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Empowering Students
With Solar 6

NSTA Reports
National Science Teaching Association

RUSS AMAN

Teaching Agriculture
To Elementary Students 14

CONTENTS

Learning About STEM and Preventing Fires

After learning about fire dynamics—how fires start, spread, and develop—and doing hands-on activities with firefighters, eighth graders in Georgia's Cobb County School District solve a virtual fire-related crime with help from an arson investigator as part of a partnership involving the district's middle schools, the Cobb County Fire Department, and Underwriters Laboratories (UL). UL offers a free module that the district's eighth-grade science, technology, engineering, and math (STEM) teachers use, Fire Forensics: Claims and Evidence, on its Xplorlabs online learning platform (see the unit at *http://bit.ly/2lKh81k*). "I saw [UL staff] at an NSTA conference and heard about UL's fire dynamics curriculum," recalls Sally Creel, the district's STEM and innovation supervisor. "Our goal is to put students in contact with [workers] in STEM fields," so partnering with UL and the fire department has helped provide students with authentic STEM learning, she observes.

"We don't get a lot of kids wanting to fight fires," says Sean Gray, Cobb County Fire Department captain and a member of the UL Firefighter Safety Research Institute's Advisory Board. By exposing students to the UL curriculum and the roles of fire service professionals, "we hope they will be interested [in a fire service career] and stay with the community if they're not going on to college," he explains, adding that "the middle level is an important time to reach kids."

MICHAEL SHEU

During a state-mandated earthquake drill held by Wilson High School in Los Angeles, California, and the Los Angeles Fire Department, students learn how to properly move an earthquake victim.

Students experience "the excitement of having firefighters in their classroom," says Creel. "The firefighters come in uniform, and we make sure to have a diverse group of firefighters" so all students can relate to the material. "The program is authentic and memorable," she maintains.

Firefighters co-teach the lessons with teachers, and they train together to use the curriculum. "We've now trained 80 firefighters and 50 to 60 teachers at the middle and high school levels," Gray reports.

The UL curriculum "is set up as a scenario, as in problem-based learning. Students have to discover what happened: an accident or arson," Creel explains. The material also supports the *Next Generation Science Standards* (*NGSS*) and three-dimensional learning because it "integrates science and engineering practices, doing research and digging into data to determine what happened," she points out. "Fire and how it behaves [serves as] the phenomenon, and students draw conclusions based on data and UL research."

Engineering Solutions

Michael Stecher, science teacher, and Amber Schick, English language arts

See Fire Prevention, pg 4

NSTA Member Poll: Seating Chart Challenges pg 11

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75th NSTA ANNIVERSARY

COMMENTARY: **Steve Oppenheimer**

The Value of Recognizing the Efforts of All Science Students

By Steve Oppenheimer

Steve Oppenheimer

Current education research has shown that precollege science experiences substantially increase the number of students choosing a science major in college. However, science fairs usually select a relatively small number of winners from hundreds of participants, leaving most with little to show for their efforts, which can diminish those students' future interest.

About 35 years ago, I established a research training program for K–12 teachers. After training many teachers in our labs, I developed the *Journal of Student Research Abstracts* (*JSRA*) to showcase and reward participating students with published abstracts in a free online journal. *All* students, not just the high achievers, should be encouraged to do precollege science research, as by the time they reach college, they often have decided on careers. The United States needs more research scientists, so we should encourage many more students, not just high achievers, to fall in love with science.

Teachers across Los Angeles and around the world submit abstracts on behalf of their middle and high school students to *JSRA*. Journal editors and teachers rigorously review abstracts, and students have the opportunity to correct any problems. Although this research is conducted by students, scientific rigor is expected. Abstracts document the use of appropriate controls, sufficient replications, and adequate numbers of samples.

Accepted abstracts are published in the journal, and student authors receive a print copy of the journal containing their published research. (*JSRA* is available online at *http://bit.ly/2kkE0Et*.) One teacher said their students dance with joy upon seeing their work in print.

Working with teachers like Greg Zem, Terri Miller, Stacy Tanaka, and Aphrodite Antoniou, my colleagues and I also created The Center for Cancer and Developmental Biology Pre-College Research Poster Symposium, which also recognizes hundreds of middle and high school student scientists each year. The posters often are based on the reviewed project abstracts submitted to *JSRA*, and a cadre of advanced senior-level university students trained in research science evaluate them. Students conduct their research at their schools and homes, and present their reviewed research in poster form at the symposium, held at California State University, Northridge (CSUN), where they receive medals and certificates recognizing their efforts. This really inspires them to continue in science.

Former students who contributed to the journal and participated in the symposium have reported that their siblings "fight" to become involved. Students have been admitted to a spectrum of higher learning institutions, including the California State University system, University of California system, Drexel University, Oxford, Pepperdine, Stanford, Harvard, Penn State, and the University of Tokyo.

Thousands of good precollege science experiences exist that can motivate students to choose science careers. Just having a great science teacher can spark students' interest. Our journal and poster symposium recognize thousands of kids for their research work. A reward like a published abstract or a medal and certificate may be the first and often only recognition from a university many of these students receive. Following the most recent symposium, CSUN Vice Provost Matt Cahn noted, "This is one of those transformative opportunities that we hope all students have."

How often do hundreds of students receive university and parental recognition for science research work? The pride that families take in their children's science work provides an extra push for them to choose a science career.

These programs are replicable by teachers, schools, and school districts if they wish to encourage many more students to contemplate future science careers. I also suggest that science educators consider urging their middle and high school students to submit research abstracts to *JSRA*. ●

Author's note

I would like to thank Andrew Weiss, Elizabeth Altman, Mindy Berman, Alvalyn Lundgren, and Helen Chun for their work on JSRA. *I have been fortunate to have support from CSUN leadership and staff in launching and running the symposium and the journal.* ●

Steve Oppenheimer, professor emeritus, CSUN, has received several awards, including the Presidential Award for Excellence in Science, Mathematics, and Engineering Mentoring and a CSU System Trustees Outstanding Professor award. He is an American Association for the Advancement of Science Fellow and serves as director of CSUN's Center for Cancer and Developmental Biology. He is editor of Elsevier's international journal Acta Histochemica, *affiliated with the International Federation of Societies for Histochemistry and Cytochemistry. He has taught, conducted research, and worked with middle and high school students and teachers at CSUN for 48 years.*

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Fire Prevention, from pg 1

teacher at Liberty Middle School (LMS) in Fargo, North Dakota, have served as team advisors for students competing in eCYBERMISSION, a web-based STEM competition for students in grades 6–9 sponsored by the U.S. Army Educational Outreach Program and administered by NSTA (*www.ecybermission.com*). As part of eCYBERMISSION, students identify community problems and explore science explanations and engineering solutions. This year, one LMS team focused on kitchen fires. "They realized most kitchen fires are grease fires," says Stecher, and after polling other students about how they would extinguish those fires, "most students said they would put water on the grease fire," which makes the fire worse. The team decided "an awareness campaign and a device was needed," he relates.

The teachers helped the team research what products extinguish grease fires. Their first proposed prototype was a pan equipped with a device "that had a button you could press to make sand come out and put out the fire," Stecher recalls. After further research, the team "decided that a small blanket could be [thrown over] a pan and put out the fire because it eliminated oxygen," he reports.

Working with the West Fargo Fire Department in a controlled environment outdoors, the students tested four prototypes on a pan of burning vegetable oil to determine whether the blanket should contain sand, baking soda, or salt or if a blanket containing nothing would do the job. The students learned that baking soda and sand worked best, and the blanket containing nothing "was the worst because it didn't have the weight to put out the fire," says Stecher.

Schick notes that the students wanted their blanket to be reusable, but they learned "the material wasn't flame retardant, so [the blanket] couldn't be reused."

The project "gave students an understanding of how to do science and how to test [prototypes] as part of the engineering design process," Stecher maintains. "It was meaningful to them because lives could be saved, and [it provided] a community tie-in with the West Fargo Fire Department. It brought science to life in my class."

Doing projects like this one "gives research meaning, why it's important to research and understand the problem," Schick contends. The project "gave them skills and expertise and was an authentic learning piece, more than just writing a paper. The students were excited and passionate, and there was 100% integration with my subject—the best way to do research."

Firefighting Technology

Wilson High School in Los Angeles, California, offers a Firefighter Academy Magnet in collaboration with the Los Angeles City Fire Department (LAFD) for students interested in learning about a career in fire service and emergency response. As part of the magnet, chemistry teacher Deborah Wang teaches Firefighting Technology, a course covering science, technology, and research with a focus on firefighting. "It's nice to integrate occupations like firefighters. It can bring more interest and relevance to students," she observes.

The course is open to all Wilson students. "Some students want to learn more about [firefighting] careers; others take it as an elective requirement," Wang explains.

Firefighting Technology also covers engineering, history, architecture, and philosophy; "it's an interdisciplinary study through a firefighting lens," says Wang. Her students learn about architecture by studying building codes and determining whether they comply with fire codes. "We mapped our school's building plan [and wondered] how we could get water to the fourth or fifth floor," Wang recalls.

Students learn "the history of how [firefighting] technology has progressed. [Firefighters] used to have only water and buckets, then fire extinguishers," Wang relates. During World Wars I and II, firefighters "learned that carbon tetrachloride was not good to use in fire extinguishers because it damages the lungs…Now there are high-tech fire extinguishers with less harmful chemicals."

She continues, "Because we work with the [LAFD], they give us uniforms and field trips…[For example,] I took my ninth graders to the [LAFD] Museum last year. It [gave them] background for my class [when they saw] the museum's artifacts." Her students also worked with the LAFD to do a fire inspection.

The firefighter magnet is valuable, according to Wang, because "the field for first responders and firefighters is really rigorous. Having more candidates who are better prepared is important for the field's future and the safety of our communities." ●

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Empowering Students With Solar

In a dim classroom last year, eighth graders struggled to take notes by the light of a single projector and a few flashlights. Kenisha Hewing, eighth-grade science instructor and science department chair at Kennedy Middle School in Charlotte, North Carolina, wanted her students to relate to the challenges faced by students in developing regions that lack reliable access to electricity. She says the poorly lit classroom helped "students realize not everywhere is like the United States" and provided the foundation for a project-based learning unit on solar energy that culminated in her students assembling stand-alone solar arrays referred to as "solar suitcases," two of which have been sent to Africa as part of the We Share Solar program (*www.wesharesolar.org*).

"This is an experience that I wish every student could have, something I wish every teacher could experience," says Hewing. "Students were able to apply the concepts that are learned in the classroom to a global impact project and see a real-world benefit in another country within one school year." In addition, her students' state and district assessment scores were highest on the energy sections.

Gigi Goldman, co-founder and strategic advisor of We Share Solar, says their goal is to "raise the next generation of global change makers through learning about, building, and sharing solar energy systems called We Share Solar Suitcases." To do that, the program—funded through grants by corporate partners including Wells Fargo, PG&E, Excel Energy, and Sun Power—begins with two-day teacher workshops targeting middle and high school. They cover "the basics of solar energy…[and teachers] build a solar suitcase." According to Goldman, the suitcases—which can light two to three classrooms and charge cell phones, e-readers, and laptops—are deployed in countries including Kenya, Uganda, and the Philippines where reliable electricity is scarce, particularly in rural areas.

The curriculum also focuses on social studies, including the geography of the region where the suitcases will be sent and the challenges facing students in these regions. Students usually work in teams of four to assemble the suitcases, learning about circuitry and current as they go.

At Washington Elementary School in Sacramento, California, Kim Schouten's students check solar panels after soldering wires. The completed solar kits were distributed to students in Ewatto, Edo State, Nigeria.

