Building STEAM
With Model Railroads 10

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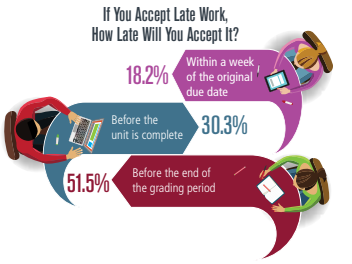
National Science Teaching Association



NSTA Member Poll:
Organizing for Student Success 6

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Medical Schools Offer STEM Pipeline Programs

Teachers and students seeking additional learning opportunities in science, technology, engineering, and math (STEM) with a health care orientation can often look to their local medical schools for precollege STEM pipeline programs. Held both on medical school campuses and offsite, these programs are geared toward engaging students in STEM early on and giving students—especially underrepresented students—extra support in pursuing STEM majors and careers, including health care careers.

In Newark, New Jersey, for example, Rutgers New Jersey Medical School (NJMS) offers Science, Medicine, and Related Topics (SMART; see the website *http://njms.rutgers.edu/smart*), a pipeline program for underrepresented students interested in careers in medicine, dentistry, biomedical research, and other health-related careers. "We hold a Winter Academy for students in grades 6–12 and a Summer Academy for rising students in grades 7–12," says SMART Program Administrator Mercedes Padilla-Register. Held on the NJMS campus, SMART is open to all New Jersey students, with preference given to students living in or near Newark.

The Winter Academy, which takes place on Saturdays, focuses on infectious diseases and public health. It features NJMS faculty—"scientists, doctors, nurses, or dentists"—who serve as guest lecturers to "inform students about their specialty," explains Padilla-Register. "We try to invite faculty who look like the students and have the same background."

KEITH BRATCHER, NEW JERSEY MEDICAL SCHOOL

In Newark, New Jersey, Rutgers New Jersey Medical School offers Science, Medicine, and Related Topics, a pipeline program for underrepresented students interested in careers in medicine, dentistry, biomedical research, and other health-related careers.

Recently a New Jersey Institute of Technology faculty member shared his experiences in studying to be an engineer in the gas industry. "We want to expose students to science careers in general, not just in medicine," Padilla-Register points out.

State-certified science teachers and medical students serving as teaching assistants also lead students in hands-on activities in applied science and technology, with a curriculum aligned to state standards. "The medical students are closer in age to the students, and they inspire students with their own stories of living and going to school in Newark. They provide mentoring and extra help to students," Padilla-Register relates.

Many students go on to participate in the Summer Academy, and students can take both academies every year through 12th grade. "In the summer, we switch up the speakers so there are no speaker duplications," notes

See Medical Schools, pg 5

NSTA Reports Update

This is your last print issue of *NSTA Reports* for this school year. The April and May issues will be published on the NSTA website at *www.nsta.org*. You'll receive an e-mail when the issues are available. Log in to your NSTA member account at *www.nsta.org* to ensure your e-mail address is correct so you don't miss an issue!

We'd like to hear about how you prefer to receive future *NSTA Reports* content. Let us know by taking this brief survey at *http://bit.ly/37m4IyD*.

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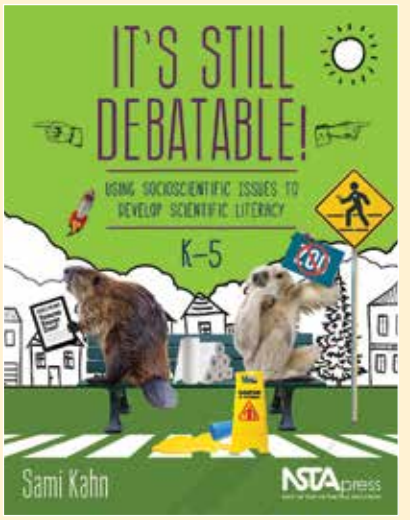

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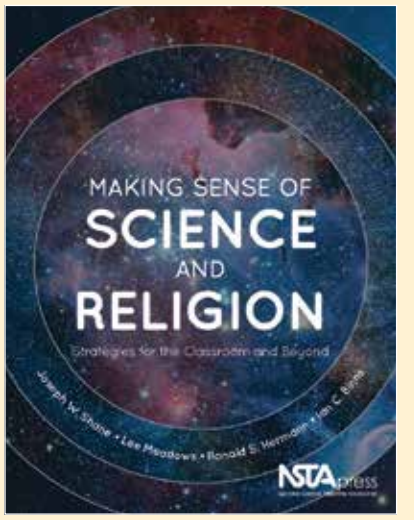

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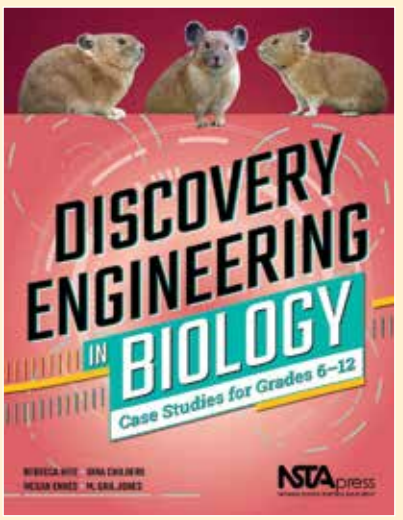

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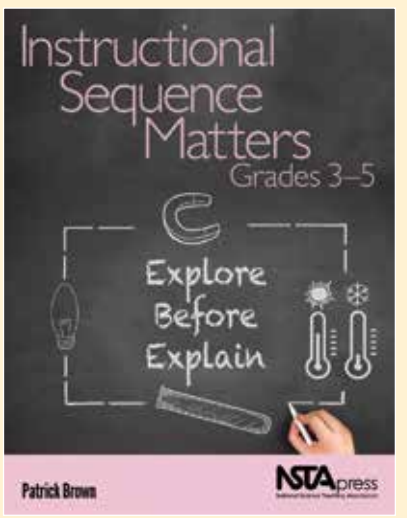

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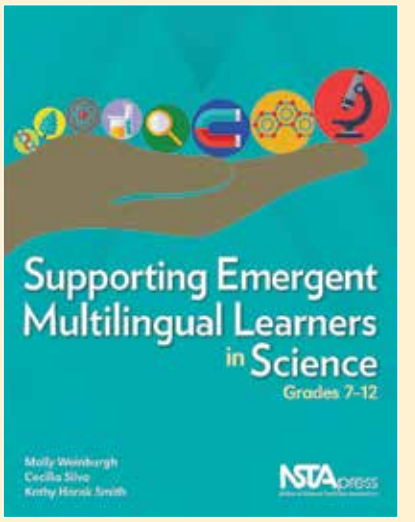

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COMMENTARY: **Alicia Santiago**

Equity in STEM Education: It's All About Culture!

By Alicia Santiago

Alicia Santiago

When you think about diversity, how does it show itself? When you stand before your students, do the faces looking back at you look like your own? Most likely, your answer is "no." Classrooms and afterschool programs are becoming more culturally, ethnically, and linguistically diverse, which is leading to both challenges and opportunities for educators.

Often students and educators do not have the same cultural, ethnic, or social background. Why does it matter, and how can you bridge this disconnect? The cultural divide between educators and students can seriously impede teaching and learning. Educators use their own cultural and experiential filters to communicate instructional messages to students; in many instances, those filters are incompatible with the students' cultural filters. Have you considered how your culture influences your students?

Culture plays a huge role in education and in everything we do. Culture shapes our values, beliefs, social interactions, worldview, and what we consider important. It also influences how we see ourselves, how we see our students, how we relate to them, what we teach, and how we teach. It is important to recognize that culture is central to teaching and learning, as it plays a key role in communicating and receiving information, and is vital in sparking interest and effectively engaging students in science, technology, engineering, and mathematics (STEM).

A way for educators to span the cultural divide between them and their students is to build bridges using *culturally responsive practices* and creating *inclusive learning environments*. Educators who approach science teaching and learning with a culturally responsive pedagogy (CRP) are effective in bridging that cultural divide. Culturally responsive educators challenge the stereotypical deficit thinking of diverse students (e.g. "culturally deficient," "at risk," "low-performing") by considering cultural differences as assets, valuing students' strengths and skills and acknowledging each student's potential.

