this canopy-climbing version of the doll in 2000 while teaching at Evergreen State University in Olympia, Washington. "The multiple responses to my creating Treetop Barbie were astonishing—from outrage that an ecologist would promote an icon of consumerism, to positive affirmations that it was about time scientists recognized the power of a pop icon to promote science and women, to the upturned face of a six-year-old girl who simply said, 'I like to climb trees, too,'" Nadkarni says.

"They taught me that connecting science with values that are not my own—but that resonate with others—is an effective pathway to public engagement of science."

When Nadkarni joined the faculty at University of Utah in 2011, she lost her corps of Olympia-based needleworkers, so Treetop Barbie is on hiatus until she can find a new corps of volunteers in the area. Learn more at *http://1.usa.gov/1In1Lvs.*

- **Through the EMPEROR Science Award Program, students from disadvantaged high schools will have the opportunity to do real cancer research with a mentor from a leading research institution, university, or industry. The initiative was created in conjunction with the Public Broadcasting Service's (PBS) documentary *Ken Burns Presents Cancer: The Emperor of All Maladies* and aims to inspire these students to pursue science careers.**

"As we learn in…*The Emperor of All Maladies*, our most effective weapons in the war against cancer are bright minds and people who are passionately committed to finding a cure," says Alicia Levi of PBS. "To find the next Sidney Farber or Mary-Claire King, we need to make sure that all students have an opportunity to pursue their scientific ambitions." Through the award program, 100 students from Title I or similarly "economically disadvantaged" schools will receive $1,500 grants, electronic tablets, and either a year of one-on-one mentoring or an intensive summer mentorship experience. Mentors include researchers from Stony Brook Cancer Center, Siemens, and the American Cancer Society.

Teachers and students can nominate students for this award; consult *http://prn.to/1bPBY51* for details.

- **A new initiative from the University of California at Irvine (UCI) will help local folks embrace their love of the ocean—and see it a little differently.**

UCI has launched the Oceans, Changing Environments, Arts, and Nearshore Societies (OCEANS) initiative to help change public perception of the area's marine challenges through research and education. The initiative will bring the university and community together to offer citizen science tours for adults, education programs for students at Crystal Cove State Park, restoration projects, theatre and artwork inspired by the oceans, and of course, traditional scientific research. The goal is to improve the natural coastal environment and the well-being of residents.

"I hope that over the next couple of years, local people will become excited about and interested in a lot of these ocean-related issues we're all facing," says Adam Martiny, a UCI professor who specializes in ocean plankton and is leading the initiative. "But [I also hope they] will be looking at them with new eyes, through the arts and the intersection between science and the urban ocean."

Learn more about the OCEANS initiative at *http://bit.ly/1Cx7PQM.*

- **Ever wanted to know what Albert Einstein was *really* like? Thanks to the Einstein Papers Project, now you can!**

This digital project offers online access to a vast collection of Einstein's correspondence and written work. Thousands of his letters, speeches, and handwritten equations provide a glimpse into his life like never before. His papers cover everything from his childhood grades to the setbacks he encountered in his research to his perspective on the social issues of his time.

Celebrate Einstein's 136th birthday by checking out the project and the man behind the famous equation at *http://1.usa.gov/1MAm2Ee.* ●

What's New

FROM U.S. GOVERNMENT SOURCES

U.S. Department of Education (ED)

Accessible Television Portal

ED's Accessible Television Portal Project has made it possible for students with visual or hearing disabilities to be able to watch programs like *Ocean Mysteries*, *Magic School Bus*, and *Bill Nye the Science Guy*, including some programs in Spanish. Part of the ED-funded Described and Captioned Media Program (DCMP), the portal offers video-on-demand content provided at no cost by the major television networks, as well as producers and distributors like PBS Kids, Sesame Workshop, and Scholastic Media. Teachers, school personnel, parents, and other professionals working with qualified students can register for free access to the portal by visiting *www.dcmp.org/accessible-television*.

Attitudes Toward STEM: High School

Gender Differences in Science, Technology, Engineering, and Mathematics (STEM) Interest, Credits Earned, and NAEP Performance in the 12th Grade, a Statistics in Brief report from ED's National Center for Education Statistics, describes high school graduates' attitudes toward STEM courses (specifically, mathematics and science), credits earned in STEM fields, and performance on the 2009 National Assessment of Educational Progress (NAEP) mathematics and science assessments. Key findings include the following: In 2009, compared to males, lower percentages of female high school graduates reported they liked mathematics or science. Compared to males, higher percentages of female 2009 high school graduates took advanced biology, chemistry, Algebra II, precalculus, and health science/technology courses. In general, among 2009 high school graduates who had earned credits in specific mathematics and science courses, males had higher average NAEP mathematics and NAEP science scale scores than females. Learn more at *http://1.usa.gov/1AlHmRz*.

National Oceanic and Atmospheric Administration (NOAA)

Mapping Diversity of Arctic Marine Microbes

Between January 2015 and August 2016, scientists from the University of Alaska Fairbanks will be using next-generation DNA sequencing technologies and cutting-edge bioinformatics approaches to explore the largely unknown molecular diversity of microbes associated with Arctic sea ice and seafloor habitats. The project aims to provide baseline microbiological community data for one of the Earth's most rapidly changing regions, the Arctic.

To bring the science and excitement of this project into middle and high school classrooms, NOAA's Office of Ocean Exploration and Research has launched a web page and learning module, Mapping the Uncharted Diversity of Arctic Marine Microbes, on its Ocean Explorer website. The Expedition Education Module contains the project's purpose, fact sheets on microbes, and an Arctic-themed page featuring essays from past Arctic expeditions, lessons, videos, career interviews, and links to past expeditions with an Arctic focus. Learn more at *http://1.usa.gov/1y9sStQ*.

Owlie Skywarn's Weather Book

NOAA's National Weather Service (NWS) produces outreach materials to help elementary and middle level students and teachers understand weather science and how to prepare for weather emergencies. Educators can download *Watch Out…Storms Ahead! Owlie Skywarn's Weather Book,* which presents age-appropriate facts and information on staying safe in hurricanes, tornadoes, floods, lightning, and winter storms. The coloring book–style publication ends with quizzes, puzzles, and other activities on each topic to help students reinforce what they learned about weather emergencies. Consult *http://1.usa.gov/1IOyJoC*.

U.S. Environmental Protection Agency (EPA)

Women of EPA: Robyn Conmy

Women serve in numerous leadership roles at EPA and are an integral part of the agency's decision making. In this video spotlighting EPA careers, students meet Robyn Conmy, a research ecologist working at EPA's Cincinnati labs. She describes how she became interested in STEM fields and why her work is important. Share the video with your middle and high school students to generate interest in STEM and encourage students, especially girls, to pursue STEM careers. Watch the video at *http://bit.ly/1GK4RLs*.