"We do it all in one school year," she says. "Students are done building in November, and everything is installed over the winter months. They receive [pictures and stories] back in May and are inspired by the fact that they have built real-world technology that is improving someone else's life chances."

Jennifer Garcia, seventh- and eighth-grade science teacher at Westmore Oaks Elementary School in West Sacramento, California, remembers feeling intimidated when she started the We Share Solar training in 2015. "When I first got there, I looked at what was happening and thought, 'There's no way I can do this. I'm not mechanical,'" she recalls. "I was just amazed I was able to complete it.

"The first year, my students built six suitcases; we sent two to the Philippines [the] next year," she says. She initially taught the We Share Solar curriculum as a unit within a larger course, but she is now teaching it as an elective class for sixth, seventh, and eighth graders. "Students in my electives need a different approach [to learning]…[they need] all hands-on. Kids who might have gotten in trouble in other classes [find] in this class, it's a completely different style of learning, and it completely impacts the behavior and attention [of] students who might have challenges," Garcia asserts.

"We will receive pictures…before the end of the school year. I have one picture from a prior year of the [Kenyan] students holding a group picture of my students; looking at it makes me emotional," Garcia says. "It's more real [for students]. We can research the schools; it feels like it is more full circle. There are real students whose lives are going to be impacted."

As an early participant in We Share Solar, Garcia has seen the program evolve. "When I started doing it, the suitcases were much larger.…The instruction manual is amazing. The manuals have pictures of students from my first year!" she exclaims.

"The first year was the hardest. We tried to do it in two days. It was mentally exhausting…fitting it into the schedule was the most challenging part," Garcia says. "I love being part of the program. For me, it's the only time I've been able to make a worldwide impact, the only opportunity in my life to help people in such a dramatic way. It's neat; [my students are] learning engineering practices…and resilience.…I hope they think about it all the time. Some kids sign up for my class hoping for part of this project. It's the largest turnout of my electives."

The program shows students that their "effort [and] dedication can change lives today. That inspiration can draw girls and other underrepresented demographics" into the renewable energy field, according to Goldman, who asserts that less than 24% of employees in renewable energy are women. She hopes to eventually expand the program so the students who will be using the solar suitcases will be building them as well.

"The solar suitcase is plug and play. Recipient students in places like Kenya learn about how solar works by actually using it every day, and we have an accompanying curriculum that helps them understand how it works.…For these students who have grown up using kerosene and candlelight, learning about and using solar energy is particularly exciting as it will play a significant role in their future energy access. If these students can ultimately build their own electricity in the We Share Solar program, it will be magic,...breathtaking to witness," Goldman says. "I believe that much like how China leaped straight to cell service instead of laying phone lines, many of these rural settings in sub-Saharan Africa will go straight to distributed renewable energy sources like solar longer term."

Integrated Learning

Kim Schouten, a sixth-grade teacher at Washington Elementary School in Sacramento, California, used knowledge she gained at a Solar Schoolhouse (*http://solarschoolhouse.org*) summer institute to lead her students through a two-year service learning project. The school's drumming instructor

shared his experience growing up in Nigeria in a region with scarce electricity with Schouten's students, inspiring them to build and send solar kits to his native home.

Working with Solar Schoolhouse, Schouten was able to get enough funding for each student to design and build one kit. Schouten, who looped with her students from fifth grade, said half of the kits were built in the first year, with the remainder completed in the second year.

"It was interesting for me to see the evolution in design and skill set of students from the year before," Schouten asserts. "When I take a step back and look at what students were doing—what they were really learning—they seemed like simple, easy concepts, but really were more complex. My students took it above and beyond any expectations I would have put before them. They were making connections more like high school students, making independent research connections…their content knowledge went through the roof. They were very excited, very engaged. They had to demonstrate understanding of content" before they could build their solar kits, she explains.

"We were covering science, math, language arts, engineering, and technology in the project. Math: They had to calculate packaging, shipping; they were measuring wiring, researching different types of energy, the carbon cycle. They were writing different pieces: brochures, step-by-step instructions. For engineering, they were drawing out…designs. Technology was designing and sketching 3-D graphic designs," Schouten continues.

"This project is something that helps them, empowers them. They have answers, not just fears. And it's part of the [*Next Generation Science Standards* (*NGSS*)] by making models," she notes.

At Solar Schoolhouse, "our primary audience is K–12 educators, though we are starting to do more with non-classroom educators," says Tor Allen, executive director of The Rahus Institute, which runs the Solar Schoolhouse program. "Mostly funding has come through electric utility public benefit funds here in California.…We've developed lessons, activities, curriculum, and solar cell kits/projects that can be used anywhere… We continue to work toward lessons that can be utilized 'out of the box' by teachers, not requiring a workshop as introduction."

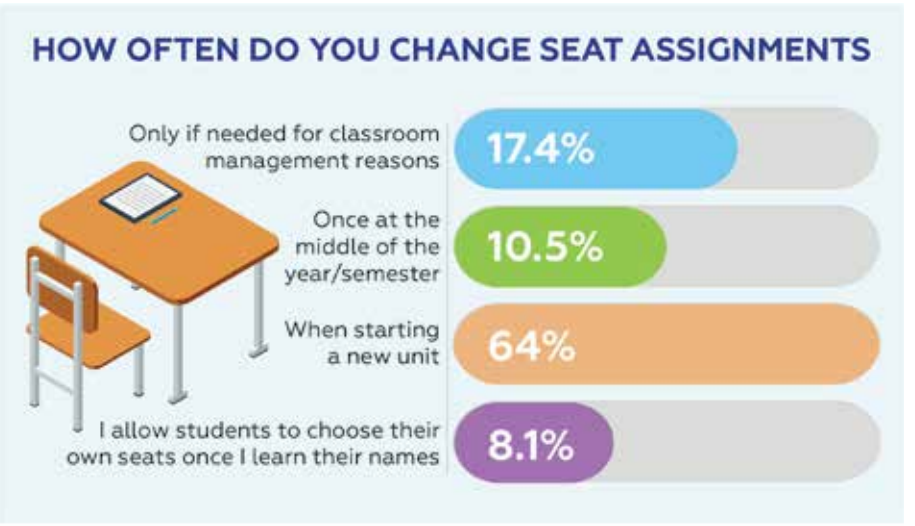
Allen says about 280 teachers have participated in the summer institute since 2003, and more than 2,000 have taken part in one-day local workshops. "Many schools are looking for 'engineering' projects to include in their *NGSS* science curriculum. Small solar projects, with multiple design options, are a great hands-on way to pursue this. There still is some hesitancy to go beyond the classroom and reach into the local community (or a remote community) to make that connection, and strengthen the project experience. If classes do this, a sense of empowerment follows that is invaluable," he claims. ●

Seating Chart Challenges

NSTA Reports recently asked educators if and how they assign seats in their classrooms. Seventy-three percent say they assign student seats at the start of the school year or semester. In addition, 64% will change seat assignments when they start a new unit, 17.4% when needed for classroom management reasons, and 10.5% once in the middle of the year or semester. Only 8.1% allow students to choose their seats once the educator has learned their names.

Thirty-two percent of participants say they prefer to sort students into work groups that sit together, and 21% assign seats randomly. Other seating strategies educators cited included seating based on skills or behavior, rotating seats to give students "different vantage points," and alternating by gender. Making sure students learned to work with a variety of peers was the most common motivation selected (34%). Some reported using seat assignments to minimize disruptions in the classroom (19%), make it possible for students to support one another (17%), and have diverse ability levels within work groups (11%).

A small majority of educators (58%) said they do not allow students to arrange workspaces in the classroom.



Here's what science educators say are their biggest challenges when assigning students' seats:

Finding spots for students who do not work well with anyone.—*Educator, Middle School, Colorado*

Some students refuse to work with a person they are seated next to. This is a huge challenge.—*Educator, Administrator, High School, New Jersey*

Emotional reactions to whom they are working with/not working with. —*Educator, Administrator, Elementary, Middle School, Illinois*

Once I get to know them and are familiar with their personalities and abilities, I find it hard to place the students in such a way that helps them educationally and socially.—*Educator, High School, Connecticut*

Putting students together who will focus and not mess around. The Kagan model of seating has made it especially difficult for me to deliver direct instruction.—*Educator, Middle School, California*

Physical space. I love rearranging, and the students come to expect it in class. Although I try to create flexible and dynamic spaces and classes, it still needs to be conducive (visually, [auditorily, and] safety-wise) to student learning and collaboration.—*Educator, High School, New York*

Too many students! Twenty-four is fine, 32 is really hard...now I have classes of 36. Yes, I still do lots of labs…and yes, I have [Talented and Gifted], average, [students with 504 plans], [English language learners]… all in the same class. Sometimes I have help; sometimes I don't. Some days I struggle, but today I feel like Superwoman!—*Educator, Middle School, Oregon*

Addressing the learning needs of all students.—*Educator, Middle School, North Carolina*

Helping them build skills to be able to work effectively with different types of people.—*Educator, Middle School, Wisconsin*

Too many kids need to be at the front according to their IEP [individualized education program] or behavior plan. Only a certain number of front-row seats!— *Educator, Middle School, Oregon*

Accommodating all of the IEPs, 504s, and other items that need to be considered for where to place middle schoolers.—*Educator, Middle School, California*

Time to plan new seats.—*Educator, Middle School, Florida*

So many students have plans requiring preferential, front-row seating. —*Educator, Middle School, Rhode Island*

Finding the right mix to decrease disruptions [and] increase collaborations and class discussions, and dealing with middle school drama.—*Educator, Middle School, Indiana*

I don't have all the information yet (IEPs and other needs, like medical). I always leave a few spaces up in the front if students have vision problems or I find out later they need to be closer to the front.—*Educator, High School, North Carolina*

To not assign strong kids with weaker kids all the time; to separate talkers or disrupters without it being obvious to their peers. In seventh and eighth grades, getting girls to not let boy partners take over the experiment and having girls only record everything—so I mix this up by assigning jobs or having girl/girl or boy/boy partners. —*Educator, Middle School, California*

Mixing it up while keeping certain students away from each other.—*Educator, Middle School, Illinois*

Trying to change up seating, but then allowing by ability and interests. —*Educator, Middle School, Illinois*

Sometimes they choose a friend [who] is not a good work partner and wants to play instead of working. Then I have to move them. I tell my students that with choices, there are responsibilities, and they will be moved if they cannot work together.—*Educator, Elementary, Louisiana*

I don't find it a challenge at all. I randomly assign, but when doing group work and labs, they will rearrange, sometimes into groups of my choosing, and sometimes into groups of their own choosing. It is constantly being mixed up.—*Educator, Middle School, Colorado*

Identifying how students will act in different groups. Some students will talk a lot next to specific students, or be silent in group conversations in a different group. This is not always determined by friends; often I see personality and the mix of personalities as the larger impact in whether students are discussing content openly.—*Educator, High School, Colorado*

Getting students to work with those who may not be in [their] friend group.—*Educator, Middle School, Oregon*

Choosing cooperative groups for students who have histories of being disruptive and uncooperative. —*Educator, Middle School, Connecticut*

Determining which students work best together and avoiding social issues. —*Educator, Middle School, Kentucky*

Making sure that all groups will work together while minimizing distractions.—*Educator, Middle School, High School, Connecticut*

The only challenge I've really ever had is when I have an extreme unequal gender demographic; then the occasional student who doesn't collaborate well. But those can be overcome.—*Educator, Middle School, High School, California*

Splitting the ability levels and aptitude levels evenly.—*Educator, Middle School, Illinois*

I prefer to assign seats randomly; and for the most part, things usually work out. However, sometimes I'll notice that a student is bothering [his or her] neighbors and being a distraction. I'll try to talk with [the student] first, to see if we can work things out together. However, sometimes I have to rearrange a few of their seats to help solve the problem. —*Educator, Middle School, Utah* ●

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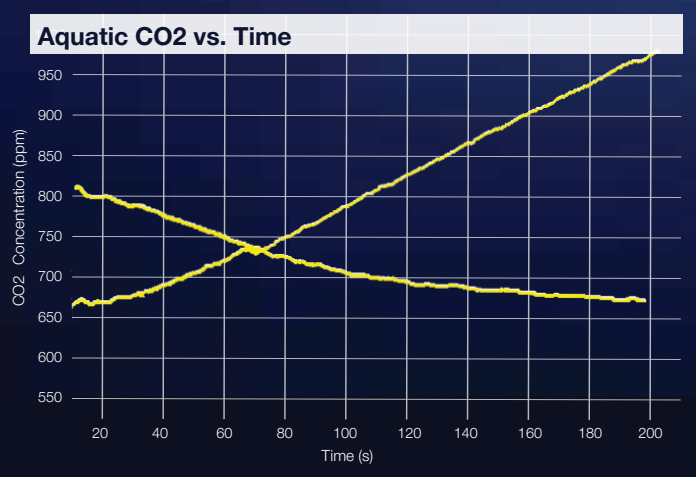

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Furthermore, NSTA presents the Angela Award to a female student in grades 5–8 who is involved in or has a strong connection to science.