So how do we engage diverse students in culturally responsive and appropriate ways? Cultural responsiveness is about developing genuine and trusting relationships with students and validating their strengths and interests. A first step to develop these relationships is getting to know your students as individuals and learning about their culture. Find out their interests and the way they operate at home and in their community. This also will help you better understand how to connect STEM to their lives and make learning experiences relevant for them.

To learn about students' culture, we first must understand our own culture and how it affects the way we relate to students. Educators often believe that they can be neutral and objective, but their life experiences and cultures (e.g., values, assumptions, and beliefs) impact how they relate to students. Sometimes these assumptions and beliefs manifest as implicit biases, which could negatively affect students. We all have implicit biases: attitudes or stereotypes that influence our understanding, actions, and decisions in an unconscious way. We need to examine our sociocultural identities and become aware of and challenge our unconscious biases to better understand ourselves and effectively communicate and work with students.

Another key aspect of CRP is creating an inviting, inclusive learning environment. In such an environment, students believe their contributions and perspectives are valued and respected. They feel that they belong. This positively impacts students' interest and motivation in STEM.

The need to belong is a basic human need that influences our behavior and motivations. When students feel that they belong in the learning environment, they feel connected to and accepted by their peers and teachers. They feel validated in a way that is accepting and positive, which increases their engagement and motivation. In an inclusive learning environment, educators use teaching strategies that accommodate students' needs in terms of learning styles, abilities, backgrounds, and experiences.

Analyzing the type of environment you created for your students is a great way to begin transitioning to an inclusive learning environment. For example, do your students feel empowered and capable of discussing concerns or challenges with you or their peers? How do your teaching practices foster a learning community in which each student is valued and considered? What strategies do you use to support diverse learners?

Culture is a key element of every learning environment. It shapes both the learning environment and the experience of each student. Cultural responsiveness is a powerful approach that allows educators to improve STEM engagement and equity. Whichever strategies you use to make the learning environment more inclusive, remember to remain sensitive to and flexible about the ways diverse students think, behave, and communicate. This will help create a supportive learning environment in which students are motivated to learn, and allows them to grow intellectually, socially, and emotionally.

Alicia Santiago, PhD, is a neurobiologist and a cultural and diversity consultant with more than 10 years of experience in informal science education. She collaborates with Twin Cities PBS to develop and implement innovative direct and mass media science and health education national-level programs for the Latinx community. She can be reached by e-mail at santiago554@gmail.com.

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Medical Schools, from pg 1

Padilla-Register. The Summer Academy also includes educational field trips, community service (for 11th and 12th graders), and college and career counseling.

Participation offers "a boost in the daily curriculum, which is good for disadvantaged students who might not be exposed to the content in their schools. There is time for hands-on activities like dissections," which may not be offered in school due to lack of time and/or resources, she contends.

"Most SMART students graduate high school and go to college," reports Padilla-Register, "with about half continuing in science and medicine."

STEM 'SSTRIDE's

Florida State University College of Medicine (FSUCOM) in Tallahassee has an outreach program called Science Students Together Reaching Instructional Diversity and Excellence (SSTRIDE; *https://fla.st/31GY6d6*) for middle and high school students in five counties, "serving a diverse group of students, but mainly African American, Hispanic, and rural. SSTRIDE was created...to address the disparity between the need for minority and rural physicians and the pool of qualified applicants," says Thesla Anderson, SSTRIDE's founder and FSUCOM's director of Precollege and Undergraduate Outreach Programs.

"We identify students with an interest in science, math, and health and provide support for them to succeed in preparing for graduate or medical school. We not only help them academically and socially, but also help with their leadership and professional skill development," Anderson explains.

"We have students as a captive audience for the entire school year, one class period every day. It's an opportunity for us to intervene in their lives to help them love learning and provide an innovative and engaging science curriculum," Anderson emphasizes. "There is a reduced class size of 15 to 20 students enrolled in each SSTRIDE class, depending on the district. Our goal is to develop a well-rounded student."

Students are chosen based on recommendations from their seventh-grade science teacher, guidance counselor, or principal; a minimum 3.0 GPA; and an interest in a five-year commitment, "and they have to love science and math. This is not a remediation program," Anderson maintains. Many students, she notes, "are the first in their family to go to college."

SSTRIDE has a "progression of science classes and a newly developed leadership course. Each district chooses the progression of courses (only one class as part of their schedule each year)," Anderson explains.

"We recruit undergraduate, graduate, pre-med, and medical students to work with teachers in the classroom, and each group of students is assigned a graduate student or undergraduate pre-medical student mentor [who serves] as a teaching assistant," says Anderson. "SSTRIDE teachers use only our curriculum, which covers biology, chemistry, Introduction to Health Science, anatomy, and leadership," she relates.

"SSTRIDE also offers in-school and afterschool tutoring; grade monitoring, so that when a student's grades fall below a B, an intervention plan is developed;...field trips, guest speakers, and academic banquets; community partnerships with doctors, hospitals, businesses, clinics, community colleges and universities (to recruit mentors), and other organizations; standardized test preparation from the ACT and SAT to the MCAT; and a professional externship for high school seniors. We collect formative and summative data, and we advise students interested in medicine and all pre-health fields," she reports.

"[Most] (97%) of SSTRIDE students go to college, and 65% choose a health and science major," Anderson notes.

Starting Early

When medical students at the Zucker School of Medicine at Hofstra/Northwell in Hempstead, New York, attended a presentation by the dean called Obesity as an Epidemic, "[i]t was eye-opening for the students; it inspired them to want to do something" about obesity prevention, recalls Catherine Bangeranye, assistant dean for Diversity and Inclusion and assistant professor of science education. "Students wanted to do community outreach."

"They wanted to [work within] the Hempstead School District and give back to the community around the [medical school]," adds Janice John, assistant professor of science education.

The medical students worked with Bangeranye, John, and Gina Granger, Zucker's community outreach liaison, to create Healthy Living Long Island (HLLI), a curriculum for third graders. HLLI is based on the American Academy of Pediatricians' 5210 guidelines advising children to eat 5 or more servings of fruits and vegetables a day, devote no more than 2 hours to recreational screen time, participate in at least 1 hour of physical activity, and drink 0 sugary drinks each day. HLLI also was adapted from "Let's Go!," an obesity prevention initiative in Maine. Third grade was chosen because "it is a good place to start because of their developmental understanding," explains John.

HLLI begins with a school assembly for third graders at Barack Obama Elementary School in Hempstead, New York (the first school in the program, which is now in its second year). After introducing themselves and HLLI in the assembly, the medical students subsequently visit third-grade classrooms four times during the school year to present mini-lessons on the 5210 curriculum covering exercise and healthy eating.

After two of these classroom visits, the third graders take a field trip to the medical school to do "four interactive stations that reinforce the 5210 concepts" and involve "experiential and active learning," says John. During the field trip, "we have medical students, scientists, and physicians interacting with the third graders," John notes. "It is an opportunity for us to see how well students are learning the concepts." So far, she reports, "our methods have [proven] to be successful. Students are able to deeply understand the concepts."