Climate Change Indicators in the United States

EPA has released the third edition of *Climate Change Indicators in the United States,* which presents observed data on key measures of our environment. The third edition adds more years of data, new indicators, and new features that connect observed data records to local communities and areas of interest. The report focuses on long-term trends for key measures of our environment for which high-quality data exist. Each indicator and the report itself were peer-reviewed by independent experts, and extensive technical documentation accompanies the report.

Watch a slideshow highlighting the report's key findings, download a brochure summarizing these findings, or access the full report at the website *http://1.usa.gov/1wC4XQ4*.

National Institutes of Health (NIH)

Healthy Vision Month

May is Healthy Vision Month, so use these resources from NIH's National Eye Institute to promote eye health for K–12 students and families. Teachers can find tips and information about protecting eyesight, such as by wearing glasses, getting a dilated eye exam, knowing your family history, using protective eyewear, and leading a healthy lifestyle. For downloadable posters for the classroom that reinforce these eye health messages, click on "Spread the Word" at *http://1.usa.gov/1aka5AV*.

In addition, NEI has activity books, posters, and a fun fact calendar to teach elementary and middle level students about the importance of eye health at *http://1.usa.gov/1aJkwPy*.

Be a Bioengineer

How do you keep an artificial limb attached to the body? What lab-grown organ have scientists successfully transplanted into patients? You can find answers to these and other questions in Want to Be a Bioengineer?, a game for high school and college students designed by NIH's National Institute of Biomedical Imaging and Bioengineering. Through a series of questions and answers, the game shows students how bioengineers are improving people's lives, from helping paralyzed individuals stand, to re-growing fingertips, to finding new ways to see inside the body. The game promotes the pursuit of STEM careers, introducing the fields of rehabilitation engineering, regenerative medicine, and biomedical imaging. Play it at *http://1.usa.gov/1Cn3qgY,* or download it from the iTunes App store

(must be age 17 or older to download) at *http://apple.co/1Irc6dc.*

NIGMS Scientific Image and Video Gallery

NIH's National Institute of General Medical Sciences (NIGMS) has a searchable collection of scientific photos, illustrations, and videos. Teachers and others have permission to use the material for educational, news media, or research purposes, provided the source for each is credited. Click "Browse All" to see thumbnail images and read description captions of the more than 630 resources in the collection, or search by resource type. Teachers can use the images and videos to enhance instruction in high school and college biology courses. Visit *http://images.nigms.nih.gov.*

National Aeronautics and Space Administration (NASA)

MissionSTEM Diversity Tool

Unconscious Bias in STEM: Addressing the Challenges is an online tool for STEM grantees from NASA's Mission STEM program. The multimedia presentation helps STEM faculty, students, program administrators, and staff understand what unconscious bias is and how it can impact the STEM environment. In addition, the tool explains how grantees can avoid the pitfalls of unconscious bias and maintain compliance with the law. Learn more at *http://1.usa.gov/1CA7eKK.*

Bees and Climate Change

NASA has released a five-minute video on phenology of plants and bees that discusses the Moderate Resolution Imaging Spectroradiometer (MODIS) satellite finding that springtime greening is happening one half-day earlier each year and correlates this to bee pollination field studies. The video is narrated by NASA research scientist Wayne Esaias, who uses honeybees as tiny data collectors to understand how climate change is affecting pollination. Esaias's citizen-scientist project, Honey BeeNet, compares bee data from across North America to satellite imagery to gain a big-picture perspective of how our warming climate is affecting both plants and pollinators. The video can be shared in high school environmental science and biology classes as a tangible example of the effects of climate change to which students can likely relate. See *http://1.usa.gov/1H692lc.*

Spacesuit Interactives

A spacesuit is a personal, mini-spacecraft equipped to enable an astronaut to survive, communicate, and work in the harsh space environment. Educators can access an interactive learning experience about spacesuits—created by NASA and appropriate for all ages—that explains the mechanics behind these "personal spacecraft" and how they work to keep a person alive in space. See *http://1.usa.gov/1Fq4Jwu.*

Want to know more about spacesuits? Check out a photograph of a spacesuit that allows you to click on its individual parts (e.g., pants, helmet, tethers, cuff, arm, layers) to read a description of the part and learn what it does. See *http://1.usa.gov/1OeTDB8.*

National Science Foundation (NSF)

Discovery Science and Engineering

NSF has launched three communication vehicles to promote discovery science and engineering: video interviews with NSF–funded scientists and program officers; conversational feature articles with leading scientists; and a weekly weekend video wrap-up of NSF–funded science news.

The video interview series—*Science and Engineering on Sofas and Other Things*—presents NSF researchers and their work and motivations. You'll hear from scientists like Margaret Murnane, an expert in ultrafast lasers, and Mark Bowles, founder of EcoATM, a multimillion-dollar business that recycles old electronics and helps the environment at the same time. The articles, known collectively as the *After the Lecture* series, present personal perspectives and interesting anecdotes from some of the most respected names in science. Capping off NSF's new communication efforts is the ICYMI ("in case you missed it") video wrap-up, which offers some of the week's most compelling research news, presented in a lively and conversational fashion. Learn more at *http://1.usa.gov/1CZC6I3.*

U.S. Department of Agriculture (USDA)

School Garden Checklist

Before starting a garden of your own, read and download this step-by-step guide to safely growing fruits and vegetables with students. Created as part of the presidential initiative Let's Move!, with material from the USDA's People's Garden program, the checklist covers all aspects of developing a school garden at any level: evaluating the available space, finding resources and establishing partnerships, checking soil health, designing the garden, understanding the plant palette, and creating and using the garden. The checklist can be found at this website: *http://1.usa.gov/1EdeNg1.*

U.S. Geological Survey (USGS)

Earthquake Data

This page from the USGS lists earthquakes that have occurred worldwide over the past 24 hours and are greater than a 2.5 magnitude. Click one of the earthquakes to reveal its longitude and latitude positions and its depth. High school educators can use the page to create geography and Earth science lessons that give students practice in working with and understanding real data. See *http://on.doi.gov/1hAyrbh.*

National Institute of Standards and Technology (NIST)

Metric Education Resources

NIST has assembled a page of engaging lessons and tools to help students learn and remember the International System of Units, more commonly known as "the metric system." You'll find printable activity cards, bookmarks, and other metric resources, including the lesson Presidents and Measurement, in which students examine height data (in metric measure) from 10 U.S. presidents and graph the results, incorporating their height (in metric measure) into the data as well. Visit *http://1.usa.gov/1CyKZEZ.*

U.S. Energy Information Administration (EIA)

K–12 Energy Resources

The EIA's Energy Kids website offers a wide range of resources for teaching elementary, middle, and high school students about energy: what it is and where it comes from. Educators will find energy lesson plans organized by grade level; learn the keys to a successful science fair project; get links to K–12 energy experiments, and watch a cartoon, *Prepare for the Science Fair;* and visit energy sites like an offshore oil rig and a hydropower plant with Energy Ant.