For more information on how to nominate a colleague or yourself, visit *www.nsta.org/awards*. In addition, NSTA will host web seminars offering advice on crafting a strong award application (learn more at this website: *https://learningcenter.nsta.org/events*). The first, on October 29, will focus on the Shell Science Teaching Award; on November 6, the web seminar will examine the application process for the NSTA Awards and Recognition Program in general. Two additional web seminars, on the Shell Science Lab Challenge and the Shell Science Lab Regional Challenge, will be held on November 21 and December 4, respectively.

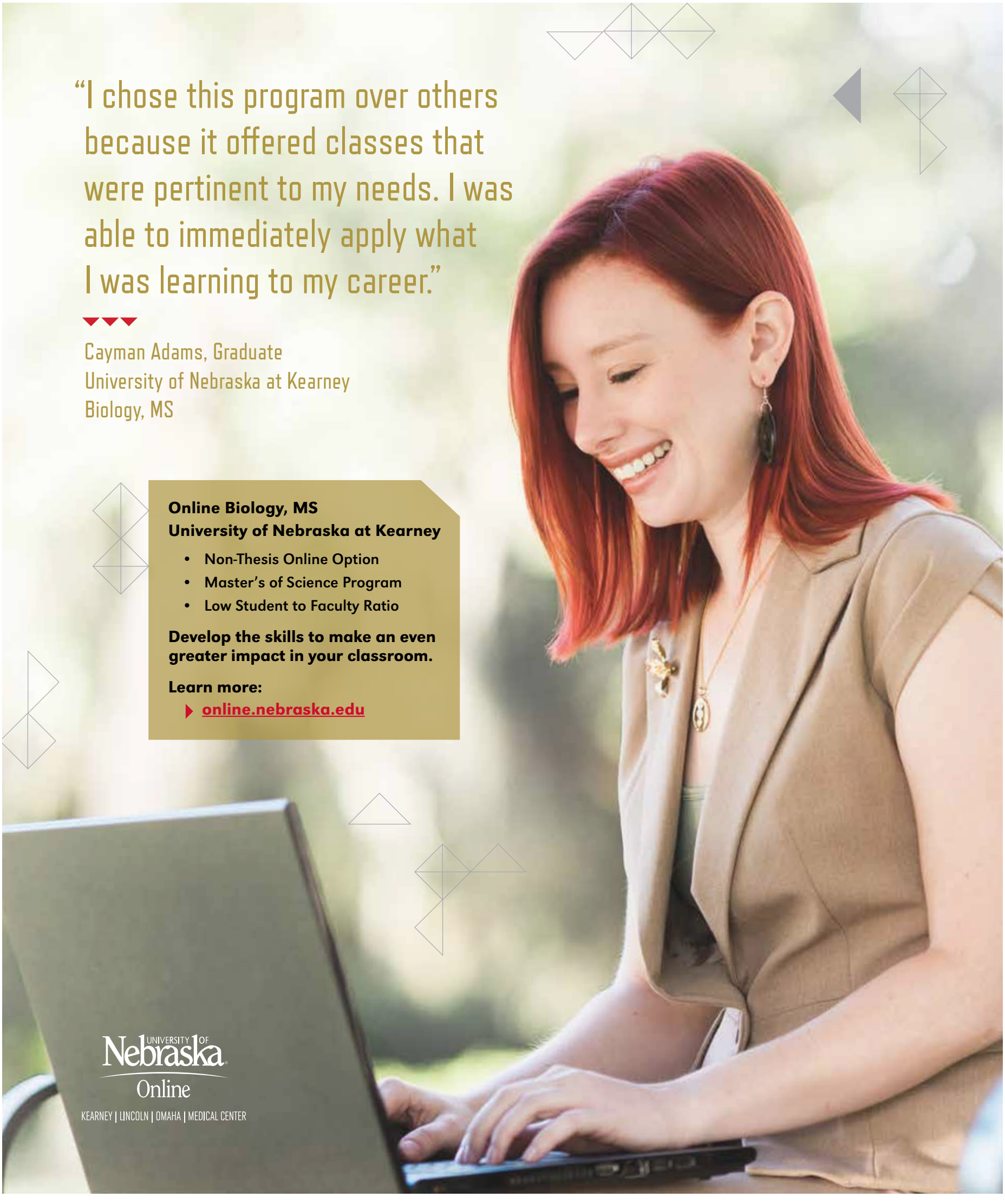
Archived web seminars, Developing a Competitive Teacher Award Application and Developing a Competitive Application for the Shell Science Teaching Award, also are available on *www.nsta.org/awards*. Applications are due by **December 18.**

The NSTA Awards and Recognition Program is sponsored in part by Bio-Rad, Corteva, Northrop Grumman Foundation, SeaWorld Parks and Entertainment, Shell, and Vernier Software & Technology. ●

Quotable

The most valuable resource that all teachers have is each other. Without collaboration, our growth is limited to our own perspectives.

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



"I chose this program over others because it offered classes that were pertinent to my needs. I was able to immediately apply what I was learning to my career."

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PULL-OUT SECTION

SCIENCE TEACHERS' GRAB BAG

Inside this Convenient Pull-Out Section you will find:

Freebies for Science Teachers

Agriculture Resources. E Corteva Agriscience, a global agriculture company that provides farmers worldwide with seed, crop protection, and digital solutions, has partnered with NSTA to offer free resources to introduce students in grades 3–5 to agriculture. Ten lesson plans help students investigate where their food comes from. Students start by learning about soil and soil health, advance to a basic understanding of seeds and seed science, then explore how farmers use science, technology, engineering, and math (STEM) to assist them in their work. The lessons make connections between agriculture and the food we eat, and emphasize the importance of a balanced diet. The lessons also include a brief discussion of food safety in the classroom, as well as targeted objectives for each theme.

In addition to the lessons, available at *www.nsta.org/corteva,* educators will find four videos about farming and food and a poster, "Where Does Our Food Come From?"

Cell Biology and Neuroscience Resources. H HE The Allen Institute, a nonprofit bioscience research institute, has lesson plans for high school and college instructors to engage students in learning core concepts in neuroscience and cell biology. The lessons—The Building Blocks of Your Brain and Mitosis and Microscopy—incorporate virtual experiments in which students work with real data sets and tools from the Allen Institute and the National Institutes of Health. Accompanying the lessons are materials such as an educator's guide, student readings, and handouts describing current research in the field. In addition, teachers can request two posters highlighting key facts about neuroanatomy and cell division. Visit *https://alleninstitute.org/learn.*

Educators attending the NSTA Seattle Area Conference, taking place December 12–14, can meet a scientist from The Allen Institute and learn more about the resources.


MARK FERGUS, CSIRO

Virtual Labs Food Science App Series. H HE Developed by the Learning Games Lab at New Mexico State University in collaboration with South Dakota State University and North Dakota State University, and funded by the U.S. Department of Agriculture, this series of educational apps introduces standard scientific methodology and biological and chemical procedures practiced by researchers and technicians in labs. Best for high school and college audiences, the series contains eight interactive lab scenarios: Testing for Corn Mold, Bacteria Sampling, Gram Staining, Using the Microscope, The pH Scale and Meter Calibration, Testing/Adjusting pH, Understanding Water Activity, and Controlling Water Activity. As students work through each scenario, they learn basic laboratory techniques and model actual methods and processes used by technicians and researchers in the food science industry and other science fields. Access the labs, which are available as both web-based learning modules and apps for iOS devices, at *http://bit.ly/2k4cGKh.*

A Medical Mystery. M This online curriculum unit—developed in partnership by BSCS Science Learning and Oregon Public Broadcasting and funded by the National Science Foundation—immerses middle level students in a study of human body systems as they work to solve a medical mystery, What's Wrong with M'Kenna? Students investigate how and why M'Kenna is unable to keep food down and losing weight. They use scientific reasoning and argumentation to identify the digestive system as the problematic organ system, then engage in interactive experiences, simulations, and animations to observe and analyze the differences between M'Kenna's digestive system and that of a healthy person.

The unit supports the *Next Generation Science Standards* (*NGSS*) and provides materials for educators, including a teacher's guide and a professional development course. Download the unit (registration required) at *http://bit.ly/2HBBF09.*

Plum Landing. E This environmental science website from PBS Kids makes it easy to bring active science learning to learners in grades 1–4 and their families. The website (*https://to.pbs.org/32tEusj*) features dozens of resources—including games, videos, animations, apps, and activities—that invite students to virtually visit ecosystems worldwide, then head outdoors to investigate nature in their neighborhoods. Activities support the *NGSS* and cover topics such as adaptations, biodiversity, ecosystems, habitats, plants, the water cycle, weather, and other environmental

See Freebies, pg G2

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

Freebies, from pg G1

concerns. The activities are designed for use in classroom, after-school, and camp settings and include embedded videos, discussion questions to spark science conversations, and ideas to extend learning.

In addition, the website offers tips for educators on preparing for outdoor science activities, managing group exploration outdoors, using digital tools to enhance outdoor explorations, and promoting students' science skills during outdoor activities.

***Laboratory Safety Guidelines:* Expanded. K12 HE** An expanded version of the Laboratory Safety Institute's (LSI) publication *Laboratory Safety Guidelines* is available free to K–college educators until **November 15, 2019.** The new version features anecdotes and reference information that expand on the principles discussed within the book's 40 guidelines and offers more extensive and relevant lab safety information for K–12 schools, colleges, and universities. To request a copy, e-mail *molly@labsafety.org,* and mention this announcement in *NSTA Reports'* Freebies for Science Teachers column. Visit *www.labsafety.org* for more details.

AIP Teaching Guides: Women and Minorities in Physics. K12 HE Introduce K–college audiences to the contributions of women and minorities in physics with these teaching guides from the Center for History of Physics at the American Institute of Physics (AIP). The collection has more than 50 guides, each containing a lesson plan, discussion questions, and an answer key, as well as related readings and supplementary resources. The guides cover a range of topics, from a study of how different cultures viewed the constellations (e.g., The Night Sky by Another Name, versioned for grades 1–3, 4–5, and 6–8) to recognition practices (or lack thereof) of female scientists in the Nobel Prize program (Fair or Unfair: Should These Women Have Won a Nobel Prize? You Decide!, grades 6–8 and 9–12). Other guides highlight diversity and the work of contemporary scientists, such as African-American Inventors in History (grades 6–12) and The American Physical Society's Woman Physicist of the Month (grades 6–college). Consult *http://bit.ly/2lsGCjD.*

SEAN O'FLAHERTY AKA SEANO1

Monterey Bay Aquarium Classroom Resources. P K12 California's Monterey Bay Aquarium has classroom resources—such as curriculum, activities, and games—to engage preK–12 audiences in learning about marine animals and habitats and ocean conservation. Explore animal adaptations with young scientists in the lesson Bird Feeding Strategies (grades preK–2), or study wave behavior with grades 3–5 in the investigation Beach in a Pan. Learners in grades 6–8 investigate the effects of ocean pollution in Plastic in the Water Column, while students in grades 9–12 examine the effects of ocean acidification in The Power of pH: Changing Ocean Chemistry.