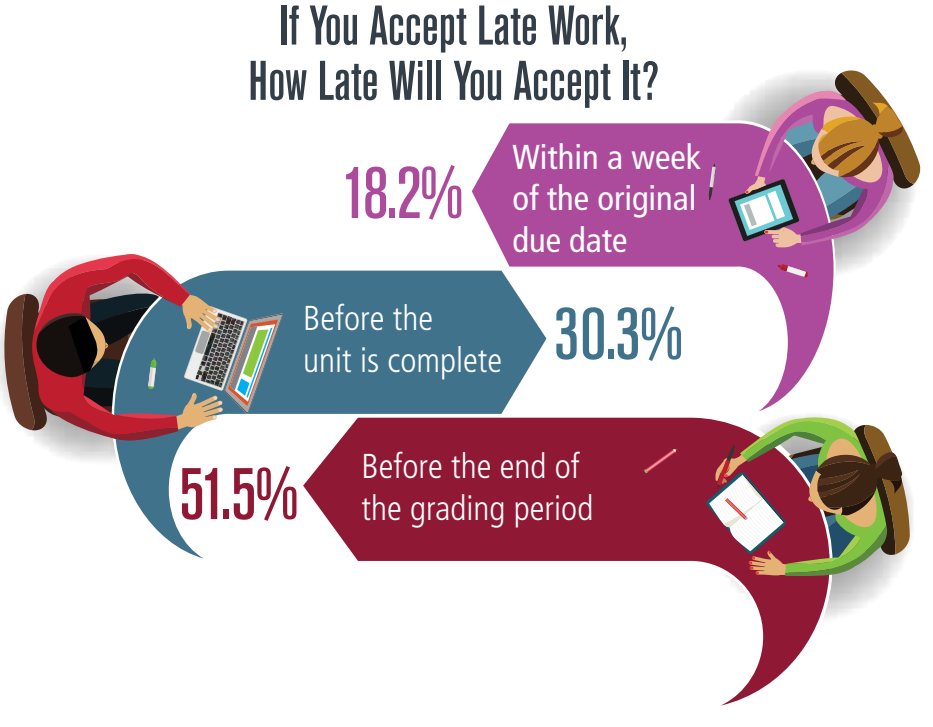
The program is longitudinal. "Third graders will be followed for two years. [We'll have a] brush-up to reinforce the concepts, and reassess them to see if they're retaining the concepts" in fourth and fifth grade, says John.

"One unexpected benefit is that our medical students become role models, [helping third graders] see what is possible for them: a range of careers in health care and science. As we engage them, we are aware that we are influencing young minds," says Bangeranye. "Once the seed is planted, we can follow them to see if they go into other pipeline programs." ●

Organizing for Student Success

Science educators responding to a recent informal *NSTA Reports* poll were nearly unanimous (94.3%) in reporting they incorporate organizational strategies in their science or STEM (science, technology, engineering, and math) teaching. Twenty percent said they prefer students to use digital calendars and reminders to track assignments, 14.3% post assignments and deadlines on the blackboard/whiteboard, 8.6% have students enter items onto a paper calendar, and 17.1% allow students to choose their own tracking strategies. Several respondents indicated they use a combination of methods, particularly posting assignments in the classroom and on digital calendars.

Only 8.6% said they do not accept late work, 31.4% accept late work for a limited time, and an additional 28.6% only do so for a limited time and they deduct points. Of those accepting late work, 51.5% do so through the end of the grading period, 30.3% until the unit is complete, and 18.2% within a week of the original due date. Nearly 53% say they do not require an explanation for late work; 54.3% said they inform parents when work is not turned in on time.



Here's what educators say are their favorite strategies for helping students organize and prioritize their work:

Science notebooks are my favorite way to help students get organized: [b]eing able to flip to the next available page, making their own tables and charts to organize information, keeping up with the table of contents, writing the date[s] on pages, learning how to take notes, how to highlight, how to keep their information organized and accessible. (I let students use their

science notebooks on tests.)—*Educator, Elementary, Middle School, California*

I start off the week having kids list their classes for each day in their planners so they are ready to record assignments and due dates. I also teach them how to use Google Classroom effectively to keep track of missing work and due dates.—*Educator, Middle School, Massachusetts*

Varies with the student, [ranging] from tak[ing] a picture of the board with a phone to writ[ing] in a paper planner. —*Educator, High School, North Carolina*

I like to have students set learning goals regularly and revisit then often to see if they are on track. This also gives me talking points for when I conference with students who are not making good progress in class. —*Educator, High School, California*

No one strategy; I try to have each student develop [their] own strate-g(ies).—*Educator, Elementary, Nevada*

Our school requires them to use a planner. This is on the board. When they enter, they have to update their planner and get their partner to initial it. Additionally, I post due dates and reminders on many whiteboards around the room, as well as online [on a] website. I tell them verbally. —*Educator, Middle School, California*

I keep a class binder with all notes and assignments that students can go to and get what they are missing, no matter why they missed it. This [has] really cut down on wasted time with each student asking me personally. —*Other, Elementary, Middle School, High School, Montana*

Take time to show [them] how to make a [date] due calendar...placing due dates two days before they are actually due...helping them plan for unplanned circumstances.—*Educator, Institution of Higher Learning, Iowa*

Seventh grade: Breaking larger assignments into chunks, discussing how many items need to be completed each day to stay on track, discussing with students what to do when they fall behind.—*Educator, Middle School, New York*

Originally writing the deadlines on the whiteboard for students to copy down as they prefer. Paper agendas get lost, but they rarely lose their phones. A month before exams, I have students sketch out a study plan allocating time for each course *and* completing end-of-term assignments.—*Educator, High School, Manitoba, Canada*

Working with them to address issues; helping them to learn various tools to find what works best for them; identifying issues that keep them from focusing on their academic goals, such as time [spent] gaming or with streaming services.—*Educator, Institution of Higher Learning, Illinois*

[I demonstrate] tools they can use, such as Outlook or Google Calendar, and using them when I schedule meetings with students; creating calendars for the major course assignments in Word and making them available to them in our [learning management system]. (I leave it to the students to add regular weekly assignments like pre-labs, homework.) I encourage students to reach out to me in advance if they are struggling [to meet] a deadline, and will provide them extensions before, but never after the fact. —*Educator, Institution of Higher Learning, Massachusetts*

I use a binder with a Table of Contents page and [do] a binder check each unit.—*Educator, Middle School, Missouri*

Using an agenda. Prioritizing to-do lists.—*Educator, Middle School, Georgia*

Model it myself with calendars, long-term planning, outlining future weeks.—*Educator, High School, California*

Showing them how to use the agenda (modeling).—*Educator, Middle School, North Carolina*

Use multiple methods: whiteboard, digital, oral reminders.—*Educator, Middle School, Texas*

We keep a class calendar [that] lists all assignments and due dates. Students and parents can all subscribe to the same calendar.—*Educator, Administrator, Elementary, Middle School, High School, Institution of Higher Learning, Pennsylvania*

Weekly hard-copy progress reports on a specific day, with rewards for As and Bs, help a lot.—*Educator, High School, North Carolina* ●

Connect With Science Educators at NSTA Boston

"When I think about NSTA's national conference, there's no greater congregation of outstanding science educators from not just our state or country, but [also] around the world," says Sean Musselman, science specialist for Burlington (Massachusetts) Public Schools and conference chairperson. "Every year, I come back from the conference with not only new resources and ideas, but also people I know I can reach out to and learn from. The opportunity to interact with other educators, whether as a presenter or attendee, really fuels us as people and educators."

The 2020 National Conference on Science Education will open on April 2, featuring hundreds of sessions and workshops focused on helping educators improve and enhance their practices. "The opportunity to interact, talk, and share tried-and-true best practices—that's what makes the program so special. Plus there'll be outstanding scientists who can speak to the process of science in real life," Musselman adds.

Many sessions align with the program strands—The Long View: Building a Lifelong Passion for Science; Learning Science in All Spaces and Places: Near and Far; Thinking, Acting, and Communicating Like Scientists: A Focus on Disciplinary Literacy; and Aligning the Lenses: Authentic, Three-Dimensional Measurement of Student Learning—to help attendees target their professional learning goals.

For inspiration and an exploration of how science advances, teachers of science won't want to miss The Kavli Foundation Keynote presentation by Jane Luu, astrophysicist and scientist/engineer at Draper Laboratory in Cambridge, Massachusetts. She will discuss Pluto, the Kuiper Belt, and scientific progess.

JACOB SLATON

Science educators explore new ideas and make professional connections at the National Conference on Science Education.

Other featured presentations include We Love to Hate Assessments; Let's Do Something About It by Aneesha Badrinarayan, senior advisor at the Learning Policy Institute; The Light at the End of the Tunnel: Phenomena and Models to Guide Us by Arthur Eisenkraft, 2000–2001 NSTA president; STEM #IRL: Hurling Science Home and Into the Future by Lindsey Murphy, creator and host of *The Fab Lab With Crazy Aunt Lindsey*; and Navigating Literacies, Navigating Sciences, Navigating Power by Elizabeth Birr Moje of the University of Michigan School of Education. A special panel will explore Building K–12 Data Fluency Within Three-Dimensional Learning, debating what students need to know and the skills they need for data-driven careers, how to get students to use data in meaningful ways, and more.