Click on Teacher Guide for extension activities using the Energy Kids website in math, language arts, and social studies lessons. Consult the website *http://1.usa.gov/1Dn8Xbf.* ●

In Your Pocket

Editor's Note

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

May 25–31

ASM's Living in a Material World Grants

The ASM Materials Education Foundation provides these grants to help K–12 teachers bring the world of materials science into their classrooms. Funds should help teachers bring awareness to the field and the role of materials scientists in society.

Twenty $500 grants are available. Applicants can contact local ASM members to help them develop innovative projects. Apply by **May 25;** see *http://bit.ly/1fAPQ2R*.

Lois Lenski Covey Foundation Library Grants

The foundation offers these grants to help libraries and other organizations serving economically or socially at-risk children buy books. Grants range from $500 to $3,000 and must be used to purchase books for preK–8 students. School libraries, bookmobile programs, and nontraditional libraries with 501(c)(3) status that have operated for at least three years are eligible.

Applications must be postmarked by **May 29;** visit *http://bit.ly/16ktYB1* for details.

SPIE Education Outreach Grants

SPIE, the international society for optics and photonics, provides these grants for optics- and photonics-related education outreach projects. Schools, youth clubs, universities, science centers, optics centers, industry associations, and optical societies are eligible for grants of up to $5,000. Projects are judged by their potential to impact students and increase optics and photonics awareness.

Apply by **May 31;** consult *http://spie.org/x36692.xml*.

June 1–2

Mitsubishi Electric America Foundation's Grants for Youth With Disabilities

The foundation provides funds for innovative projects that help youth with disabilities develop the leadership and employment skills they need to succeed—particularly in science, technology, engineering, and math (STEM) careers and environmental fields. Grants range from $10,000 to $75,000 for one to three years. Preference is given to projects that involve Mitsubishi Electric employee volunteers or take place in Mitsubishi Electric communities. These include Cypress, Irvine, and Garden Grove, California; Vernon Hills, Illinois; Northville, Michigan; Mason, Ohio; Maysville, Kentucky; Suwanee, Georgia; Cambridge, Massachusetts; Warrendale, Pennsylvania; and Arlington, Virginia.

Apply by **June 1;** visit the website *http://bit.ly/1eDT0l2*.

NEA Foundation Learning and Leadership Grants

The National Education Association (NEA) Foundation provides funds for individual teachers and support professionals or groups of them through its Learning and Leadership program. Individual grants support participation in professional development programs, summer institutes, or action research. Grants to groups fund study groups, lesson study, or mentoring experiences for new faculty or staff.

Individuals receive $2,000 grants; groups, $5,000 grants. PreK–12 public school teachers, public education support professionals, and faculty and staff in public institutions of higher education are eligible. To apply, visit *http://bit.ly/XMe5xB* by **June 1.**

NEA Foundation Student Achievement Grants

The foundation provides these grants to support work at public schools and universities that improves academic achievement and encourages critical thinking and problem solving in any subject area. Grants of $2,000 and $5,000 are awarded to programs that encourage inquiry, critical reflection, and self-directed learning.

Some funds may be used to support professional development, but most should pay for student materials or educational experiences. PreK–12 public school teachers, public education support professionals, and faculty and staff in public institutions of higher education are eligible. Apply by **June 1** at *http://bit.ly/Xo4n8W.*

National Weather Association's Sol Hirsch Educational Grants

The association awards these grants of up to $750 to help K–12 teachers improve meteorology education. Funds can be used to purchase scientific equipment; start school or community outreach programs; enhance or expand existing programs; or attend accredited courses, workshops, or conferences.

Teachers, program directors, school district supervisors, or other individuals or groups seeking to improve meteorology education for K–12 students are eligible. Apply by **5 p.m. Central Time on June 1;** see *http://bit.ly/14yMEPw.*

Escalante–Gradillas Prize for Best in Education

This $20,000 prize goes to one outstanding K–12 school administrator whose efforts have helped students achieve remarkable academic success despite organizational challenges. Nominees should work in the United States and demonstrate a commitment to learning, discipline, character building, and high expectations for his or her students. Principals, superintendents, guidance counselors, and other staff are eligible.

The winner will receive $10,000, and so will his or her school or district. Nominate an outstanding administrator online at *http://bit.ly/1CFrBuu* by **June 1.**

Spencer Foundation's Areas of Inquiry Small Grants

The foundation offers these $50,000 grants to support research in the following areas: education and social opportunity; organizational learning; purposes and values of education; and teaching, learning, and instructional resources. The principal investigator (PI) and co-PIs applying for a grant must have a doctorate in an academic discipline or professional field or have equivalent experience in an education research–related profession. The PI must also be affiliated with a college, university, research facility, school district, or cultural institution that is willing to serve as the fiscal agent if a grant is awarded.

Proposals will be accepted from the United States and abroad but must be written in English and propose a grant amount in U.S. dollars. Apply online at *http://bit.ly/Xjev1S* by **4 p.m. Central Time on June 2.**

June 12–19

The Fab School Labs Contest

The Northrop Grumman Foundation will award five $100,000 grants to public middle schools in need of a lab makeover. The goal is to help get more students excited about STEM through state-of-the-art lab facilities. To apply, submit a video about your current classroom and what your dream lab looks like. Twenty-five finalists will be selected, and five winners will be chosen by community vote.

Visit *www.fabschoollabs.com* for details, and submit your video by **June 12.**

NAGT Outstanding Teaching Assistant Awards

The National Association of Geoscience Teachers (NAGT) honors 30 outstanding teaching assistants (TAs) in geoscience education with these awards. Winners receive a one-year NAGT membership, which includes a subscription to the *Journal of Geoscience Education* and the *In The Trenches* quarterly magazine. Both graduate and undergraduate TAs are eligible and must be nominated by the department chair or faculty member coordinating TAs.

Submit your nominations at *http://bit.ly/10WLGZO* by **June 15.**

Presidential Awards for Excellence in Science, Mathematics, and Engineering Mentoring

The White House established this award to recognize people or organizations that demonstrate excellence in mentoring those from underrepresented groups in STEM education and the workforce. Both individuals and organizations are eligible. Nominees must be U.S. citizens or permanent residents or organizations located in the United States.