Other highlights from the aquarium's resources include printable Animal Fact Cards (grades preK–5), which can be used for activities such as Critter Concentration, Critter Go Fish, or Make Your Own Critter Card Field Guide. The Shark School of Art (all ages) uses an art-based activity to teach students how to draw a realistic shark, step by step, then invites students to try their new skill in their own comic strip. Visit *http://bit.ly/2lIqz13.*

Developing Classroom–Scientist Partnerships. A Ever wondered how to reach out to a scientist or scientific organization to partner with your classroom? A blog post from the Ecology Project International (EPI) offers practical advice for educators of all levels. Written by EPI program coordinator and former high school educator Megan Edgar, the post at the website *http://bit.ly/2lXXbEp* guides readers through determining what you want students to gain from the experience, choosing the type of science experience to have (e.g., data collection, informational/science hook, STEM career promotion), finding a scientist to work with, handling event logistics and funding, and developing and maintaining a meaningful partnership.

Big Kid Science. K12 Developed by astronomer, educator, and children's author Jeffrey Bennett, this website (*www.bigkidscience.com*) presents accurate, kid-friendly space science resources for K–12 students and educators, including apps, classroom activities, and tutorials. For example, Totality, an app for iOS and Android devices developed by Big Kid Science, helps students understand total solar eclipses and features related classroom activities, such as Pinhole Camera Activity (grades three and higher) and Using Shadow Measurement and Exploring Shadows (both for grades 8–12). Other notable resources are the 30-minute program Max Goes to the Moon Movie and Planetarium Show (all ages), and interactive web tutorials exploring topics such as the Phases of the Moon, Seasons, and a Tour of the Solar System (middle level and higher).

STEM From the START. P E This curriculum resource for teaching STEM content to preK–2 students blends animated adventures with guided activities. These engaging video-based lessons—called missions—are easy to prepare and support the *NGSS.* The lessons address topics such as materials, temperature, and motion and feature discovery breaks (video stopping points for hands-on exploration) and footage of real-world applications. Teachers guides include Discovery Quizzes, Review Questions, and printable Certificates of Achievement. Visit *http://stemfromthestart.org.*

Soil Science Websites. K12 The Soil Science Society of America's (SSSA) website at *www.soils4teachers.org* provides K–12 educators with resources to deepen their understanding of soil science and activities to share with students. Discover soil basics in the webinar Soils: Foundation for Life; watch videos to learn about the ways soil helps the natural environment and society; and access a searchable database of soil science lessons for the classroom. The site also has online profiles of soil scientists and downloadable posters and bookmarks on careers in the field.

MUSSAPEDIA

At SSSA's companion website for K–12 students (*www.soils4kids.org*), select a grade band of interest (K–4, 5–8, or 9–12) to access background information, games, experiment ideas, and more on soil topics.

OpenScienceEd's Curriculum Units. M OpenScienceEd, a national initiative, offers high-quality, open source science materials to educators and schools. The group, which organized in 2017 to produce materials to help teachers implement the *NGSS,* has produced three curriculum units for the middle level: Thermal Energy (grade 6), Metabolic Reactions (grade 7), and Sound Waves (grade 8). The units (available in PDF format and Google Docs) each contain about six weeks' worth of lessons and include videos, slide decks, student handouts and assessments, and instructions for hands-on activities.

These units are the first to be released from a three-year middle level curriculum currently in development and expected to be completed by winter 2022. See *www.openscied.org.*●

News Bits

- **Students surveyed by Bayer and the National 4-H Council reveal they are unaware of career options in the agricultural sector.** H

In the second annual Science Matters survey, Bayer and 4H studied the opinions of parents, teachers, and students about the importance of agricultural science in high schools. Bayer and 4H created the Science Matters program to equip approximately 25,000 high school students with the tools to deepen their understanding of science. Science Matters seeks to enhance science, technology, engineering, and mathematics (STEM) education to grow the STEM workforce by fostering a love of science in students across urban and rural areas in the United States.

The 2019 survey confirmed that students are unaware of career options in agriculture beyond farming—despite alternatives such as veterinary science, biotechnology, raising and training animals, and forestry. The survey findings linked this to the limited pool of skilled applicants. Only 19% of students reported they are likely to consider a career in agriculture.

Most teachers surveyed (92%) felt it is important to expose students to agricultural science education, and feel more prepared than ever to play a role in educating students about it. In all, 55% of teachers would like to focus more on STEM subjects, but only 43% of parents and 30% of students wanted this. Kamal Bell, a former teacher for Durham Public Schools and current student at North Carolina State University, said students have to understand real-life implications of concepts in the classroom: "It is more important than ever for students to have access to hands-on activities that broaden their perspectives about science and agriculture and make tangible their future opportunities for development and impact." For more information on Science Matters, refer to *http://bit.ly/2kqh4Du*.

- **Many of today's students turn first to educational technology resources for answers to their homework questions, not to their parents—unlike students from past generations.** K12

Researchers from the multinational technology company Lenovo surveyed 15,000 people in countries including India, China, and Germany. The researchers found that not only do children favor technology for answers, but parents do as well, with 60% saying they have searched for information online when helping their child with schoolwork. Parental online research was most common with STEM subjects.

Most respondents (83%) agreed that advances in educational technology resources are helping students perform better in school. However, parents regularly reported feeling unequipped to help their children with schoolwork. Learn more at *http://bit.ly/2lAEg24*.

- **Middle and high school students are chief science officers (CSOs) in Oregon.** M H

The Columbia Gorge STEM Hub's CSOs are a cohort of peer-elected student leaders in grades 6–12 from across eastern and southern Oregon. As CSOs, students will advocate for STEM in their schools and communities, gathering insights from their peers, working with teachers and administrators, and bringing important topics to local and state government. The CSOs in Oregon will be "creating a makerspace, changing the perspective toward STEM, and battling the teen vaping epidemic with science."

The CSO program is national and international, with groups in several states, Mexico, and Kuwait/the Middle East. The program is partially funded by the National Science Foundation. Learn more at *http://bit.ly/2lw50AU* and *http://bit.ly/2jTw8t4*.

- **University of California, Santa Barbara, is collaborating with the Navy base at Port Hueneme to offer an immersive experience to science and engineering undergraduates and community college students.** HE

The eight-week summer program, Problem-based Initiatives for Powerful Engagement and Learning in Naval Engineering and Science (PIPELINES), pairs students with a scientist or engineer at the Navy base and with a graduate student. Each team must solve a different challenge, such as designing a tether system that would connect a seafloor sensor to an antenna mounted on a surface buoy, a system needed by the Navy. Now in its fourth year, PIPELINES was recently recognized by Excelencia in Education for its outstanding service to underrepresented students, particularly those in the Latino community.

The university and the Navy base are resubmitting the project for another round of funding from the Office of Naval Research (*www.onr.navy.mil*). Maria Napoli, PIPELINES founder, said the program shows underrepresented students career pathways into STEM professions. "At the community college level, there is a lot of talent that is often overlooked for a number of reasons," says Napoli. "The idea was to bring back this talent into the fold, and encourage them to stay in school and to complete degrees in science and engineering." Learn more at *http://bit.ly/2krDPai*. ●

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

In Your Pocket

Editor's Note

Visit https://bit.ly/2ZlRIp5 *to learn about more grants, awards, fellowships, and competitions.*

October 21–31

I Love My Librarian Award Nominations A
This award recognizes exceptional public, school, college, community college, or university librarians. Ten will receive a $5,000 cash award, a plaque, and a travel stipend to attend an award ceremony in their honor. Nominate your favorite librarian by **October 21** at *http://bit.ly/2kv0ceO.*

State Farm Good Neighbor Citizenship Company Grants K12
State Farm awards grants of $5,000 or more to K–12 public schools for teacher development, service learning, academic improvement, and education initiatives that help underserved youth enroll in postsecondary education and gain workforce skills. Apply by **October 31;** see *http://bit.ly/2lYtkf1.*

The Lawrence Foundation Grants A
Public schools, libraries, and nonprofit organizations that support the environment, human services, and other causes may apply for these grants. Both program and operating funds are available; the average amount ranges from $5,000 to $10,000.

Apply by **October 31.** See the website *http://bit.ly/2XuD0w5.*

November 1

Annie's Grants for Gardens P K12
These grants go to edible school gardens in the United States. Funds can be used for seeds, plants, raised beds, fencing, wheelbarrows, greenhouses, drip irrigation systems, and other items to help create or sustain the garden.

Apply by **November 1** at the website *www.annies.com/grant-faqs.*

Kinder Morgan Foundation Education Grants K12
These grants of between $5,000 and $20,000 go to education programs serving at least 500 underserved youth in communities where Kinder Morgan operates. K–12 public and private schools and nonprofit organizations with arts education or academic programs, including tutoring, in the United States and Canada are eligible.

Locations must be within 30 miles of Kinder Morgan sites in Birmingham, Alabama; Phoenix and Tucson, Arizona; Carson and Concord, California; Colorado Springs and Lakewood, Colorado; Tampa, Florida; Alpharetta, Georgia; Chicago and Downers Grove, Illinois; Harvey, Port Sulphur, and Shreveport, Louisiana; Williston, North Dakota; Port Newark, New Jersey; Tulsa, Oklahoma; El Paso, Houston, Midland, and Pasadena, Texas; Norfolk, Virginia; Vancouver, Washington; Calgary, Alberta; and North Vancouver, British Columbia. Apply by **November 1** at the website *http://bit.ly/2k4lS1q.*

Spencer Foundation's Small Research Grants K12 HE

These grants fund research projects with budgets of $50,000 or less that aim to improve education. Principal investigators (PIs) and co-PIs must have a doctorate degree in an academic discipline or professional field, or equivalent experience in an education research–related profession. PIs must also be affiliated with a university, school district, or nonprofit research facility or cultural institution that will administer the grant.

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

ACS Award for Achievement in Research for the Teaching and Learning of Chemistry M H HE

This award recognizes an individual's contribution to experimental research that has improved the teaching and learning of chemistry and increased our understanding of chemical pedagogy. The winner will receive $5,000, a certificate from the American Chemical Society (ACS), and up to $2,500 for travel expenses to attend the meeting at which the award is presented. Submit nominations by **November 1;** see *http://bit.ly/2lwqFJm.*

James Bryant Conant Award in High School Chemistry Teaching H

This award honors one outstanding high school chemistry teacher in the United States or its territories. Nominees should demonstrate quality teaching, the ability to challenge and inspire students, extracurricular work that stimulates student interest in the field, and a willingness to stay current. The awardee will receive $5,000, an ACS certificate, and up to $2,500 in travel expenses to attend the meeting at which the award is presented.

Nominations are due by **November 1.** Consult *http://bit.ly/2luymj7.*

ACS Award for Encouraging Disadvantaged Students Into Careers in the Chemical Sciences HE

This ACS award goes to a person who encourages students who are underrepresented in the profession to pursue careers in engineering or the chemical sciences. The recipient may work in academia, industry, government, or any other professional setting in the United States. The honoree will receive $5,000, an ACS certificate, and up to $1,500 for travel expenses to accept the award. The Camille and Henry Dreyfus Foundation will also present a $10,000 grant to an academic institution of the recipient's choosing to help it better meet the award's objectives.