Conference participants will also be able to participate in special events targeted by grade level, the *Next Generation Science Standards* (*NGSS*), and literacy. The Elementary Extravaganza will feature more than 100 presenters sharing hands-on activities, science trade books, and more resources; while Meet Me in the Middle—for middle school educators—will showcase roundtable discussions, workshops, and a share-a-thon with dozens of presenters. The High School Share-a-Thon will feature opportunities to discuss new ideas one-on-one with presenters and learn about award and grant programs. The *NGSS*@NSTA Forum and *NGSS*@NSTA Share-a-Thon both will focus on three-dimensional teaching and learning, providing a variety of resources to participants. For teachers who need strategies that combine science and English language arts, particularly at the elementary level, Linking Literacy will include small-group "Conversations With Authors" of trade books and suggestions for how to incorporate those books in the classroom.

Best of Show

New this year is the Science Educators' Best of Show program, which helps teachers identify the products and services their peers give top ratings. Using the NSTA app, attendees can cast their votes for their favorite technology, lab equipment, and STEM products and services on display in the exhibit hall, as well as for the Outstanding Vendor, Attendees' Choice Award.

On-site member registration costs $360 for members of NSTA and the Massachusetts Association of Science Teachers. Attendees can earn one graduate-level credit/unit in professional development through Cambridge College for an additional fee. For more information on the National Conference on Science Education or to register, visit *www.nsta.org/boston.* ●

Focus Your Experience with PLIs, Short Courses

Professional Learning Institutes (PLIs) are focused, content-based programs that explore key topics in science and STEM education in depth. PLIs are presented by experts in science and STEM education, professional learning, standards implementation, assessment, curriculum, and resources development. For complete descriptions and a list of presenters, visit *http://bit.ly/38llNtZ*.

- The Next Generation of Language Learning in Science: Engaging Multiple-Language Learners in the Science Classroom
- *The NSTA Atlas of the Three Dimensions*
- Teaching With and Developing *NGSS* Storylines
- Using Technology to Conduct Investigations and Model Scientific Phenomena
- Teaching *A Medical Mystery:* A Digital Middle School Science Unit for the *NGSS*
- Developing Data Fluency Through Citizen Science and Real Data

Short courses are designed for teachers who want to explore the topics in greater depth than is possible in an hour-long session. The nine short courses being offered are

- Building Understandings of Natural Phenomena: Hands-On Learning About Living Things and Their Relationships to Each Other and Their Environment
- A Collection of Climate and Energy Educational Resources, Guiding Teachers Toward Climate and Energy Education
- "I Don't Know What to Write!" Use Models and Activity Summary Boards to Give Students Something to Write About
- Using the "How Do Eggs Become Chickens or Other Living Things?" Storyline to Support Students in Meaningful Engagement in Core Life Science Performance Expectations
- NSTA Press Short Course: Understanding Climate Change
- An Introduction to Using Free, Online CODAP Data Software in Grades 6–14 STEM Classrooms
- NESTA and CIRES: On Board With MOSAiC: Unprecedented Science and Curriculum From a Year in the Arctic
- Assessing What Matters: Designing Equitable 3-D Performance Assessments to Support All Learners
- Equity and STEM

Additional tickets are required for these events.

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Building STEAM With Model Railroads

Are you a science, technology, engineering, arts, and math (STEAM) teacher seeking a new way to interest students in these subjects? While model railroading is not a new hobby, STEAM teachers can accomplish learning goals while introducing it to a new generation of students.

"Over the last 25 years, model railroading has been going through a significant change from relatively simple analog electronics to more complex digital electronics," says Greg Maas, a member of the Amherst Railway Society in Palmer, Massachusetts. "Now trains can run independently of [one another] because of the microprocessors installed in the locomotives. And those microprocessors have to be programmed and fine-tuned, which brings mathematics into the arena. Digital electronics has added the whole world of sound to model railroading. LED lighting has brought even more realism to the hobby. Wireless communications and internet technology have made it possible to run trains with a smartphone."

Maas also points to "the shift to building model railroads in sections that conform to track and electrical specifications (modules). Then modules can be combined to form a working model railroad." Model railroad modules, he contends, "are ideal for high schools and middle schools where space is limited. It is relatively easy to take modules apart and store them in limited space. Yet in building modules, students are learning and using all the model railroad skill sets."

Many model railroaders believe "it is important to include the A (Arts) in STEM education. Scenery planning, design, and execution [are] an important part of model railroading that often takes a back seat to the technology. It shouldn't," Maas maintains.

Julia McMeans, director of education for the San Diego (California) Model Railroad Museum, has developed preK–8 STEAM programs for the museum. As a former elementary and middle school teacher and K–12 curriculum writer, McMeans notes that while model railroading is not part of content standards, it has "meaningful connections with content standards," the *Common Core* and the *Next Generation Science Standards*. She says her programs "are designed to support and enrich and extend what teachers are doing in school," providing "standards-aligned experiences for students" that many teachers can't do because of a lack of time and resources.

In the Working With Scale program, for example, students in grades 6–8 build scale models "to address the math that rail modelers would use," McMeans explains. Students measure their scale models "and use math to scale real-life objects up and down. For example, we scale the Statue of Liberty down to a factor of 1:1. They can see the real-world implications of how scale would be used," she asserts.

Students in grades 3–8 in The Able Arch and the Trusty Truss program learn about the physical science and history of arch and truss bridges and what makes arches and triangles so strong, "why those shapes are attractive to civil engineers," McMeans relates. K–2 students in Communities Then and Now: Making a 3-D Model explore model train layouts of the past and present to learn about science topics like friction, the shape and stability of structures, and properties of matter, along with social studies and history. "They build an actual 3-D model of their community," she notes.

The museum has free resources at *http://bit.ly/2HkNtmM* that teachers can use in conjunction with a museum visit or as a supplement in their classrooms.

More Curriculum Connections

Stacey Walthers Naffah, president of Milwaukee, Wisconsin, model railroad supply company Walthers, suggests other STEAM topics students can learn through model railroading. "Electrical currents make trains move, something that kids can actually see. Speed can regulate movement in a miniature world just as it can in the real world," and students can control it "through a digital controller…People can run their railroad like a real one. Wiring a layout for operations helps to create a truly great model railroad."

Students at the San Diego (California) Model Railroad Museum explore STEM concepts like scale by building a 3-D model of their community.

Model railroading teaches students about how things work, such as gears in a locomotive or steam engines versus diesel engines. "Students can see things in miniature and take things apart to see how they work," says Walthers Naffah.

To make a scene look realistic, knowledge of depth of field is required. "It gives the illusion you can see far off in the distance because you don't have unlimited space [in a train layout]," Walthers Naffah relates.

Students also learn about city planning. "Discovery World [Science and Technology Center in Milwaukee] developed a curriculum for a summer camp called Design Your City…In one week, kids designed and created a small city," as model railroaders do for their layouts, Walthers Naffah reports. Creating scenery brings in art, "which is a very valuable skill," she asserts, and the teamwork and collaboration the children experienced while working on the city helped develop those soft skills.

In addition, students learn about "the economics of our country and how railroads are a part of it, moving people across the country and moving food and other goods. There's a lot to learn about how things are moved around, and the importance of railroads in connecting our country," Walthers Naffah contends.

She suggests teachers visit the website *http://wgh.trains.com* from the World's Greatest Hobby, which features free resources on model train basics.

Blaine Holbrook, treasurer of the Salt Lake City Northern Utah Division and Rocky Mountain Region Director of the National Model Railroad Association, runs the Pizza Box Model Railroad Group for children and their families. "We give kids extruded foam and a track, and they can use their

You don't put tunnels on steep inclines due to erosion.... Conservation, where to plant trees, how mountains are formed can all be incorporated into the build.

—Blaine Holbrook

imagination and build" a train layout with scenery, he explains. "It's a wonderful family activity."

One STEM-related thing children learn is "we had to start cooperating with nature. You don't put tunnels on steep inclines due to erosion, [for example]…Conservation, where to plant trees, how mountains are formed can all be incorporated into the build," he contends.