Sixteen winners will receive $10,000, a presidential certificate, and an invitation to the awards ceremony in Washington, D.C. Nominate yourself or a colleague by **June 19;** see *http://1.usa.gov/1Pdn9bX.*

June 30

Collaboration Nation

This program rewards schools or districts that have successful collaborative educational technology projects. One $50,000 grand prize and three $15,000 monthly prizes will be given to the winners to help enhance their existing projects. Submit a nomination and short video chronicling your collaboration and how the project has impacted teaching and learning in your school or district by **June 30.** Refer to *http://bit.ly/1NPbzQB.*

ASM's Kishor M. Kulkarni Distinguished High School Teacher Award

Presented by ASM International, the materials information society, this award recognizes the accomplishments of a U.S. high school science teacher who has demonstrated a significant and sustained impact on precollege students. The winner will receive a $2,000 cash grant and up to $500 in travel costs to attend the ASM Awards Dinner.

ASM members can nominate colleagues for these awards. Suggested candidates include past recipients of ASM Foundation K–12 Teacher Grants and graduates of the ASM Materials Camp Teachers Camp program. Submit nominations by **June 30** at *http://bit.ly/1fXOyJL.*

July 7

My Macy's District Grants

Macy's provides grants to nonprofit programs supporting education, the environment, arts and culture, women's issues, and HIV/AIDS in local communities nationwide. Grants of between $5,000 and $900,000 are available. Apply by **July 7;** visit *http://bit.ly/1arxUHY.* ●

Summer Programs

Editor's Note

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

June

GreenSTEM: Inspiring and Empowering Learners to Change the World. Join McREL in Denver, Colorado, for a two-day workshop on June 11-12 to learn about the GreenSTEM concept. You'll hear about tools, tips, and information needed to design a GreenSTEM lesson or program that can ignite your students' passion for learning. This workshop is designed for K–12 science, technology, engineering, and math (STEM) teachers, curriculum coordinators, and program leaders, as well as educators from schools/classes focusing on environmental sciences and green/renewable technology.

Continuing education credits are available at no charge. Learn more and register at *http://conta.cc/1xYsSg8*.

Chemistry Collaborations, Workshops, and Community of Scholars. Open to university and college faculty, this workshop series focuses on bringing a modern perspective to topics in the chemical sciences. The Developing and Implementing Case Studies in Undergraduate Chemistry Courses workshop will take place June 16–18 at the University of California at Riverside, and will provide hands-on activities and ways to introduce these resources in the college curriculum. Accommodations, meals, and tuition will be provided for participants. Learn more at *http://bit.ly/1Ib3xTI*.

National Agriculture in the Classroom Conference. The National Agriculture in the Classroom 2015 conference, themed "Unbridled Possibilities," will take place June 16–20 in Louisville, Kentucky. Workshops, tours, keynote speakers, and networking events will help educators increase their comfort level with agricultural topics and learn how to integrate agricultural content into instruction to support academic standards in science, math, health, language arts, and social studies. Visit *http://naitcconference.usu.edu*.

Teachers examine the structures in a sunflower during one of Life Lab's The Growing Classroom workshops, which focus on garden-based learning.

Educator Training Workshop in Bermuda. During this six-day workshop offered by the Bermuda Institute of Ocean Sciences (BIOS), June 22–27, teachers, curriculum specialists, administrators, and informal educators will learn how to plan and execute field study courses for their students at BIOS. Participants will visit Whalebone Bay, Cooper's Island, and Fort St. Catherine, among other attractions, to learn how to incorporate them in educational experiences for their students as well. Middle and high school educators may apply.

Tuition must be fully paid by **June 5.** Visit *http://bit.ly/1Byus3s* for details.

July

Shelburne Farms: Project Seasons for Young Learners: Cultivating Joy and Wonder. Early childhood educators can enrich their curriculum by attending this workshop, taking place July 13–16 at Shelburne Farms in Shelburne, Vermont. Participants will explore ways to improve their curriculum with sustainability in mind and help students make connections between the natural and agricultural worlds.

Scholarships are available, and graduate or undergraduate credits may be earned. Contact Linda Wellings at *lwellings@shelburnefarms.org* for an application before you register, and register online at *http://bit.ly/1a44jE4*.

Techbridge Summer Institute. This program helps prepare front-line staff, administrators, and educators for out-of-school science, technology, engineering, and math (STEM) instruction. The institute takes place July 29–31 at the Girl Scouts of North America headquarters in Oakland/Alameda, California. Participants will explore inquiry-based STEM curriculum for grades 4–12 and how best to design an after-school STEM program.

Educators earn up to two continuing education credits and receive free curriculum. Register online at the website *http://bit.ly/1GCpoSh*.

August

The Growing Classroom: Two-Day Intensive on Garden-Based Learning. This two-day workshop in Santa Cruz, California, teaches educators in grades 2–6 how to incorporate gardens in their lesson plans. The *Growing Classroom* activity guide provides participants with hands-on activities that promote ecological literacy and healthy eating, while supporting the *Next Generation Science Standards*. Participants may earn graduate education credit.

The workshop takes place August 1–2. Register online at *http://bit.ly/1I7joiN*.

Sea Turtle Trek. Travel to Bald Head Island in North Carolina to discover the biology, ecology, and natural history of sea turtles. Examine sea turtle anatomy and nesting habitats. Explore the unique environment of marshes and maritime forests on the island. Learn about current research, and participate in conservation monitoring activities.

North Carolina Environmental Education Criteria II and III credits are available. Sea Turtle Trek is a program of Discovery Place Education Studio, a professional development program serving preK–12 educators and administrators from schools, museums, science centers, zoos, and aquariums. Learn more and register at the website *http://bit.ly/1B4mAtE*. ●

Making a Difference Through Environmental Projects

DEB PERRYMAN

Students at Elgin High School in Elgin, Illinois, completed three different projects to educate people about the importance of protecting biodiversity.

Sometimes teachers find just the right project to educate students about the environment and inspire them to take action. In 2012, when Brigid Trimble and Deb Perryman—environmental science teachers at Elgin High School in Elgin, Illinois—taught their students about Martha, the last passenger pigeon, their students were shocked to discover that in less than 40 years, the entire passenger pigeon population was decimated. The students wanted to share Martha's story and educate people about protecting biodiversity.