Submit nominations by **November 1.** Learn more at *http://bit.ly/2kjfXFV.*

ACS Award for Research at an Undergraduate Institution HE

This award honors a chemistry faculty member whose research with undergraduates has significantly contributed to the field and to the development of their students. The awardee will receive $5,000, a certificate, and up to $2,500 for travel expenses to the meeting at which the award is presented. The Research Corporation for Science Advancement will also provide a $5,000 grant to the recipient's institution.

Nominees must be tenured faculty members at a predominantly undergraduate institution that does not have a doctoral program in chemistry. Nominations are due by **November 1.** Refer to *http://bit.ly/2lxw6rm.*

George C. Pimentel Award in Chemical Education A

The ACS presents this award to recognize outstanding contributions to chemical education. This can include integrating chemistry into the educational system, training professional chemists, and disseminating reliable information about the field to prospective chemists, students in other fields, members of the profession, and the general public. The activities recognized by this award may be in the fields of teaching (at any level), administration, research, writing, or public enlightenment.

The honoree will receive $5,000, a certificate from the ACS, and $2,500 for travel expenses to accept the award. Submit nominations by **November 1** at *http://bit.ly/2lZBeEZ.*

November 10–17

Dreyfus Foundation Educational Grants A

The Max and Victoria Dreyfus Foundation provides grants of between $1,000 and $20,000 to community-based nonprofit programs in the United States. Schools; museums; educational and skills training programs; environmental and wildlife protection activities; cultural and performing arts programs; and programs for youth, seniors, and persons with disabilities may apply. Proof of 501(c) (3) status is required.

The foundation must receive mailed letters of request by **November 10.** (Online submissions will not be accepted.) Learn more at the following website: *www.mvdreyfusfoundation.org.*

SeedMoney Grants A

These grants are available for 255 school, community, food bank, and other public food gardens. Those that crowdfund donations between November 15 and December 15 are eligible for grants ranging from $50 to $700, depending on how much the project is able to raise over the 30-day period. To register by **November 12,** visit *https://seedmoney.org/apply.*

Albert Einstein Distinguished Educator Fellowship K12

This U.S. Department of Energy program gives current science, technology, engineering, and math (STEM) teachers in K–12 public and private schools the opportunity to work in public policy. Fellows spend 11 months in Washington, D.C., where they work in a federal agency or U.S. Congressional office to help bridge the gap between the legislative and executive branches and the STEM community.

Applicants must be U.S. citizens and have spent at least five of the last seven years teaching full-time in a STEM discipline. They should also be currently employed by an elementary or secondary school and able to obtain a leave of absence for the duration of the program. Fellows receive a $7,500 monthly stipend and a $5,000 housing allowance, as well as reimbursement for moving expenses.

Apply by **November 14** online at *http://bit.ly/2lxxev6.*

NSHSS IB Teacher Grants H

These $500 grants support teachers in International Baccalaureate (IB) programs. Funds can be used for supplies, materials, field trips, or other resources that enhance the delivery of IB courses. Applicants must register as an educator with the National Society of High School Scholars (NSHSS) and submit applications by **November 15.** Learn more at *http://bit.ly/2ktb25c.*

Real World Design Challenge H

This competition asks students in grades 9–12 to work in teams of 3–7 on a pressing engineering challenge, supported by a coach and mentor. Teachers leading teams get access to $1 million in professional engineering software and training, curriculum, and mentors. Students first compete in a state-level Governor's Cup; the team with the best design then competes in the national finals in Washington, D.C. Each student on the winning team receives a $50,000 scholarship to Embry-Riddle Aeronautical University.

Register by **November 17** at the website *http://bit.ly/2lZbs3F.*

Apply Year-Round

Computers for Learning Grants P K12

Through this program, the federal government has placed hundreds of thousands of surplus computers in schools across the country on a needs-first basis. Schools register and request equipment on *http://bit.ly/2JQPIBC,* the Computers for Learning web page, and federal agencies match their surplus equipment to schools with those needs.

Any public, private, or parochial school serving preK–12 students and located in the United States, the U.S. Virgin Islands, American Samoa, Guam, the Commonwealth of Puerto Rico, or the Commonwealth of the Northern Mariana Islands is eligible. ●

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2020

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THIS YEAR'S CONFERENCE PROGRAM WILL FOCUS ON THESE STRANDS:

The Long View: Building a Lifelong Passion for Science

To build a lifelong passion for science, educators should ensure that all students have access to activities that encourage growth of individual interests. Connecting science learning to student interest builds their capacity to continue applying these skills throughout their lives. As a part of the teaching/learning process, it is imperative to select phenomena that relate to student interests and allow students to ask their own questions, and identify possible solutions, effectively connecting with the goal of encouraging three-dimensional learning.

Learning Science in All Spaces and Places: Near and Far

Students benefit when teachers engage the broader scientific community in the teaching and learning of science. Students need opportunities to see real-world connections and explore science-based careers. Teacher collaborations with business and industry, community groups, and informal science institutions strengthen learning opportunities for all students, helping to make science relevant to students in their everyday lives.

Thinking, Acting, and Communicating Like Scientists: A Focus on Disciplinary Literacy

To generate knowledge, members within a discipline use specific practices. These include articulating questions or problems for pursuit, investigating those questions using discipline-specific methods, communicating results of investigations to specific audiences, and evaluating one's own claims and those of others. Disciplinary literacy practices are shared language and symbolic tools that members of different academic disciplines use to construct knowledge alongside others in their discipline. In science, to become critical consumers of and contributors to scientific knowledge, all students need explicit instruction in and opportunities to practice how to think, act, and communicate as scientists do.

Aligning the Lenses: Authentic, Three-Dimensional Measurement of Student Learning

Whether formative or summative, assessment in a three-dimensional landscape requires greater flexibility and scope in what is measured. As teachers instruct with three dimensions, so must they assess the three dimensions of science learning. Increasingly multi-modal and performance-based assessments play an important role providing data on student progress, informing instruction and providing feedback to students. Any assessments must be useful in a variety of classroom contexts and settings and aspire to provide access and success for all students.

For more information and to register, please visit *www.nsta.org/boston*

#NSTA20

75th NSTA ANNIVERSARY

National Science Teaching Association

What's New

FROM U.S. GOVERNMENT SOURCES

U.S. Geological Survey (USGS)

Water Science School K12

The Water Science School website makes it easy for everyone—including K–12 teachers and students—to learn all about this valuable natural resource. Whether you would like to learn about the properties of water, understand the components of the water cycle, study water-use patterns and habits, discover where water is located on Earth and how much is available, or explore other water-related topics, this website has content for you. In addition to explanatory content, the site features a collection of Water Science Photo Galleries that explore the world of water through images, and a Water Science Activity Center, which encourages students (and others) to communicate their ideas about water issues through quizzes, opinion surveys, questionnaires, and challenge questions.

Download a Water Science School Flyer at *http://bit.ly/2lzFlr1*, or visit *www.usgs.gov/water-science-school*.

National Aeronautics and Space Administration (NASA)

How Do Hurricanes Form E M

Hurricanes are the most violent storms on Earth. Help elementary and middle level students better understand how these storms form and how they are measured with explanatory content from NASA's Space Place. Written in student-friendly language, the text covers the scientific definition of a hurricane (e.g., tropical cyclone), the conditions and processes of cyclone formation, and the tropical cyclone category scale. In addition, the page includes a diagram showing what it would look like if you could "slice" into a tropical cyclone and a "movie" made from images taken by the Geostationary Operational Environmental Satellite (GOES) system weather satellite that show the formation of Hurricane Katrina, a Category 5 hurricane that struck the coasts of Louisiana, Alabama, and Mississippi in August 2005. Visit *https://go.nasa.gov/2lDs54G*.

U.S. Fish and Wildlife Service (FWS)

A Few Words for Nature Nerds M H

Want to stretch your students' nature science vocabulary? Check out this FWS website (*http://bit.ly/2lxYrxT*), and see how many of these conservation biology terms they know! With enticing nature photographs and short explanatory text accompanying each term, the site is an ideal resource to increase middle and high school students' vocabulary and engage learners in wildlife science. Featured terms include *crepuscular, exoskeleton, flyway, habitat, passerine, riparian, rufous, ungulate,* and *watershed*.

U.S. Department of Energy (DOE)

Women Who Shoot for the Skies E M H

Women in science, technology, engineering, and math were critical to the success of the Apollo 11 mission 50 years ago, and play important roles in the continued exploration of our galaxy. Energy.gov has created Women Who Shoot for the Skies, a web page (*http://bit.ly/2lRun06*) recognizing four scientists who have made important contributions to human spaceflight and space science: Annie Easley (rocket scientist), Evelyn Boyd Granville (mathematician/computer software designer), Mae Jemison (astronaut), and Ellen Ochoa (astronaut). The page features colorfully illustrated posters of each scientist, along with descriptive text about each person and a link to a "Five Fast Facts About…" page for more information. Download the posters for your classroom, and share the web page with students in elementary, middle, and high school levels. Perhaps you'll inspire a student to join these women in space!

U.S. Environmental Protection Agency (EPA)

How Do I Recycle? Common Recyclables A

Visit this EPA website to jump-start school conservation habits and help students of all ages understand how recycling benefits your home, school, community, and the environment. Targeted for consumer audiences, but suitable for use in upper-elementary, middle, and high school classrooms, the web page presents facts and information about how to properly recycle various types of trash, including paper, batteries, plastics, glass, used oil, household hazardous waste, used electronics, and food waste. In addition, a colorful infographic titled What Can I Recycle? depicts the "Top 10 in the Bin" and provides a quick reminder for students and educators about what items can be recycled. Consult the website *http://bit.ly/2lDGAoY*.

Library of Congress (LOC)

Explorations in America's Environmental History M H

These learning units engage students in grades 6–12 in exploring America's environmental history. In two units—The Photographer, The Artist, and Yellowstone Park, and Resource Management: Local and Historical Perspectives—students examine materials from the LOC's collections (photographs, paintings, legislative records, and maps) and complete writing tasks to understand the development of America's concern for the environment in context. Refer to *http://bit.ly/2JWcrfR*.

Samuel F.B. Morse Papers, 1793–1919 M H

This LOC collection features documents from the life and work of Samuel Morse, the inventor of the electromagnetic telegraph, and his participation in the development of telegraph systems worldwide. The collection includes many of Morse's drawings, designs, and photographs. Share the collection with middle and high school students to show science processes at work. Supporting resources include Using Primary Sources, which offers guiding questions to ask when examining any document, and the Primary Source Analysis Tool, a printable graphic organizer students can use to record their observations. Access these resources at *http://bit.ly/2MrYvw5*.

U.S. Department of Labor

Apprenticeship Finder M H HE

The Department of Labor has a searchable database for individuals, including students, seeking opportunities to start their career and build their skillset through apprenticeship. Students can search the database by occupation, keywords, or company name and location. A search using the keyword "science" resulted in more than 500 positions nationwide, including Apprentice Engineer, Data Scientist, Forestry Technician, and Diesel Truck Mechanic.

Middle school, high school, college, and university educators can visit the Educators section (link at the top of the page) to read about how apprenticeships boost education and what roles educators play in apprenticeship. A subsection aimed at middle school and high school educators provides additional resources for those grade levels. See *http://bit.ly/2lAEwyn*.