"How much track do you need? [That brings in] math, circumference," Holbrook notes. The extruded foam that children work with "lasts a long time and can be reused and recycled easily," which offers a lesson on the environment.

At group events or during Holbrook's school visits, children can learn skills like 3-D printing, airbrush painting, design, and planning. Creating scenery allows children to learn about shapes, carving and soldering (with adult supervision), and painting, among other skills. "Building is how students get creative and think," Holbrook maintains. ●

Quotable

In education, nothing works if the students don't.

—Donald E. Simanek, U.S. physicist, educator, and humorist

NSTA Online Course Providers

NSTA partners with professional development providers that offer their online learning opportunities on a continuing basis. These institutions offer short courses as well as degree-granting programs to assist the teacher of science.

American Museum of Natural History

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

Montana State University – Bozeman

Take online graduate credit and non-credit courses for professional development, or work toward one of five 12-credit online graduate certificates (Life Science, Physics, Chemistry, Elementary Science and Earth Science) or an online Master's of Science in Science Education.

California University of Pennsylvania

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

University of Maryland

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

- High quality interactive content for K–12 science teachers
- Earn graduate credits and advanced degrees
- Affordable and user-friendly
- Moderated by world-renowned faculty
- Gain knowledge specific to your area of instruction

https://www.nsta.org/course-providers

nsta
National Science Teaching Association

PULL-OUT SECTION

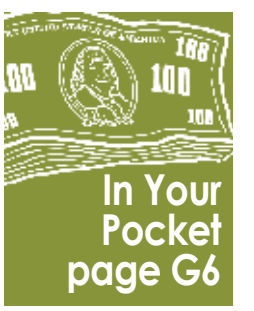
SCIENCE TEACHERS' GRAB BAG

Inside this Convenient Pull-Out Section you will find:


Freebies page G1


News Bits page G3


What's New page G4


In Your Pocket page G6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Freebies for Science Teachers

Bottles-4-Bucks app. K12 HE Promote positive recycling habits at K–college schools and other community venues with this mobile phone app system designed by veteran science, technology, engineering, and math (STEM) educator Mark Supal. With this app, available for both iOS (*https://apple.co/2UiPtnu*) and Android (*http://bit.ly/36MKUEB*) platforms, QR (Quick Response) code stickers are added to recycling bins at participating locations to establish designated sites for collecting (and sorting) items such as returnable bottles, glass, plastic, aluminum, and electronics. Users—students, teachers, and others—earn "green points" on their devices by recycling items at the designated collection sites and scanning the QR code at the bin, as well as the items' UPC codes (if available).

Earned points can be exchanged for such perks as prime classroom seats or parking spots, school event tickets, school store items, study hall or cafeteria passes, outdoor classroom sessions, computer time, or restaurant coupons. For more information, e-mail Mark Supal at *stemwalkers@gmail.com*.

Using Crosscutting Concepts (CCCs) to Prompt Student Responses. K12 Produced by the Council of Chief State School Officers, this primer for K–12 educators and administrators helps users develop consistent, clear prompts structured around the CCCs. The prompts are connected to lesson components and provide a common scientific language for students and teachers as they engage in the formative assessment process. The 68-page document examines the CCCs within the context of the *Next Generation Science Standards* (*NGSS*) and provides lessons and examples of teacher prompts and student responses. In addition, the document includes a Formative Assessment Process Template, which educators can use in developing three-dimensional assessment items. Visit *http://bit.ly/393nnRk* to download the publication.

Mocomi.com. P E M This website has videos, animations, interactive activities, and more to engage students ages 4–14 in learning core subjects, including science. The site offers a range of resources on kid-friendly topics, from video experiments such as *How to Magically Blow Up a Balloon* (ages 6–12) and *Can Magnets Attract Anything?* (ages 9–14) to animations such as How Do 3D Films work? (ages 7–14), Why Do Crabs Walk Sideways? (ages 8–12), and Why Do Astronauts Float in Space? (ages 7–14). Teachers also can access online interactives to help students understand fundamental concepts in chemistry (e.g., Structure of an Atom, ages 7–14), biology (e.g., Classification of Plants, ages 8–12), and physics (e.g., Types of Motion, ages 7–14). Search for resources by subject category (e.g., biology, chemistry, experiments, physics, or technology), media type (e.g., animation, interactive, video), student age, or most downloaded at *http://bit.ly/2tnnjwx*.


ANEY

Mystery Bags, Revisited. E With paper bags and a few household items, you can spark scientific thinking and involve K–5 students in authentic science and engineering practices, including gathering and recording evidence and communicating ideas. A video from STEAM Café—found at *https://youtu.be/KRvwKpproO4*—walks viewers through the classic Mystery Bag activity, but updates it with questions that propel scientific thinking and maintain curiosity. (Hint: It's about the process: Don't open the bags!) Click on the link in the video's description to access the full activity lesson plan and accompanying student sheets (free registration required).

Earth Science All Around. K12 Check out the website and resources based on the teacher workshop Using 360 Imagery to Support Place-Based Instruction, held recently at an American Geophysical Union conference focused on place-based instruction. During the workshop, teachers explored watersheds using online modeling apps such as Runoff Simulator and Model My Watershed, which allow users to adjust parameters and consider effects of different ground cover scenarios. Teachers also learned how to capture 360-degree camera images, locate 360 images online, and design a place-based instructional scenario (e.g., a virtual field trip) that connects 360 images and geoscience topics using their own images and those available in Google Street View.

Earth Science All Around, the workshop's companion website, provides access to the tools used in the workshop along with background information on place-based instruction, resources on designing virtual field trips, and tips on capturing and using 360 imagery. Refer to the website *http://bit.ly/395s2C4*.

Science Modeling Talks! K12 HE Developed by the American Modeling Teachers Association and hosted by media

See Freebies, pg G2

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

Freebies, from pg G1

producer Mark Royce, this podcast series introduces top science modeling teachers and education thought leaders in a relaxed and conversational interview format. Model-based instruction helps K–college learners build, extend, elaborate, and improve the accuracy and completeness of mental models they create themselves to explain STEM phenomena. The podcast series covers various facets of modeling instruction from its premise of "collaborative sensemaking" to stories of "aha" moments teachers experience when using this approach. The episodes run from 30- to 60-minutes long and include Show Notes, which list interview highlights and link to the program transcript. Listen at *https://sciencemodelingtalks.com.*

ABF

AMA Aviation Model Tutorials. E M Use these instructional tutorials from the Academy of Model Aeronautics to explore the physics of flight and engineering design with elementary and middle level students and aviation enthusiasts of all ages. The tutorials can be used in various educational settings (classroom, afterschool program, camp, and home) and feature directions for building several different aircraft models. Featured models include airplanes from foam plates, jet stream gliders, paper airplanes, rockets, and parachutes. The site also has supplementary resources—such as a sample parent letter, enrollment form, and promotional flyer—for educators interested in hosting their own aviation-themed event. Visit the website *http://bit.ly/31AP1lV.*

The Supertrees Project. M H Use this multimedia photo essay and text to engage middle and high school students in exploring climate change topics. Produced by Vox Media, the essay combines text, 360-degree camera imagery, and infographics to highlight three important supertrees, each known for a specific ecological superpower useful in mitigating climate change. For example, the Brazil nut tree (*Bertholletia excelsa*) is known as a rainmaking icon of the Amazonian rain forest; Indonesia's stilt mangrove (*Rhizophora*) is known as the country's carbon guardian; and with its ability to support other species and the ecosystems around it, the African teak tree (*Pericopsis elata*) is known as the "forest caretaker" of the Democratic Republic of Congo. At *http://bit.ly/2SmTbcY,* view the supertrees up close and learn more about how each tree "works."