Through Project Passenger Pigeon (*www.passengerpigeon.org*), a nonprofit group that draws attention to the pigeons' extinction and promotes species conservation, the teachers obtained a list of project ideas. "[The students] wanted to do two projects," says Perryman. They wanted to ask President Obama to declare 2014—the centenary of the pigeons' extinction—the Year of the Passenger Pigeon. And they wrote a fictional story about Martha.

When the school year ended in June 2013, the students "were still so interested in passenger pigeons and getting Obama on board" that they convinced a new group of students to "contact legislators to get to Obama" and to work on a new project, The National Biodiversity Teach In, says Perryman. "They wanted to do 20 free webinars for schools nationwide to promote biodiversity," she explains.

Students "solicited a number of environmental professionals from around the world to share what they do and to give suggestions of what others can do to help," says Trimble. To build an audience, the students created a Twitter feed and a Facebook page.

Next, "we had to make sure [we had] a webinar service [that] could handle everything" at an affordable cost, notes Trimble. A local representative from the software company omNovia Technologies, impressed with the students' work, agreed to provide one month of service for $2,000—a $10,000 discount.

When the school year ended, the students "handed off assignments" to new environmental science students, challenging them to do as well as they did with the project, say the teachers.

Though the students didn't get President Obama to sign their proclamation, they convinced then Illinois Governor Pat Quinn to declare September 2014 as the Month of the Passenger Pigeon. In addition, U.S. House Representative Tammy Duckworth (D-Illinois) arranged for the proclamation to be included in the *Congressional Record*.

More than 8,000 people watched the webinars in September 2014. The worldwide audience included four home school organizations, 189 public school classrooms, 15 universities, 52 organizations/agencies, and 13 citizens at large. "Scientists in the field were so excited to talk to that many classrooms," Trimble remarks. (Webinars are archived at *http://bit.ly/1IXVSVH*; look for videos labeled "National Biodiversity Teach In.")

The next National Biodiversity Teach In will take place every Friday in February 2016. For more details, see *http://nationalbiodiversityteachin.com*.

Going Beyond Statistics

When teaching about environmental science topics like climate change, "the statistics can be overwhelming," contends Rebecca Newburn of Hall Middle School in Larkspur, California. "I want [students] to be empowered, to feel like they [can] make an impact rather than feeling overwhelmed and depressed." Last year, Newburn implemented a project called Earth Care Geek to inspire her Earth science students to become "citizen scientists and activists." She paid for a web domain, *http://earthcaregeek.org*, so her students could post their work online.

Students progressed through three project phases: Learn, which involved conducting research and exploring their feelings about a topic; Act, during which they created a slogan for their web page and educational campaign and discovered how to get more involved; and Geek Out, in which they used social media to "get people to care," Newburn explains.

Student groups researched environmental topics. "I had to step back and be okay with whatever topic choices they had," she notes. "If their topics were controversial, they had to argue from evidence and examine all sides, then formulate a deep understanding of the issues...[It's] incredibly powerful for them to engage with complex issues, look at multiple perspectives, and analyze data."

Students contacted organizations connected with their topic, followed related news feeds, and collected data from different age groups. "They couldn't create their web pages and [do the] social media piece until they did the research and came up with multiple perspectives," Newburn explains.

In the Act phase, students created public service announcements, videos, and a list of 10 actions people could take. Newburn assessed them at various checkpoints: "Can you summarize what you learned in writing? Can you write a 140-character tweet that grabs people's attention? Were you able to find enough sources?"

"The kids had a lot of enthusiasm and buy-in for [the project]," she concludes. Learn more at the website *http://earthcaregeek.weebly.com*.

Saving Honeybees

Jackie Bold, who taught fourth grade at Murdock Elementary School in Marietta, Georgia, during the 2013–2014 school year, uses articles about a current event to spark project ideas among her students. At the beginning of that school year, she read an article about honeybee extinction to her students, and "used it as a writing prompt," asking them to share their opinions about the topic, she relates. She taught the students about the difference between facts and opinions, and held a class debate about the pros and cons of honeybee extinction.

When the students realized bee pollination is crucial to the human diet, even those who supported extinction became concerned. "They asked, 'What can we do about it,'...then developed a plan to make a difference" by planting 100 bee-friendly plants to increase pollination, Bold notes. They raised funds for purchasing the plants by selling flowering bulbs to friends and family members via FlowerPowerFundraising.com.

Bold also invited a beekeeper to teach lessons. Students "looked at scientific studies, articles, and a beekeeping association website" to study environmental impacts on bees and bee flight patterns, she relates.

Artistic students "drew intricate pictures and diagrams of bees," while others analyzed bee data or wrote stories about bees, says Bold. "They really had the opportunity to shine with their individual projects, and they were able to learn from one another," she contends.

Her students wanted to put the plants on school grounds, but the principal raised concerns about students with bee-sting allergies. Instead, they donated the funds to Dunwoody Nature Center, to establish a new pollinator garden for its on-site beehives.

"It's important that students learn through life situations," she maintains. "Kids just have to be shown what they can do." ●

BLICK ON TELEVISION

Scorpion Stung by Weak Science

By Jacob Clark Blickenstaff, PhD

The television series *Scorpion* is loosely based on the life experiences of the show's creator and executive producer, Walter O'Brien. The show stars Elyes Gable as Walter O'Brien, a self-described genius leading a team of talented folks who solve high-pressure, unusual problems. The team includes Happy, a mechanical genius; Toby, a psychologist who understands individual and group behavior; and Sylvester, who is described as a "human calculator."

In the pilot episode, they meet Paige and her son, Ralph. Ralph is a nine-year-old version of Walter—a genius misunderstood by everyone around him. Paige waits tables in a diner, but she can translate between the misfit geniuses on the Scorpion team and "normal" people. This skill leads to an invitation to join the team.

Agent Cabe Gallo (Robert Patrick of *The X Files* and *Terminator 2*) with the Department of Homeland Security is also a regular character. He has a history with O'Brien, but seeks out Scorpion's help when a software glitch in air traffic control threatens to bring down a number of passenger jets. In the end, the government hires Scorpion to solve problems that regular law enforcement and emergency response channels cannot handle.

In the interest of full disclosure, I must note that I have not seen every episode of *Scorpion*, so other episodes may feature better science. The episodes I have watched included a mix of *MacGyver*-like exaggerations of real science and some out-and-out errors that could spark a discussion in class.

By "*MacGyver*-like exaggeration," I refer to the classic 1980s television series in which the title character used random bits of stuff to build bombs, cut metal bars, and do other amazing things. His tricks were usually based on science, but dramatically overestimated the effect. In one of my favorite episodes, he needed to pick up a metal capsule that had fallen down a storm drain. MacGyver grabbed a metal pipe and banged it a few times on a fire hydrant to create a magnet strong enough to pick up the capsule.