U.S. Department of Health and Human Services

My Body, My Senses Teacher's Guide P

Use this resource from Head Start's Early Childhood Knowledge and Learning Center to teach children ages 3–5 about the human body and its five senses. The guide—which was developed as part of the Marvelous Explorations Through Science and Stories (MESS) supplemental science curriculum series—presents 16 hands-on inquiry explorations for young children that focus on hands, feet, internal organs, muscles, the human skeleton, and growth. In addition to the student inquiry explorations, the guide includes background information for early childhood educators, as well as related vocabulary and recommended books and materials for each topic. Refer to *http://bit.ly/2k4dxL8*. ●

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

Summer Programs

Editor's Note

Visit https://bit.ly/2ZlRIp5 *to learn about other summer professional development opportunities.*

Earthwatch Teach Earth USA Fellowships K12

As a Teach Earth USA fellow, you'll spend one to two weeks on an Earthwatch expedition with other K–12 teachers and develop skills and understanding around environmental concerns. Teachers from all subject areas are chosen to assist scientists by collecting data on climate change and sustainable resource management. You'll be trained on everything you need to know in the field. Applicants must specify if they are seeking a fully or partially funded fellowship. If awarded a fellowship, Earthwatch will inform you of the level of funding covered by Earthwatch grants. Teachers must complete and submit an interest form to determine whether they meet the program's requirements. Those deemed "qualified" are invited to apply by **January 10, 2020.** See the website *http://bit.ly/2k29Vcp.*

Miami University's Earth Expeditions A

This program pairs university courses with field experiences allowing teachers to engage in inquiry and action research projects at conservation hot spots and build relathionships with scientists, naturalists, and conservationists in Africa, Asia, Australia, and the Americas. After returning home, they continue work on these projects in their schools and communities.

Earth Expeditions are open to all preK–12 teachers, administrators, and university faculty, as well as educators, naturalists, and other professionals from non-school settings. Courses are for stand-alone graduate credit or can be applied toward a master's degree. Apply by **January 28, 2020;** consult *www.EarthExpeditions.org.*

Fermilab Teacher Research Associates Program M H

Teacher Research Associates (TRAC) program appointments will be available at Fermi National Accelerator Laboratory in Batavia, Illinois. The TRAC program provides outstanding science, mathematics, computer science, and technology teachers with cutting-edge science and technology research opportunities that they can translate in their classrooms. Appointments are for eight weeks with a weekly stipend of $1,040.

The program is open to educators in grades 7–12 who are employed full time in public, private, or parochial schools with primary teaching assignments in science, math, computer science, or technology education. Visit *http://bit.ly/2kuyvCU* for more information. Applications will open on December 2 and will be due by **February 16, 2020.**

National Agriculture in the Classroom Conference K12

This year's conference will take place June 23–26 in Salt Lake City, Utah. Workshops, tours, keynote speakers, and networking events will help K–12 educators increase agricultural literary and learn how to integrate agricultural content into science, social studies, language arts, and nutrition classes. See *http://bit.ly/2km64Hx* for more details. ●

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

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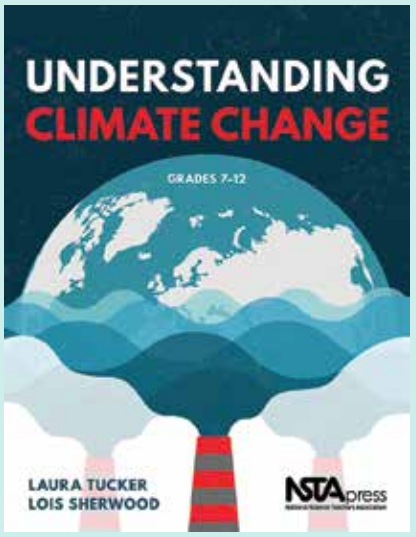

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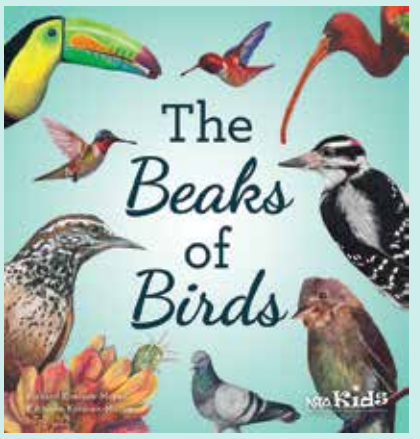

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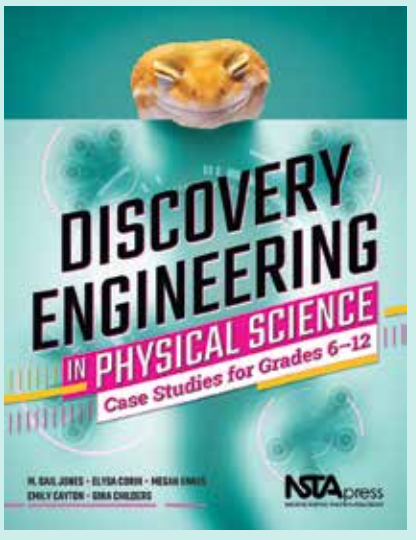

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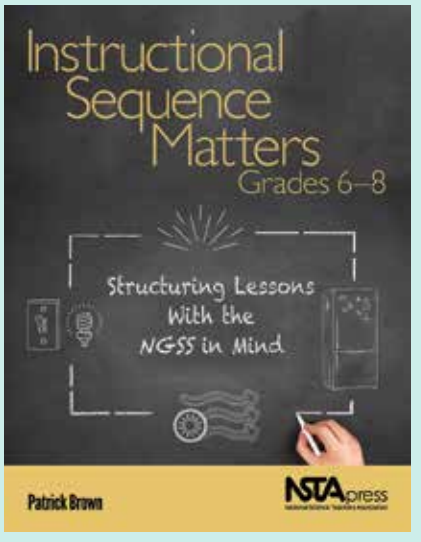

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National Science Teaching Association

Teaching Agriculture to Elementary Students

"It is important for elementary students to learn about agriculture because there is a lot of illiteracy when it comes to agriculture. Social media is a main contributor to ag-illiteracy because there are a lot of negative social media campaigns out there…No one looks at the science-based facts, but instead [they believe] what they read," contends high school student Katelyn Young, vice president of the Arcadia Valley Career Technology Center Future Farmers of America (FFA) Chapter in Ironton, Missouri. She earned certification to teach third graders the Ag-Ed on the Move curriculum (see *www.agmoves.com*) from Missouri Farmers Care, an organization promoting the continued growth of Missouri agriculture and rural communities.

Young says it's crucial "to push that positive message across to students who don't know much about agriculture. These kids are three to five generations removed from the farm. Elementary school is such an important learning time for kids, so what better time to teach them about agriculture? These kids are growing up in a world where the population will be [more than] nine billion in the year 2050. It will be these kids' job to figure out how to feed the growing world."

RUSS AMAN

Students at Moss Haven Elementary School in the Richardson Independent School District in Dallas, Texas, learn about agriculture at Moss Haven Farm, located on the school's campus. Most students "are pretty interested [in agriculture] because it's novel to them; they don't get outside much," says Kim Aman, the farm's program director.

"Almost everything we do is related to food,…[and students need to know that] agriculture careers involve more than just farming," maintains retired teacher Darleen Horton of Louisville, Kentucky, who contributed lessons to the book *Ready, Set, Grow: A Kentucky Educator's Guide to School Gardens and Hands-On STEAM Learning* (available free at *www.kyreadysetgrow.org*). "Some agriculture jobs are lab jobs," she points out, while some "involve food already grown," such as restaurant jobs and careers "connected with the business end of food." She adds, "Students need to understand the economics of farming, such as gas costs,…and

natural ways to garden that help the environment."

Horton notes that "elementary students embrace what you teach them" and what they learn "can impact their families, who can [be inspired by young students to] learn to recycle and grow plants and food."

"There's not a lot of food grown in North Texas, and we're in the city,… [so] students don't understand food production," says Kim Aman, retired teacher and now program director of Moss Haven Farm, located at Moss Haven Elementary School in Dallas, in the Richardson Independent School District. It's important to reach elementary students because "they will be the future policy makers, shoppers, and buyers," she asserts.

In addition, agriculture connects with topics like healthy eating. "There are 10-year-olds who already have type 2 diabetes," Aman points out, so teaching agriculture to young students could positively affect their health. Aman has written related preK–5 curriculum for the American Heart Association and Whole Kids Foundation (see *http://bit.ly/2mfO7el*).

"Some students are scared [initially about farm work]. Some are afraid to get their hands dirty, or to eat radishes, or to be near bees," Aman relates. She helps them overcome their fears, especially of bees. "I teach them not to be scared of bees and how to act around them."

Most students, she notes, "are pretty interested [in agriculture] because it's novel to them; they don't get outside much." And for students who struggle in school, "digging up worms and growing plants levels the playing field for them."

Incorporating Agriculture

Tara Kristoff, curriculum director for Rock Falls School District 13 in Rock Falls, Illinois, partnered with local farm bureaus for teacher professional development in agriculture and resources for students. In her prior school district, where she was a curriculum director, teachers initially weren't receptive to teaching about agriculture.

Teaching students that animals can be food sources requires "a delicate balance."

—Tara Kristoff

"We had representatives from the [Cook County Farm Bureau] show our teachers…how they can link trade books with science and social studies to teach agriculture," says Kristoff. "[Teachers] understand the science of growing corn and soybeans, but with literature [added], they really get enthusiastic" because they can teach it in their English language arts block.

"For example, our fourth-grade teachers taught a unit on pigs. The students learned that Illinois is a major producer of pork as a staple economy globally, and the importance of raising pigs for food. Then the students read *Charlotte's Web* to wrestle with the ethical dilemma [of] raising pigs for food versus a pet. Lastly, the students went for a tour of a pig-raising farm at Fair Oaks Farms in Indiana, where experts explained [how] the life cycle of the pig [relates] to our economy," Kristoff recalls.

Teaching students that animals can be food sources requires "a delicate balance," she observes. Younger students simply learn that "we grow pigs in Illinois," while third and fourth graders discover that "pork is a staple and pigs are part of our food system. The things students eat—pork tamales and bacon, for example—they [learn to] associate with pigs. They understand they've been eating it; they just hadn't realized it," Kristoff explains.

"In Illinois, agriculture is the most important job, our main source of income and revenue," she contends. Noting her current school district has 80% of residents living in poverty, she asserts, "It is especially important for me as a director of curriculum to have students understand where their food truly comes from as well as consider agriculture/agribusiness as a future career."

"I have been incorporating agriculture fairly heavily [over] the past three years," says Nancy Smith, first-grade teacher at Bentwood Elementary in Overland Park, Kansas. Smith says she finds it easy to blend agriculture with science, technology, engineering, and math (STEM), and she starts the school year by teaching "about careers in agriculture and STEM as part of my Labor Day lessons." Later on, "we talk about farmers' tools, the axe, the trowel, and the shovel" as part of a STEM lesson.

For her school's student and family night this year, she will incorporate agriculture throughout the event. "The stations will be all agriculture-related. [For example,] Kansas Corn [an organization comprised of the Kansas Corn Growers Association and the Kansas Corn Commission] will have a station. [Students from all grade levels and their families] will learn about Kansas agriculture and do hands-on activities," she relates.

"I invited a farmer who uses drones to examine his crops. He will demonstrate his drones at the event and explain why he uses them," she reports.

When she can't bring students to a farm, Smith takes them on virtual field trips to farms. She also invites high school students from the local FFA chapter "to design activities and centers for my students. This has an impact on the high school students as well," she observes.