Marine Activities, Resources, and Education (MARE) K–8 curriculum guides. E M Developed at the University of California, Berkeley's Lawrence Hall of Science, these ocean literacy curriculum guides enable K–8 audiences to study ocean science and marine habitats continuously throughout the elementary and middle level years. The primary curriculum addresses familiar marine habitats such as ponds (kindergarten), life at the seashore (first grade), sandy beach (second grade), and wetlands (third grade), while the curriculum for upper-elementary students broadens to focus on ocean habitats, such as the kelp forest (fifth grade) and the open ocean (sixth grade). At the middle level (grades 7–8), learners explore the Ocean-Atmosphere Connection and Climate Change. See *http://bit.ly/3bpbszk.*

STEM Teaching Boxes. K12 Developed by the National Center for Atmospheric Research and managed by the University Center for Atmospheric Research, these thematic collections of classroom-ready, standards-supported activities, content, and multimedia can expand K–12 students' understanding of STEM topics. Each box contains high-quality vetted resources on Earth science topics such as satellites and weather, greenhouse effect, El Niño, the Sun, tornadoes, air quality, climate and water, and flash floods. While most are targeted to middle and high school levels, two boxes are best suited to elementary learners: Winter Weather (grades K–3) and Clouds (grades 3–6). Consult *https://scied.ucar.edu/teaching-box.*

Blue Origin's Club for the Future. K12 This nonprofit organization aims to inspire K–12 students and others to pursue STEM careers and help visualize the future of life in space. Club members participate in space-themed activities involving Blue Origin's reusable rockets. First, in the Launch Your Vision on a Rocket mission, members share their future vision of living and working in space on the blank side of a self-addressed, stamped postcard, and mail the postcard to club headquarters. The first 10,000 postcards received will fly aboard the Crew Capsule on an upcoming New Shepard flight.

Once the spacecraft returns to Earth, the postcards will be mailed back to participants, officially stamped "flown to space." To participate, visit *https://www.clubforfuture.org.*

MARTINVL

Hands-On Astronomy Activities. E M The California Academy of Sciences has hands-on and kinesthetic astronomy lessons for elementary and middle level students that support the *NGSS* and can be used at home or in the classroom. By doing a Mars Opposition Dance (grades 3–8), for example, students come to understand astronomical terms such as opposition, conjunction, and retrograde. In Worlds in Comparison and Moons in Comparison (grades 3–6), students model the relative size of the planets and moons using modeling clay. Other model-based activities develop student understandings about cardinal directions (Which Way Is North?, grades 3–5), solar eclipses (Modeling Eclipses With Science and Distance Scales, grades 3–8), and the reasons for the seasons (Longer Days, Shorter Nights, grades 3–8). See *http://bit.ly/2SkWv8s.*

Type 2 Diabetes Learning Modules for High School. H Genome Sciences Education Outreach at the University of Washington in Seattle has released two learning units for high school health and biology courses. The modules —Health, Nutrition, and Type 2 Diabetes and Biology, Homeostasis, and Type 2 Diabetes—use the phenomenon of increased growth of type 2 diabetes as the unifying context for exploring concepts in nutrition, homeostasis, genetics, and more. The multi-lesson modules (with five lessons each) support the *NGSS* and incorporate the use of creative instructional practices, such as a Silent Chalk Talk Posters activity or a Scenario Scaffold game activity. Both modules feature teacher's guides, necessary student materials, and assessments. Download both modules from this website: *https://gsoutreach.gs.washington.edu.*

eSchool News K–12 Robotics Guide. K12 This online publication covers everything teachers need to know about robotics education. The guide presents articles, company profiles, and other resources to manage robotics instruction in K–12 classrooms. Article topics address key trends in robotics education, the essential elements of successful robotics and coding programs, and robotics learning apps for the classroom. In addition, the guide includes tips and information on obtaining grants to fund robotics programs and provides examples from teachers who have implemented highly successful robotics programs at their schools. See *http://bit.ly/2UrCIH9.* ●

News Bits

- **Among science, technology, engineering, and math (STEM) trends for 2020: Teachers of color needed.** A

A report from 100kin10, a national network of organizations and agencies, found people of color make up half of the nation's student population, but only 20% of educators overall (and even fewer STEM teachers). The organization's goal is to train and retain 100,000 STEM teachers by 2021. "[To] increase student engagement and success in STEM, students of color need to see STEM teachers who look like them," 100kin10 claims.

Other 2020 trends include early exposure to STEM before kindergarten; a rise in environmental literacy related to student activism; a more comprehensive approach to technology and increasing digital literacy for teachers and digital citizenship for students; and increased interest in computer science. Challenges include districts in rural areas being isolated from STEM opportunities and a need for more educators to teach computer science courses. See *http://bit.ly/2v0cd0F*.

- **Student readiness for higher-level computer classes requires early exposure to coding and programming.** E M

Rob van Nood, an educational technology specialist in Oregon, maintains that because coding and computer science courses were only offered to high school students in the past, a gap exists in skills such as problem solving, designing, and computational thinking. Integrating coding and computer science beyond the lab is key, he contends, and incorporating coding and programming in elementary and middle school core curricula requires a commitment from classroom teachers and instructional technology specialists. Visit *http://bit.ly/2OhJMSQ*.

- **New Mexico's Public Education Department approved a digital animation and video curriculum for middle school math students.** M

With funding from the U.S. Department of Education, the National Science Foundation (NSF), and other organizations, New Mexico–based MidSchoolMath LLC has developed a program that uses interactive storytelling to engage students in virtual worlds where they use math to solve problems. For example, one game takes place on a sea vessel, and students learn algebra while navigating the ocean, trading spices, and contending with pirates. As students solve problems faced by the video characters using an online math simulator, a teacher dashboard simultaneously provides feedback on students' work.

The program is used in 17 states, reaching nearly 40,000 middle school students. New Mexico districts will use simulations that address state core middle level math standards.

Turquoise Trail Charter School in Santa Fe has used MidSchoolMath for three years. "It engages the kids in problem solving," says principal Sharyn Gray. "They have to think about what's actually needed to solve a math problem...And the concept of teaching math through storytelling gives context for the students to understand why they're doing the math." A three-year NSF-funded study found the program produced positive results. See *http://bit.ly/2UfV3qF*. ●

What's New

FROM U.S. GOVERNMENT SOURCES

U.S. Fish and Wildlife Service (FWS)

Antlers! 12 Amazing Facts K12

Did you know that antler tissue is among the fastest-growing animal tissues on the planet? Antlers can grow up to an inch per day. While browsing the dozen factoids presented in Antlers!—a photo essay from the National Wildlife Refuge System—K–12 students learn about elk, caribou, moose, white-tailed deer, and other antlered animals of North America.

Featuring photographs of antlered animals in natural habitats taken in National Wildlife Refuges, the essay informs students and teachers about the biological characteristics of antlers, as well as the role of antlers in the mating process. The essay also explains the differences between horns (a feature of bovine animals) and antlers (a feature of the deer family), which are often incorrectly used interchangeably. Access this resource at *http://go.usa.gov/xpVbW.*

Junior Duck Stamp Art Program Curriculum Guides K12

The FWS Federal Junior Duck Stamp art program combines science and art to teach K–12 students about the importance of wetlands and the species that live there, especially ducks. In addition to an annual art contest, the program offers four activity-packed curriculum guides tailored to meet the needs of specific audiences—student, classroom teacher, informal education specialist, and homeschool educator. Though the guides are written for middle level learners, the activities can be used with students of any age, as all of the activities encourage students to engage with the natural world and develop a deeper appreciation of natural resources. Visit *http://bit.ly/2OsgAJ5.*

Library of Congress (LOC)

Examining the Origin of Federal Air Pollution Policy M H

Use this activity from the Teaching With the LOC blog to help students understand when and why society began to focus on the impact of air pollution on the environment, as well as give them practice working with and interpreting primary source documents. Most appropriate for middle and high school levels, the activity guides students through the process of analyzing documents relating to the 1948 air pollution environmental disaster in Donora, Pennsylvania, in which thick smog covered the city for four days, resulting in 19 deaths and adversely impacting the health of more than 1,440 residents. The activity includes links to newspaper articles relating to the event, as well as the Primary Source Analysis Tool, which students can use to organize their reflections on and responses to the documents. Refer to *http://bit.ly/2Uql4DN.*

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

Analyzing Geographic Data Using Historical Atlases H

Examining historical statistical atlases allows students to practice geographic thinking and data literacy skills while gaining insights into American history. A post from the Teaching With the LOC blog describes the process using statistical data from the 1890 census. Most appropriate for the high school level, the activity asks students to compare and interpret historical data on population density presented in three different formats: a bar graph, map, and text. Students then interpret multiple visualizations on different subjects and discover how analyzing these representations together tells an even bigger story. Read the post and learn more about using historical data to develop data literacy skills at *http://bit.ly/39b8exm*.