The episodes I have watched included a mixture of MacGyver-like exaggerations of real science and some out-and-out errors that could spark a discussion in class.

You can create a magnet by hitting a piece of metal while it is aligned with a strong magnetic field. However, the Earth's magnetic field is not strong enough for this to work—certainly not well enough to pick anything up. He explained the process with gibberish about ions running to one end of the pipe. *Scorpion* writers seem to borrow from the *MacGyver* playbook.

Exaggerations

In Episode 19 of season 1, Sylvester is in danger of being overcome by a wildfire while he tries to drag an injured helicopter pilot through the forest. He saves them both by sheltering in a large metal drainpipe with the helicopter door propped over the opening. Sylvester explains (to us and the injured pilot) that since titanium is a poor conductor of heat, they will be safe. (While it is very unlikely that a whole helicopter door would be made of pure titanium, I will leave that aside.)

Titanium *is* a poor conductor of heat compared to other metals. All metals are pretty good at conducting heat, though. Another problem is the large window in the door. Heat flows from one object to another by conduction, convection, or radiation. Conduction requires contact, convection is the movement of fluids (hot liquids rising, for example), and infrared light can carry tremendous amounts of energy. Wildfires can generate enough infrared energy to cause homes to ignite well in advance of the flames. (See *http://bit.ly/1JgkUAd* for more on this topic.) Sylvester and the pilot would likely have been cooked by heat coming through the window of the helicopter door as infrared radiation.

Errors

Exaggerating real science is one thing. Making stuff up is another. In the wildfire episode, the Scorpion team is trying to save a group of lost hikers. One of the hikers is a teenaged rock hound who wants to keep boracite rocks he found on the trip. It turns out that Walter will use the boron in the boracite to make green smoke.

Unfortunately, while such a mineral exists, it occurs as small crystals in large chunks of gypsum. Only tiny trace amounts of boron would be in the sample he had.

The wildfire the Scorpion team and lost hikers are trying to escape is said to be driven by the Santa Ana winds. This weather phenomenon in southern California has spread major wildfires in the past. The Santa Anas blow from east to west across the region from deserts in the interior of California toward the Pacific Ocean. The funny thing in this episode is that the team leaves the helicopter crash site (and source of the wildfire) and heads east. They should be safe from a Santa Ana–driven wildfire, which would be heading west.

An earlier episode in the season, "Plutonium Is Forever," alludes to the real long-term storage issue with radioactive waste from nuclear power generation. However, it appears to support a misconception that plutonium is used in nuclear power plants. Uranium is the radioactive element typically used in large-scale commercial power plants, while plutonium has been used on a small scale to power deep space missions.

Inspirations

Teachers who don't want to poke fun at scientific errors could use some plot points as starting points for conversation about real science, technology, engineering, and mathematics issues.

In "Plutonium," the problem with the power plant is caused by old hardware and software controlling critical systems. This issue is typical of power plants, nuclear missile silos, and other pieces of infrastructure built in the 1960s and 70s. While this could lead to problems as engineers with expertise on the older systems retire, a measure of security is afforded by keeping information in formats that few can access. See *http://bit.ly/1DToYGm* for more.

This episode also could be used to introduce how our understanding of radiation hazards has changed. The ongoing recovery of the exclusion zone around Chernobyl in Ukraine and what happened at the Fukushima reactors in Japan illustrate how much is still to be learned about the impacts of radiation on ecosystems. I would use the comparative dosage chart Randall Munroe created for his web comic, which he has made available without copyright restriction at *https://xkcd.com/radiation*.

All in all, *Scorpion* is not an exemplar of high-quality science content. Teachers may be able to use some scenes to start a conversation about nuclear safety, legacy systems, or heat transfer, but may better serve students by setting them to look for incorrect or exaggerated science. ●

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

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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. NSTA member discount.

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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: *Earth Science Success: 55 Tablet-Ready, Notebook-Based Lessons*

Piling Up the Water Lab

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 Earth Science Success: 55 Tablet-Ready, Notebook-Based Lessons, *by Catherine Oates-Bockenstedt and Michael Oates, edited for publication here. To download the full text of this chapter, go to* http://bit.ly/1IzIxU2. *NSTA Press publications are available online through the NSTA Science Store at* www.nsta.org/store.

Problem

What is so special about water?

Prediction

Give a working definition of a water molecule.

(*Teacher note:* Have students share several predictions aloud, so misconceptions can be anticipated and explained.)

Thinking About the Problem

What does H_2O mean? Each molecule (*molecula,* meaning "small bit" in Latin) of water is made of two hydrogen atoms (H_2) and one oxygen atom (O). What is special about water molecules is that they tend to "stick" to one another (cohesion) and to other molecules (adhesion). They do this because water is built like a magnet, with a positive end and a negative end. This helps it bond well.

Water makes life on Earth possible. It covers almost three-fourths of the surface of our planet. Because so much of it is available, water may seem very ordinary to us, yet it is unique when compared to all other substances. For example, water is the only substance on Earth that occurs naturally in all three states: solid, liquid, and gas. In addition, solid H_2O (ice) is less dense than its liquid form (water), so it floats. Most other solids are denser than their liquid form, so they sink! Another difference with respect to water is that large amounts of energy must be added to water to achieve even a relatively small change in temperature. That explains why our oceans moderate the temperatures of coastal communities on Earth.

Write three main points from the "Thinking About the Problem" reading:

1.
2.
3.

6B. Piling up the Water Lab

NGSS Alignment

MS-ESS2-4. Develop a model to describe the cycling of water through Earth's systems driven by energy from the Sun and the force of gravity.

MS-PS1-1. Develop models to describe the atomic composition of simple molecules and extended structures.

Materials

- 8 oz. drinking glass
- Dish soap
- Eyedropper
- Variety of water containers (assortment of five glasses, buckets, or bowls)
- Pennies (or similar replacement item; control for size)
- Other coins

Procedure

1. Predict which of your five large containers (each full to the rim with water) will be able to withstand the addition of the greatest number of pennies (or replacement item) without spilling over. Test and record your results in a data table. Take photos with your iPad while conducting this step.
2. Place a dry penny on a piece of paper towel.
3. Predict the number of drops you can pile on the penny before water runs over the edge.
4. Test and record for each particular coin in the data table. Take photos with your iPad during this step.
5. Take a photo for your labeled image of the water on the surface of the coin just before the water spilled over.
6. Conduct the same tests with the soapy water, and record your results in another data table.