To prepare to celebrate the state holiday Kansas Day (January 29, the day Kansas was admitted to the United States), Smith will have her students spend a week researching a school lunch that will feature ingredients produced on Kansas farms. "I'll have farmers and grocery store employees come in," she relates. "The students will look at the nutritional values and costs of the food. They'll pitch [their menu] to the food service workers at our school [and ask them] to serve it next year." ●

BLICK ON FLICKS

Probability and Topology in *Avengers: Endgame*

By Jacob Clark Blickenstaff

Last spring saw the theatrical release of *Avengers: Endgame,* the culmination of the four-film Avengers storyline, and the 22nd film in the Marvel Cinematic Universe (MCU). I've written about some of the earlier MCU movies (*Black Panther,* 2018; *Ant-Man,* 2015; *Captain America: Winter Soldier,* 2014; and the first *Avengers,* 2012), finding connections to biology, physics, and mathematics. This movie is very big in almost every way. It is long (about three hours); had huge box office returns; and featured a large, star-studded cast, and its complex storyline resolved a lot of plot arcs from several previous MCU movies.

Given its popularity, it is enough to say that *Endgame* is the response to the end of *Avengers: Infinity War,* when Thanos snapped his fingers and killed half of the living things in the universe. The efforts of the remaining heroes (Captain America, Thor, Iron Man, War Machine, Rocket, Nebula, the Hulk, Ant-Man, Black Widow, and Hawkeye) to undo that snap and restore the lost lives involve a lot of time travel and bring up some useful and fun mathematics.

50/50

As I mentioned earlier, Thanos' snap killed half of the living things in the universe (we won't worry about how), which means any individual had a 50% chance of surviving and a 50% chance of dying in that moment. Math teachers often use a coin flip as the standard example of 50-50 probability, since the coin has an even chance of coming up heads or tails. One of the points of confusion about things like coin flips is that just because there is an even chance of heads or tails does not mean that flips will alternate between heads and tails, or that if you flip a coin 10 times you will get five heads and five tails.

This is a great experiment to have a classroom of students conduct, and it doesn't take much time. Give each student a penny, and have each student do 10 coin flips, keeping track of the sequence of heads and tails. Collect the data from all the students and get a classroom total of heads and tails. You are likely to have some individual students who get fairly unequal numbers of heads and tails (7 and 3 or even 8 and 2). When you total the results of 30 students, though, the number of heads is likely to be between 140 and 160, with very close to a 50/50 ratio of heads to tails. (If you don't have enough pennies to do this, Random.org provides a coin flip simulator at *www.random.org/coins,* but I think using real coins has a strong appeal.)

A common misconception is that if a coin has come up heads three or four times in a row, it is "due" to come up tails next. While that feels right to our brains, actually each coin flip needs to be considered individually as an event with a 50/50 chance of either

outcome. At the same time, a sequence of 10 heads in a row is very unlikely. It is easy to calculate just how unlikely.

Each flip has a 50% chance of coming up heads, so a sequence of three heads in a row will happen 1/8 of the time (0.5* 0.5* 0.5 = 0.125 or 12.5%). That's not all that rare. The probability of 10 heads in a row, on the other hand, is (0.5)^10, or 1/1,024. One in a thousand is unusual, but not impossible. Fifty heads in a row will only happen once in (0.5)^50, or 1/1,125,899,906,842,624. One in one thousand trillion is outside the realm of probability.

To bring this back to *Avengers: Endgame*, we see Hawkeye with his family (a daughter, two sons, and his wife) as the movie opens. Suddenly, the rest of his family vanishes, leaving Hawkeye alone and distraught. With the understanding of 50/50 probability, we can calculate just how unlikely it was that Hawkeye should lose four members of his family to Thanos: 0.5*0.5*0.5*0.5= 1/16.

I would not suggest doing such a cold-blooded calculation if we all didn't know this movie is based on a comic book, and Thanos will not be allowed to win in the end.

Twisting Space

To undo Thanos' work, the Avengers have to figure out how to travel through time, which they do with some techno-speak about the quantum realm. The quantum realm first came up in *Ant-Man* as the place where you end up if you shrink too far. It is true that our everyday world is very, very different from the subatomic scale, so I'm okay with this bit of comic book magic.

Initially, Tony Stark (Robert Downey Jr.) says that using the quantum realm for time travel is impossible, and some funny moments happen when characters use science fiction movies as models for how time travel must work. Stark starts to work on the problem, using a supercomputer to model potential solutions, and he mentions the term "Mobius strip." When the computer uses this new Mobius math, a method for time travel is found.

The Mobius strip is probably the most famous, and easily constructed topological oddity. If you take a narrow strip of paper, give one end a half-twist, then connect the two ends, you've made a Mobius strip. Trace your finger along a side or an edge, and you'll discover that your finger comes back to where you started: The paper now has only one side and one edge. This has some cool applications, such as when conveyor belts are built as giant Mobius strips to even out wear on the material, but I just think they are a fun bit of topology.

The epic *Avengers: Endgame* has some interesting opportunities for middle school math teachers to address probability and the stretching of shapes in class.

Rated PG-13 for sequences of sci-fi violence and action, and some language

Jacob Clark Blickenstaff is an independent science education consultant in Seattle, Washington. Read more Blick at http://bit.ly/2S2wH2L, *or e-mail him at* jclarkblickenstaff@outlook.com.

ASK A MENTOR, **Advice Column**

Dealing With Shy Students, Recycling, and Split Classes

I've been having trouble getting students willing to talk, answer questions, or share their ideas in class. What strategies/activities do you use to help kids feel more comfortable talking and sharing in your class?

—C., Arizona

Few things can seem worse to a teacher than having a group of quiet students whom you really want to participate! I addressed how to get discussions started in a previous blog post (*http://bit.ly/322RAfK*), but it's probably good to revisit this common bane of teachers.

Start the lesson with an impressive demonstration or engaging video to prompt interest. Many students who are shy or introverted may just need some more time to digest and formulate ideas and questions before they're comfortable talking with others. Graphic organizers allow students to think and write on their own so they have fuel for the discussions to follow. Some graphic organizers may be found in this collection in the NSTA Learning Center: *http://bit.ly/30BgZwO*.

Using their notes, you can set up learning circles for larger groups to discuss topics. Establish rules for how they need to work: Always stop at each and every person and always in the same direction, never skipping or reversing.

Handheld whiteboards are excellent tools to get students involved. Every student or pair of students writes short answers, sketches graphs, or indicates their understanding for quick feedback without having to talk in front of classmates. As students raise their boards, simply point and give a quick nod or simple feedback to help them find the correct answer. Don't advance to the next question until everyone has successfully participated. This activity can be exciting and fast-paced, so don't have too much down time, and keep it moving along with a series of prepared questions. You can even invite students to question the class and give their own feedback.

I had a hard time figuring out a way to get my second-grade students involved with recycling or something with the 3Rs. So I was just wondering if you had any suggestions for something better?

—N., Massachusetts

While all three of the Rs (Reduce, Reuse, Recycle) are important, I find that we really only concentrate on one: Recycle. Reducing our use of resources, which in turn reduces energy consumption and waste, is the ideal first step.

For your young class, I recommend starting with awareness. Identify and quantify the waste in your classroom. This integrates math, observation,

measuring, and sorting skills. Introduce how to display and present their collected data. Students can research how the different items are produced and how they behave in the environment.

Once the students have a baseline of their waste production, brainstorm ways to reduce the amount. This may include communicating the students' ideas to parents. Ask the class if they've seen refuse that could be replaced with reusable items such forks, spoons, and water bottles. Identify the items still being discarded that can be recycled, and research recycling options.

Continue quantifying how much waste your students produce, and track results as they try different strategies to reduce it. Don't forget to update the display!

Once your students become 3R practitioners, consider introducing them to advocacy. They can create posters, make presentations to other classes, or set up an information booth with literature for the other students in the school.

Your 3R program has now become a complete cross-curricular project!

How does one model a 5E lesson plan for each topic covered when teaching a split grade level?

—C., Illinois

Split classes can be very challenging, particularly if they have drastically different curricula. However, I believe you can manage better if your lessons use a three-dimensional approach. Instead of content topics, you can structure your 5E (Engage-Explore-Explain-Elaborate-Evaluate) lessons around a crosscutting theme, a core idea, or a scientific practice common to all science curricula. What would differ in your class is what the students "Explore" about the common theme, idea, or practice. I believe the core ideas in each subject area would be the easiest to focus on, but it would be powerful to wrap a lesson around a science practice like engaging in arguments based on evidence.

Have the students from both grades share what they learned and ask questions that arose from their explorations. This flows nicely to the "Explanation" and "Elaboration" stages of a 5E lesson. Consider pairing students across the grades and incorporating some peer teaching and evaluation.

You can structure formative and summative evaluations around their understanding of the themes, core ideas, and practices by how they apply the knowledge of the topics from the lesson. You might be able to create tests that ask the same questions, but would have slightly different answers depending on the exploration used in each grade level.

For ideas, lessons, and workshops involving 3-D learning, visit the *NGSS@*NSTA hub at the website *https://ngss.nsta.org*.

Hope this helps!●

Check out more advice on diverse topics or ask a question of Gabe Kraljevic from Ask a Mentor at http://bit.ly/2FpGb1u, *or e-mail* mentor@nsta.org.

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NSTA PRESS: *It's Still Debatable! Using Socioscientific Issues to Develop Scientific Literacy, K–5*

It's Debatable! for the Next Generation

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 It's Still Debatable! Using Socioscientific Issues to Develop Scientific Literacy, K–5, *by Sami Kahn, edited for publication here. To download the full text of this chapter, go to* https://bit.ly/2k4r5Gu. *NSTA Press publications are available online through the NSTA Science Store at* www.nsta.org/store.

I have heard it said that today's students are tomorrow's decision makers. It is also true that today's students are today's decision makers! Children are deluged with information that impacts their lives and choices, from which foods are healthiest to whether a particular product or technology is best. Children receive input from a variety of sources and must learn to distinguish fact from fiction. There is so much information available today that it is sometimes easy to forget that information isn't knowledge, and knowledge isn't wisdom. As elementary teachers, we try to instill in children the ability to weigh information and make thoughtful choices. Quality science education demands that our students apply scientific understanding to their everyday lives, yet this is a tall task, particularly since science teaching is often done in isolated contexts, making it difficult to recognize and apply science in everyday situations.

The authors of *A Framework for K–12 Science Education* clearly had this challenge in mind when they noted the importance of preparing students to "engage in public discussions on science-related issues, to be critical consumers of scientific information related to their everyday lives, and to continue to learn about science throughout their lives" (NRC 2012, pp. 1–2). *The Next Generation Science Standards* (*NGSS*) echo the importance of ensuring informed decision making through science:

There is no doubt that science, and therefore, science education is central to the lives of all Americans. Never before has our world been so complex and science knowledge so critical to making sense of it all. When comprehending current events, choosing and using technology, or making informed decisions about one's healthcare, science understanding is key. (*NGSS* Lead States 2013, p. 1)

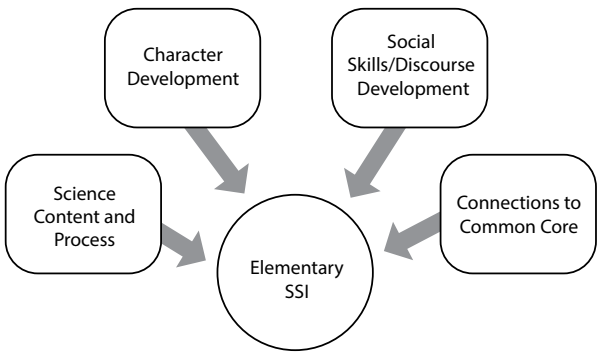
This vision of scientific literacy expects students to make sense of science and apply it to real-world decision making. It also requires teachers to address an extensive array of standards and position them in meaningful contexts for our learners. As daunting a task as that is, there's even more to the story. Elementary teachers know that the real-world scientific questions that students confront can't always be answered easily by science. The messiness may stem from the fact that scientific understanding is often incomplete and ever changing, a situation that can lead students (and the public) to be confused about the information they receive, or worse, to doubt the integrity of science itself. Children also wonder about moral or "should" questions that can be informed by science but also require consideration of the consequences of their decisions on others. A growing body of research suggests that these are precisely the types of questions that fascinate and engage students, including those who otherwise might not be interested in science. The use of debatable, science-related societal questions, or socioscientific issues (SSI) (Zeidler 2014), can serve as a powerful teaching framework that addresses science content, the application of that content, and the type of informed citizenship that is envisioned within the *NGSS*.