National Oceanic and Atmospheric Administration (NOAA)

The Monitor National Marine Sanctuary Resources E M H

The Monitor National Marine Sanctuary offers hands-on educational resources for teachers, including science, technology, engineering, art, and math (STEAM) activities, social studies activities, lesson plans, and guides. The resources are organized by theme: Civil War and *USS Monitor,* Shipwrecks and STEM (science, technology, engineering, math), Wrecks as Reefs, Outer Banks Trail, and Newsletter Archives. They feature experiences best suited for students in grades 4–8 and 6–12. Browse the activities at *http://bit.ly/36ZBwxh*.

Mock Shipwreck Lesson Plan E M

In this activity for grades 4–6, students participate in simulated archaeological and historic research to solve mysteries surrounding the "wreck" site: What ship is it? Who sailed her? How did she sink? What role did she play in our maritime heritage?

Developed by NOAA's Office of National Marine Sanctuaries, the simulation provides opportunities to model archaeological techniques while also developing math, science, and problem-solving skills and delving into historic research. In addition, it generates excitement for maritime archaeology and piques students' curiosity about the people who lived and worked along our coasts and the events that shaped who we are today. Learn more and access the lesson plan at *http://bit.ly/2unD8nf*.

National Aeronautics and Space Administration (NASA)

Digital Badging K12

Digital Badging is an online professional development process for certifying learning. The NASA STEM Engagement and Educator Professional Development Collaborative's Digital Badging System allows you to select from a wide variety of STEM topics, engage in learning opportunities, demonstrate your mastery of the topic, and receive a badge of accomplishment for your work to share with others. Choose from more than 30 Educator badges (hover over the topics of interest to read a short abstract of program content). *Note: Teachers must create a free account on the Digital Badging site to get started.* Refer to *http://bit.ly/2OyH3V4*.

Explore Mars Game E M

Excite students in grades 3–8 about Mars exploration with this interactive game. Developed in anticipation of NASA's Mars 2020 mission, the game lets students maneuver a rover on Mars' surface, program it to collect and analyze rocks, then transmit its data to scientists on Earth. In this way, students model processes similar to those used by mission scientists while learning about Mars.

Teachers can access an activity, Make a Moon or Mars Rover Game, that can deepen students' understanding of space mission–planning as they design their own computer Mars exploration game using Scratch, a visual programming language. Visit *https://go.nasa.gov/2Q9EWbK*.

Earth Day Posters A

NASA has a collection of illustrated posters suitable for the annual celebration of Earth Day. High-resolution printable PDF files are available for download. Topics covered include life science and nature, Earth and space science, and the 2017 total solar eclipse. You'll find these posters at *https://go.nasa.gov/31xjRvY*.

U.S. Department of Energy (DOE)

Hydrogen and Fuel Cells Career Map M H HE

At *http://bit.ly/2O0SFjA,* mouse over the career map to show middle level to college students the range of potential careers in the hydrogen and fuel cells industry. The DOE-produced map features industry-related jobs in fields such as Research and Development, Engineering, and Manufacturing; Operations and Management; and Communications, Training, and Outreach, and includes positions in every category along the career path from entry level to advanced.

STEM Resources on Nuclear Energy K12

Use these resources from the DOE and its partners to introduce K–12 audiences to nuclear power, one of the cleanest and most reliable energy sources in the United States. The website at *http://bit.ly/3bdvFrC* presents three types of learning materials to discover more about the topic: lessons and activities, multimedia resources, and career information. Of particular interest is Navigating Nuclear: Energizing Our World, a standards-supported curriculum for middle and high school levels developed collaboratively by the DOE, Discovery Education, and the American Nuclear Society. The resource combines classroom lessons, virtual field trips, and career profiles to give students a clear glimpse of the nuclear industry.

U.S. Environmental Protection Agency

Planet Protector Resources E M

EPA's Planet Protector activity booklets can be used to inspire K–8 students to take an interest in reducing, reusing, and recycling. Available in Spanish and English, the four booklets—*The Case of the Broken Loop, Follow That Trail, Trash and Climate Change,* and *Planet Protectors Create Less Waste in the First Place!*—contain games, puzzles, and vocabulary to encourage resource conservation and promote recycling and other waste reduction efforts. The website also includes resources to support a school conservation club, such as a Planet Protector club fact sheet, membership badge, activity calendar, and certificate of completion. Access these resources at *http://bit.ly/2H1APZH*.

Idaho National Laboratory (INL)

A Parent's Guide to STEM M H HE

This 16-page booklet from the INL offers tips for how to better encourage middle, high school, and undergraduate students in pursuing careers in STEM fields. The book shows readers where to find STEM inspiration in the community, and debunks myths and stereotypes about STEM, such as STEM jobs are isolated and lonely or that girls do not like math or science. The book also advises students about the most appropriate coursework to take in high school if interested in STEM fields and provides information about various STEM-oriented internships and scholarship opportunities for high school and undergraduate students. Consult *http://bit.ly/3bbDVIt*.

USA.gov

Videos About Government Careers E M

At *http://bit.ly/2MFOqcu,* educators can access video profiles and transcripts highlighting more than 20 men and women in careers in the federal government. Targeted for students in grades 3–8, these short videos represent fields such as animal science and care, engineering and science, military and security, and health care. Among the professions mentioned are an animal keeper at the National Zoo, an aerospace engineer working on the James Webb Space Telescope, a Marine pilot, a White House chef, and a fitness instructor at the Federal Bureau of Investigation's National Academy Training Program. Each profile describes daily life on the job and offers advice for students interested in pursuing a career in the field. ●

In Your Pocket

Editor's Note

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

March 21–31

PCS Edventures Curriculum Giveaway E M

Educators can win a Drone Designers (grades 4–8) or Plants and Seeds (grades 1–3) curriculum and equipment system by entering this giveaway. These two science, technology, engineering, arts, and math (STEAM) curricula will interest young botanists and aerial enthusiasts and allow them to explore career paths.

Schools, libraries, clubs, and afterschool programs can enter for a chance to win a free set of materials. Two winners will be selected, one winner for each program. Enter by **March 21** at *http://bit.ly/37Q9uFM*.

National Public Radio (NPR) Student Podcast Challenge E M H

Students in grades 5–12 can create three- to 12-minute podcasts on any topic. They might, for example, tell a story about their school or community, a moment in history, what they might want to change about the world, or something they understand that grownups do not. Students can work as a class or with an extracurricular group to make their podcast, but a teacher must submit their entry. Winners will be interviewed by NPR or have their podcast discussed in a news segment for *All Things Considered* or *Morning Edition*.

Learn more at *https://n.pr/37PtzvX*. Enter by **March 24.**

Host an ARISS Contact M H

Amateur Radio on the International Space Station (ARISS) gives U.S. students a chance to speak with astronauts living and working in space. Students get 10 minutes to ask questions and get answers from astronauts in real time. The ARISS program seeks organizations that will draw numerous participants and integrate the contact into a well-developed education plan. That means students should be studying topics related to space technology, exploration, and research and learn about wireless technology and radio science before contact.

ARISS provides planning guides, online information sessions, and other resources to help applicants prepare their proposals and also connects them with local radio amateurs. Proposals are due by **March 31.** Consult *http://bit.ly/2SkI6JI*.

EJK Mini-Grants P K12

The Ezra Jack Keats (EJK) Foundation provides $500 grants for public schools and libraries with innovative programs that support or extend the *Common Core*. Projects should foster creative expression, collaboration, and community for preK–12 students and be informed by Keats' books, life, and vision. Public schools, public libraries, and public preschool programs, such as Head Start, in the United States and its territories can apply by **March 31.** See *http://bit.ly/1ZzqINI*.

April 1–6

Frances R. Dewing Foundation Grants P E M

These grants fund projects or programs focused on early childhood education. Of particular interest are those at new, untried, or unusual educational organizations that aim to introduce new methods for children from age 2 to sixth grade. Grants range from $1,000 to $20,000, but average $5,000.

Programs must be located in the United States and have tax-exempt status. Submit proposals by **April 1;** see *http://bit.ly/2OeOiUM*.