Analysis

1. Describe the shape of the water as it "sits" on a coin.
2. Why does water accumulate on a coin, rather than overflowing the edges immediately? How is the soapy water different? (Describe the science behind your thoughts. Review the "Thinking About the Problem" section of this lab.)
3. Use science concepts to suggest reasons why each of the five containers holds a different number of pennies. See student sample, Figure 6.4, p. 232.
4. Explain "surface tension" as if you were explaining it to a second grader.
5. (Enrichment) Investigate the difference between the surface tension of tap water and salt water. Although the addition of impurities, such as salt, decreases the cohesion between water molecules, it also increases the density of water (allowing things to float more easily). Draw a Comparing and Contrasting Diagram to show your findings.
6. (Enrichment) Prepare an Explain Everything video that describes either "capillary action" (the mechanism by which plants transport water from their roots throughout the plant) or "water striders" (animals that take advantage of water's surface tension to live on the surface of the water).

Learning Target

Develop an understanding about how water is unique when compared to all other substances.

I Learned:

Redo:

Manipulated Variable:

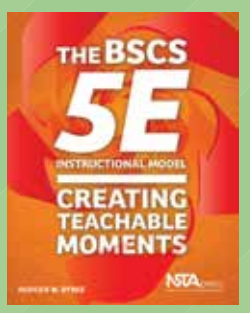
Measured Variable:

Controlled Variable:

Liter Bottle World Water Analogy

1. Show a one-liter bottle, full of water. It represents all of the water on Earth.
2. Pour 30 ml into a graduated cylinder. This represents all of the freshwater.
3. Pour off 6 ml into a smaller graduated cylinder. The remaining 24 ml represents what is stored in glaciers, which will eventually melt into and dilute oceans. The 6 ml represents nonfrozen rivers, lakes, and aquifers.
4. Pour off 1.5 ml of the 6 ml, into a small graduated cylinder. This represents groundwater.
5. Using an eyedropper, take one drop of that 1.5 ml. This represents the accessible, unpolluted ground water.
6. Remind students that many people in the United States use 50% of that one drop to water their lawns. ●

Spring Forecast: NSTA Books!



The BSCS 5E Instructional Model

Creating Teachable Moments

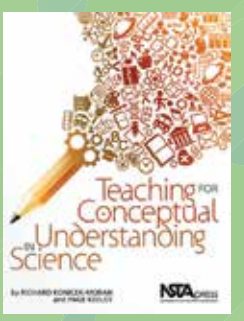
Grades K–12

The BSCS 5E Instructional Model can help you deliberately structure and sequence your lessons so you experience more teachable moments in your classroom. Created in the late 1980s by a team led by author Rodger Bybee, the popular BSCS 5E Instructional Model includes five phases: engage, explore, explain, elaborate, and evaluate. The book elaborates on how the model connects to the *Next Generation Science Standards* (*NGSS*), STEM education, 21st-century skills, and real classrooms. *The BSCS 5E Instructional Model* addresses every teacher's concern: how to become more effective in the classroom—and enjoy more of those teachable moments.

Book: Member Price: $25.56 | **Nonmember Price: $31.95**

E-book: Member Price: $20.77 | **Nonmember Price: $23.96**

Book/E-book Set: Member Price: $33.23 | **Nonmember Price: $41.54**



Teaching for Conceptual Understanding in Science

Grades K–12

This book is a rich source of ideas to make you consider science teaching from a whole new perspective. *Teaching for Conceptual Understanding in Science* is a collaboration between Richard Konicek-Moran and Page Keeley. The book is a fascinating combination of deep thinking about teaching and learning for understanding; field-tested, classroom-ready strategies that support conceptual understanding in all grades; and personal vignettes with lessons for all educators.

Book: Member Price: $27.16 | **Nonmember Price: $33.95**

E-book: Member Price: $22.07 | **Nonmember Price: $25.46**

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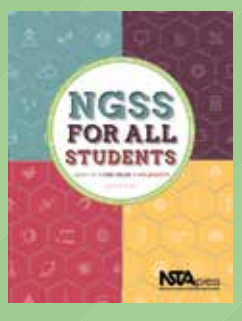

NGSS for All Students

Grades K–12

NGSS *for All Students* shows you how to teach diverse students and align your lessons with the *Next Generation Science Standards* (*NGSS*). The emphasis is on *show*. At the core of the book are case studies that vividly illustrate research- and standards-based classroom strategies to engage seven diverse demographic groups. The book also includes additional chapters on how to design a unit with the *NGSS* and diversity in mind, apply a rubric to examine and improve teaching the *NGSS* with diverse students, and use the case studies in teacher study groups.

Book: Member Price: $27.96 | **Nonmember Price: $34.95**

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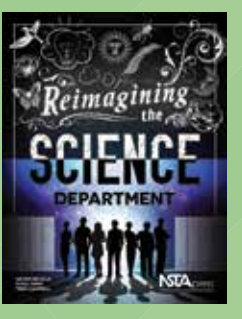

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NSTA National Science Teachers Association

MS. MENTOR, **Advice Column**

Presentation Options; Avoiding Burnout, Staying Positive

One of my goals is for students to communicate what they're learning in science through presentations. For many of my students, traditional oral reports are overwhelming. I'm looking for authentic alternatives.

—T., Oregon

Once, I assigned students a five- to eight-minute oral report on a science topic that interested them. I thought I was doing a good job by sharing a template and rubric and providing class time for students to prepare. It took several class periods for the presentations, and even then, some students weren't ready. I provided a comment sheet for audience members to complete, but I wasn't sure the students were engaged enough to justify the time and effort.

So I revisited the original purpose of the assignment to provide opportunities for students to communicate and share what they were learning. This goal is authentic; most scientists write reports and give presentations at conferences, to potential sponsors, and to the public. It also can be an effective assessment strategy and aligns with the *Next Generation Science Standards* Science and Engineering practice of "Obtaining, evaluating, and communicating information."

From my own experience, I knew many presentations are done as a team or panel. Most include visuals and use different formats. I questioned which was most important for my students: using an assigned format or engaging in the process of communicating their interests and enthusiasm.

I asked my students how to improve this experience. They wanted to have a choice of formats, work with a partner, and use their creativity. I learned that for some students, addressing the entire class may not be a positive experience, but they still have a lot to share.

The following year, during a unit on invertebrates, students gave presentations in their choice of format, demonstrating something they learned or were excited about. The variety of media and formats made it impossible to use a traditional rubric, but my students did not disappoint!

It's important for students to learn about other effective ways to communicate the results of their investigations.

One girl created an anthology of original poems about these animals. Several students worked on a mural depicting coral reef ecology, a few wrote term papers, several collaborated on live performances or videos, and one boy did a poster on marine arthropods.