How does this work? Let's consider the question "Is football too dangerous for kids?" Examining this question would require understanding concepts of forces and motion. It would also require an understanding of anatomy. Engineering also enters the picture, as we could ask students to examine and test different helmets, and even design their own. Even after all this scientific investigation, this issue leaves open questions like these: Who should decide whether football is too dangerous? What are the costs and benefits of youth sports? Approaching the topic of forces and motion in this way creates a rich context for learning by engaging students in an issue that feels real to them, motivates them to investigate the underlying content through science and engineering practices, and allows them to emulate real-world, evidence-based decision-making practices.

One of the most compelling reasons for SSI implementation in contemporary classrooms is it clearly supports the conceptual shifts that drove the development of the *NGSS*.

Elementary teachers don't just teach science: They teach children! This means that social and communication skills, literacy and numeracy, and character development are also key goals. Through thoughtful, collaborative problem solving, students begin to think about ways they can support their classroom, school, town, and global community through scientific understanding, civic engagement, conscience, and caring. Typical SSI lessons engage students through hands-on investigations and research in conjunction with discourse through debates, role-playing, in-person or online discussion platforms, and written communications. By interacting with others in this way, students challenge their existing beliefs, collect and examine evidence through multiple research experiences, and develop arguments from evidence.

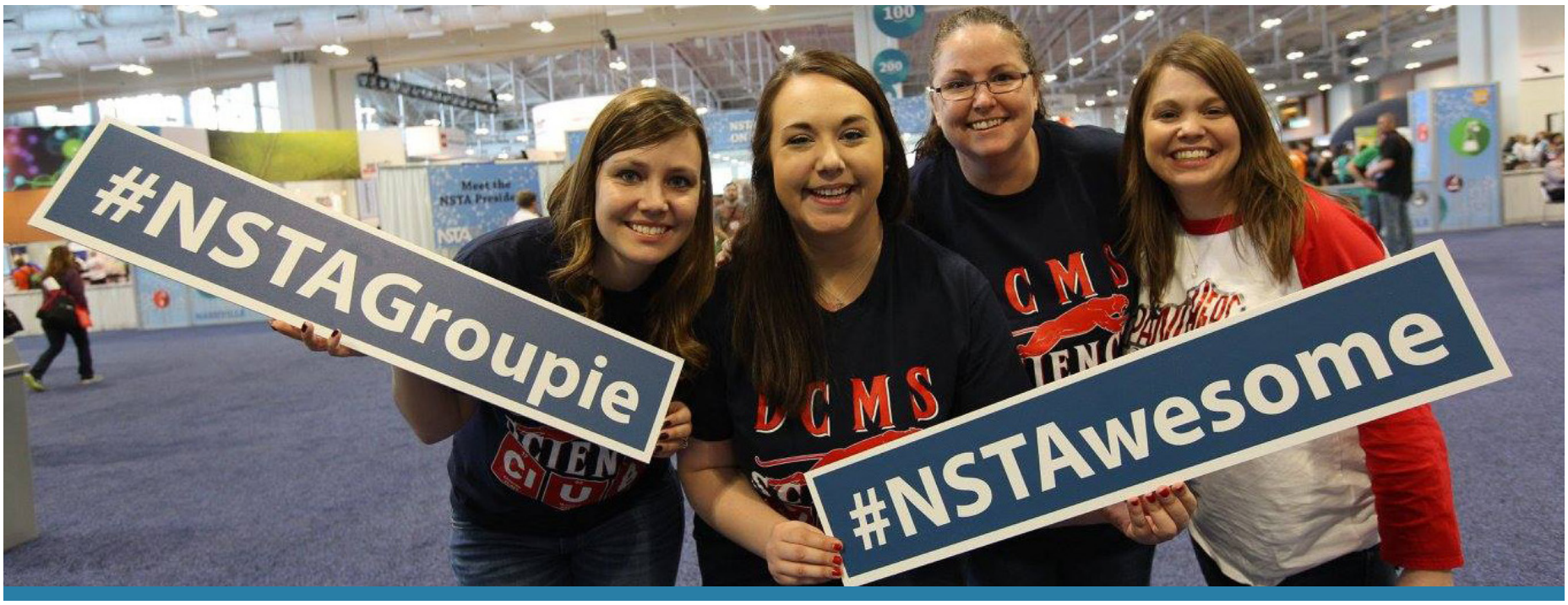
Figure 1.1.



Although moral and ethical issues are broached, teachers do not instruct students in *what* to believe, but rather *how* to integrate information from a variety of sources, evaluate the quality of those sources, and develop perspective-taking skills. Unlike other science-and-society approaches, SSI focuses on empowering students to become agents of change in their schools and communities by integrating diverse viewpoints, appreciating the impact of their actions (or inactions) on others, and finding common ground toward the development of thoughtful solutions. Extensive research has suggested that the SSI approach supports increases in students' science content knowledge, understanding of the nature of science, quality of argumentation abilities, and characteristics for global citizenship, including empathy and perspective taking (Zeidler 2014). And SSI's emphasis on evidence-based argumentation and civic engagement makes integration with the *Common Core State Standards* in English language arts and mathematics (NGAC and CCSSO 2010), as well as the National Council for the Social Studies (NCSS 2010) curriculum standards, seamless. This supports what we know about how young children learn best. It is also an efficient way of teaching.

Most important, SSI makes science real for students. This book uses a model for elementary SSI (Figure 1.1) that recognizes the importance of social skills and discourse, interdisciplinary connections, character development, and of course, science learning. ●

NSTA Partnership School Program



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National Science Teaching Association

(All dates are deadlines unless otherwise specified.)

October 24—The **NSTA Area Conference on Science Education in Salt Lake City, Utah,** opens today and runs through October 26 at the Salt Palace Convention Center, and features keynote speaker Mireya Mayor, primatologist and National Geographic Explorer. For more information or to register, visit *www.nsta.org/saltlakecity.*

October 25—Don't miss the start of this two-day **Making Sense of Three-Dimensional Teaching and Learning Workshop** in Salt Lake City, Utah, where participants will deepen their understanding of the three dimensions of the *Next Generation Science Standards* (*NGSS*): science and engineering practices, disciplinary core ideas, and crosscutting concepts. Registration costs $575 for NSTA members and includes *The NSTA Quick-Reference Guide to the* NGSS, *K–12,* and access on Thursday to the NSTA Area Conference in Salt Lake City. For more information or to register, visit *https://bit.ly/2Y5yI1X.*

October 29—The Shell Science Teaching Award recognizes outstanding science educators, but you have to apply before you can win. Join presenter Melissa Collins for the **Developing a Competitive Application for the Shell Science Teaching Award free web seminar** to learn how to make your application as strong as possible. The event will be held at 6:30 p.m. Eastern Time (ET). For more information on NSTA Web Seminars or to register, visit *http://bit.ly/2RGhr8N.* For more information on the NSTA Awards and Recognition Program, visit *www.nsta.org/awards.*

November 4—Register now for maximum savings for the **NSTA Area Conference on Science Education in Seattle, Washington**, December 12–14. Nalini M. Nadkarni, STEM (science, technology, engineering, math) Ambassador Program (STEMAP) Director at the University of Utah, will present the keynote session. Early bird registration costs $195 for members of NSTA, Washington Science Teachers Association, American Association of Chemistry Teachers (AACT), American Association of Physics Teachers (AAPT), American Chemical Society (ACS), American Society for Engineering Education (ASEE), and National Association of Biology Teachers (NABT). One-day registration options are also available. For more information or to register, visit *www.nsta.org/seattle.*

November 6—Get recognized for your hard work, or nominate an exceptional colleague through the NSTA Awards and Recognition Program. A **free web seminar, Developing a Competitive Teacher Award Application**, will provide tips and insight into the application process. The event will be held at 6:30–8 p.m. ET. For more information on NSTA Web Seminars or to register, visit *http://bit.ly/2RGhr8N.* For more information on the NSTA Awards and Recognition Program, visit *www.nsta.org/awards.*

November 14—The **NSTA Area Conference on Science Education in Cincinnati, Ohio,** opens today and continues through November 16. Luke Dollar, National Geographic Explorer and Bashore Distinguished Professor and chair of the Department of Environment and Sustainability, Catawba College, North Carolina, and Adjunct Professor of the Environment, Duke University, will present the keynote session. For more information or to register, visit *www.nsta.org/cincinnati.*

November 16—The workshop **Three-Dimensional Teaching and Learning Powered by STEM,** taking place in Cincinnati, Ohio, is your chance to learn how to bring STEM together with three-dimensional instruction to enhance your students' learning. Early bird registration by **October 4** for the workshop costs $200 for NSTA members; combined early bird member registration for the workshop and the **NSTA Area Conference on Science Education in Cincinnati** costs $300. For more information or to register, visit *https://bit.ly/2MfZWvK.*

November 21—Middle and high school teachers, would you like to win a $20,000 lab makeover for your school? Apply to the Shell Science Lab Challenge! Join the **Developing a Competitive Application for the Shell Science Lab Challenge free web seminar** to learn about the application process and the keys to a strong application. The event will be held at 6:30 p.m. ET. For more information on NSTA Web Seminars or to register, visit the website *http://bit.ly/2RGhr8N.* More information on the NSTA Awards and Recognitions Program is available at *www.nsta.org/awards.* ●

#ICYMI

In case you missed it, check out a few highlights from NSTA's e-newsletters. Catch up on all the latest e-newsletters at *https://bit.ly/2X5iuEQ.*

"Science and Humanities Classes Collaborate for Engineering Integration" With limited time dedicated for science instruction, K–4 science teacher Kathy Kennedy finds unique opportunities to connect science and engineering to established humanities activities.
—*Next Gen Navigator* (August 2019, *https://bit.ly/2Yr2PAD*)

"Teaching the News: Climate Change" According to the National Oceanic and Atmospheric Administration (NOAA), July 2019 was the hottest month on record for the planet. Share this news with your students this fall, and take advantage of the (mostly free) climate change materials for teachers from NOAA (*https://bit.ly/2kkhs6x)* and NSTA (*https://bit.ly/2k1EfE0*).
—*NSTA Express* (August 20, 2019, *https://bit.ly/2K9R5M0)*●

Celebrating 75 Years at NSTA

1999 NSTA launches SciLinks®, linking science textbooks to the internet.

2017 NSTA participates in the first March for Science in Washington, D.C.

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Step Up to NSTA Leadership

Interested in taking on a leadership role with NSTA? We need science educators committed to advancing our mission of science education for all to join our Board of Directors and Council!

Board positions open for election this year are President, Multicultural/Equity Director, Preservice Director, and Research Director. In addition, directors are needed for Districts I (Connecticut, Massachusetts, and Rhode Island), VI (North Carolina, South Carolina, and Tennessee), VII (Arkansas, Louisiana, and Mississippi), XII (Illinois, Iowa, and Wisconsin), XIII (New Mexico, Oklahoma, and Texas), and XVIII (Canada).

Members of the Board and Council serve three-year terms, June 1, 2020, through May 31, 2023. Applications for the positions are being accepted through **October 17** online at *www.nsta.org/nominations.* For more information, e-mail Amanda Upton at *nominations@nsta.org.* ●

Quotable

Nature never breaks her own laws.

—Leonardo da Vinci, Italian artist and inventor (1452–1519)