His experience made me think more about posters as an alternative to term papers. Many conferences have sessions in which participants summarize their work in poster displays. As the audience circulates, presenters explain their work.

A poster could also be called an "infographic." They present and illustrate data, information, and concepts in a way that encourages the viewer to make connections or ask questions. At a recent conference, a presenter described how he uses infographics as bell-ringer discussions, familiarizing students with effective ones.

Students can use a range of tools to create them, from pencils and chart paper to online graphic tools. I've created a Posters and Infographics resource collection in the NSTA Learning Center (*http://bit.ly/1xX1L5g*) with related articles and examples from publications, including two recent issues of NSTA journals. Regardless of the format, students need to cite credible sources for their information.

I've taught Earth science for 10 years, and I like my students and what I'm doing. But sometimes I feel overwhelmed and frustrated. Is this normal? How can I avoid burnout and stay positive?

—R., Washington

This dilemma arose at a recent event I attended. One teacher remarked that when he started teaching 20 years ago, teachers were dealing with many of the same issues: increased demands, fewer resources, competition from students' jobs and extracurricular activities, "lazy" students, helicopter parents or parents who seem uninvolved, administrators who don't understand science teaching, the influence of standardized testing, and a lack of respect for teachers. He and others agreed that a lot of burnout comes from unrealistic expectations and the influence of other adults. Teachers have been overwhelmed for years!

We want to do whatever we can for our students, but sometimes forget to nurture ourselves. By now you should have a good repertoire of teaching strategies and a comfort level with Earth science content. If you're doing schoolwork 24/7, it's time to re-prioritize and focus on your health, your family, professional growth, and outside-of-school interests.

Colleagues offer these suggestions:

- Some unrealistic expectations are self-inflicted. It's okay to dispense with things that are not essential to student learning, such as creating elaborate bulletin boards.
- Put time for exercise on your calendar. Eat healthy, and don't skip meals.
- Surround yourself with positive people. Share your planning or lunch period with a colleague or two and exchange ideas, or divide some of the work. Or talk about something other than school.
- Students have one year of Earth science: You've already had 10 years. Try a new theme or different "big ideas" each year to keep fresh.
- Peruse social media, such as e-mail lists, blogs, discussion forums, Facebook, or Twitter, for ideas, resources, advice, a few laughs, or a virtual shoulder to lean on. One place to start is NSTA's Social Media Dashboard (*www.nsta.org/dashboard*).
- It's hard for some, but sometimes we have to blow our own horns. If you're teaching a good lesson, tell your principal about it, post a description on your class website, or send a note to parents.
- It's important to guard personal and professional time. If you hesitate to say no to a principal because of time, your response could be "If I do this, what can I take off my plate?" Some teachers come to school early or stay late to plan and do paperwork, rather than taking work home.
- Keep a personal diary or journal. Record the good things that happen each day, and save positive notes from students or parents.
- Maintain a professional rapport with your principal or other administrators. If you don't complain about every little thing, when something important comes along, they might be more inclined to listen to you.
- Each month (or more frequently) set aside a "school-free" block of time. Visit a museum, take a hike, participate in sports, work on a hobby, read a novel, go to a movie—allow yourself time to be a real person.

Every teacher has moments of frustration. I was often re-invigorated by attending a conference or working on a project with likeminded teachers. You are not alone, and you have a virtual community of colleagues to support you. ●

To maintain anonymity when requested, some letters to Ms. Mentor are signed with a pseudonym. We regret any coincidental resemblance to other educators when a pseudonym is used. Check out more of Ms. Mentor's advice on diverse topics or ask a question at www.nsta.org/msmentor.

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NSTA National Science Teachers Association

WHAT TEACHERS ARE SAYING:

*"Attending an NSTA conference was one of the **most influential experiences** I have had since becoming a teacher. Attending an NSTA conference should be a requirement for every teacher. I could not wait to get back to my classroom to **implement the incredible ideas** I had been immersed in at the conference."*

*"**The experience was absolutely unbelievable.** Not only did the experience positively impact me, but it has influenced fellow teachers as well as **increased my students' excitement for science."***

*"I am extremely grateful to NSTA for giving me the opportunity to attend one of the greatest professional development opportunities available for elementary science teachers. **I grew so much** professionally while at the conference, and I **implemented many of the strategies** I learned at the conference as soon as I returned to my classroom. My students and I have both **benefited greatly** from this opportunity."*

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(All dates are deadlines unless otherwise specified.)

May 5—Find out how to **Enhance Your Content and Pedagogical Knowledge Using NSTA Resources: Earth and Space Science** during this **free NSTA Web Seminar**. Designed for educators of grades K–12, both formal and informal, the discussion will focus on Learning Center electronic resources related to the topics of Earth, Sun, and Moon and the Solar System. An archive and related Power Point presentation will be available at the end of the program. All participants will receive one free SciPack (an online, interactive learning module valued at $18), 100 Learning Center Activity Points, and a certificate of participation for attending and completing an evaluation afterward. The session runs at 6:30–8 p.m. Eastern Time. For more information or to register, visit *http://bit.ly/Eo1MU*.

May 20—NSTA's STEM Forum & Expo opens today in Minneapolis, Minnesota. Captain Barrington Irving, founder and president of Experience Aviation, Inc., and the Flying Classroom, will present the opening keynote address. The forum includes grade-specific strands, panel discussions, and a model Family STEM Night. You also don't want to miss the address by Freeman Hrabowski, president of the University of Maryland, Baltimore County, in Baltimore, Maryland, on May 22. On-site member registration costs $215. For more information and to register, go to *www.nsta.org/confreg*.

Check Out the *NSTA Reports* Archive

Did you know that back issues of *NSTA Reports* are available online? The archive (see *http://bit.ly/1aaF560*) features issues going back to January 2012. You must be logged in as a member to access the archive.

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To invent, you need a good imagination and a pile of junk.

—Thomas A. Edison, U.S. inventor (1847–1931)

Classic Tunes Become Modern Carbon

Could outdated music and movie collections help reduce greenhouse gases? Scientists in Poland have developed a way to turn unwanted CDs and DVDs into activated carbon. The American Chemical Society's (ACS) journal *ACS Sustainable Chemistry & Engineering* reports that carbon made from discarded CDs and DVDs then treated with either potassium hydroxide or carbon dioxide resulted in an activated carbon with "excellent adsorption properties" that could be used to capture and store carbon dioxide, for the adsorption and separation of volatile organic compounds, and for hydrogen storage.

Activated carbon is used in adsorption and chemical reactions. It has many medical, industrial, and environmental applications including decaffeination, gold purification, water purification, and air filtration. Read more at *http://bit.ly/1EzOFfC*. ●