NiSource Charitable Foundation Grants K12

These grants support communities where NiSource employees and customers work and live: in Indiana, Kentucky, Maryland, Massachusetts, Ohio, Pennsylvania, and Virginia. Nonprofit organizations with programming in these areas are eligible:

- science, technology, engineering, and math (STEM) and energy education;
- economic and workforce development;
- environmental stewardship; and
- safety.

See *http://bit.ly/2GnKHhu*. Apply by **April 1.**

American Chemical Society's Dorothy and Moses Passer Education Fund HE

This $1,000 award supports continuing education activities for teachers at two- and four-year colleges and universities that don't have graduate programs in the chemical sciences. Activities should directly relate to the recipient's teaching and take them off campus. Applicants must be full-time faculty and registered Division of Chemical Education members 60 days before applying. Funds can be used for transportation, housing, and meals.

Consult *http://bit.ly/XFpNZT*. Apply by **April 1.**

Pilcrow Foundation Children's Book Project Program Grants P K12

This program provides a 2-to-1 match for rural public libraries that receive a grant through its Children's Book Project. It also contributes $200–$400 through local sponsors for purchasing up to $1,200 worth of new hardcover children's books. The foundation provides a list of more than 500 titles to choose from.

Libraries must be in rural areas, raise $200–$400 through a local sponsor, and have an active children's department and a limited operating budget. Those with budgets of less than $50,000 receive priority, though town libraries with budgets of more than $150,000 may also apply.

Applications must be postmarked by **April 1.** See *http://bit.ly/31HYp7H*.

The Sparkplug Foundation Grants A

These grants go to organizations with new projects in education, music, and community organizing. Grants should spark change and encourage sustainability. "Smallish" organizations with small budgets that are less likely to receive corporate, government, or institutional funding are preferred. Projects anywhere in the United States or Israel/Palestine are eligible.

Answer preliminary application questions at *http://bit.ly/3951SQ8* by **April 6**.

April 10–15

AFCEA STEM Teacher Graduate Scholarships HE

In partnership with NSTA, the Armed Forces Communications and Electronics Association (AFCEA) awards these $2,500 scholarships to those pursuing a graduate degree, credential, or licensure to teach STEM in grades K–12. Graduate-level applicants should be attending an accredited U.S. college or university on campus and majoring in education; enrolled in at least two semester-equivalent classes per term; and have a minimum 3.5 GPA.

Credential or licensure applicants must have a bachelor of science degree or a master's degree in a STEM field. Applicants must be U.S. citizens. Apply by **April 10** at *http://bit.ly/2Strmlj*.

McCarthey Dressman Teacher Development Grants K12

These grants go to small teams of teachers who plan to develop and implement groundbreaking K–12 instruction. Funds should help teachers integrate fresh strategies that encourage critical inquiry and observe their effects on students. Teachers write and reflect on their projects and share their insights with other educators.

Licensed K–12 teachers employed by public or private schools with the background and experience to successfully complete such projects may apply. Those willing to partner with the foundation receive up to $10,000 per year for up to three years. Apply by **April 15** at *http://bit.ly/3bjUF0s*. ●

NSTA School Partner Program

Each Partner School receives these benefits:

- **NSTA membership** for all teachers in the school building
- **One free conference registration** for a teacher/administrator to a STEM Forum or an NSTA Conference
- **Recognition** as an NSTA Partner School
- **One print journal** for the school building and e-journals for every teacher/member in the school
- **One hard copy of *NSTA Reports*** (newspaper) with e-Reports for every teacher/member in the school
- **Access to Learning Center Forums**, including collections of *NGSS* and STEM resources differentiated by grades
- **An initial one-on-one conversation** with NSTA to determine which products and services can best support school-wide professional learning goals
- **Participation in three virtual conferences** per year, exploring critical topics for STEM and *NGSS* integration
- **Access** to a national *NGSS* and STEM listserv and 16 other listservs

In addition, each teacher gets discounts on

NSTA conferences and workshops

NSTA Press books

Enhanced e-books

For more information please visit
www.nsta.org/schoolmembership

Contact us:
schoolmembership@nsta.org

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Summer Programs

Editor's Note

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

Library of Congress Teacher Institute on Science, Technology, and Engineering K12

K–12 teachers, school librarians, and curriculum or professional development specialists can spend a week at the Library of Congress exploring its primary sources for use in science education. The institute will cover topics like the nature of science, science and engineering practices, the historical context of discovery and invention, and the interdependence of science, technology, and engineering. Teachers will work with library education specialists and collections experts to develop a primary source–based activity on these topics for use in their classrooms. Educators will return home with strategies for using this activity and share the outcome with their cohort.

The institute takes place July 6–10 in Washington, D.C. Tuition and materials are provided at no cost. Apply by **March 23;** visit *http://bit.ly/3b5fDjr.*

San Diego Zoo's Teacher Workshops in Conservation Science M H

The zoo's Institute for Conservation Research, Conservation Education Division, invites middle and high school teachers and informal educators to attend these workshops. Educators from around the world will visit the zoo's research headquarters in Escondido, California, to learn about wildlife conservation. Participants engage in cutting-edge lab and field activities focusing on critical issues facing endangered species. These activities support the *Next Generation Science Standards* (*NGSS*) and can be implemented in the classroom.

Formal grades 6–12 educators are advised to form on-site teams composed of 2–3 members, with at least one science teacher "anchor" and 1–2 non-science teachers interested in incorporating conservation in their subjects. Grant-funded scholarships include meals and lodging and a $500 stipend. Apply by **April 12.** See *http://bit.ly/37YJ3xV.*

Wings Over Water STEM Education Program M H

This program sparks middle and high school students' interest in science, technology, engineering, and math (STEM) research through studying ospreys. Teachers attend an all-expenses-paid workshop June 22–26 in Missoula, Montana, where they do field work and collect data. They return to their classrooms with data and *NGSS*-based curriculum.

Visit *http://bit.ly/36TwmTy.* Apply by **April 17.**

ARRL Teachers Institute on Wireless Technology E M H HE

This institute is offered at two levels: Introduction to Wireless Technology (TI-1) and Remote Sensing and Data Gathering (TI-2).

TI-1 provides tools and strategies for teachers wishing to learn more about wireless. It covers basic electronics, understanding signals, radio applications in the classroom, microcontrollers, and robotics, as well as options for those who want to start radio clubs and find career and scholarship opportunities for students or grants for their own programs.

TI-2, the advanced institute, provides hands-on instructional resources and equipment and covers sensor basics, deployment methods, and an introduction to satellite communications.

Applicants must teach in a school, college, or educational organization serving students in grades 4–12 or lead a school-affiliated enrichment program. Apply by **May 1;** see *http://bit.ly/2DyyDa1.*

OxBridge Academic Programs Educator Seminars A

These seminars are held at two of the world's leading universities: Oxford and Cambridge. Educators meet with scholars, writers, and public figures to study topics ranging from environmental studies at Oxford (July 5–12) to thinking mathematically at Cambridge (June 26–July 3). Apply by **May 15;** visit *http://bit.ly/2GSiPRv.*

University of Cambridge's Science Summer Programme A

Located in the United Kingdom, the university's Science Summer School offers courses for teachers, other professionals, and undergraduate and graduate students. Participants can attend for one, two, three, or four weeks. Term 1 (July 5–18) features courses in microbiology, genetics, crystallography, and more. Term II (July 19–August 1) courses include solar energy science, cryptography, and sustainability.

Those with a strong interest in science but little formal training may apply, though some courses require knowledge of differential calculus and integral calculus and fluency in high school algebra and geometry. Register by **May 17.** Consult *http://bit.ly/2Onjsa3.*

Science Olympiad Summer Institute M H

Taking place in Phoenix, Arizona, July 13–17, this institute helps middle and high school teachers, administrators, coaches, event supervisors, and tournament personnel and administrators stay current on all 46 Science Olympiad events. Participants attend sessions designed to improve any school's Science Olympiad program and meet state science benchmarks and standards. Two credit hours from the University of the Pacific are available, and participants can apply for Title II Teacher Quality program funds by contacting their school district's science curriculum administrator.

Visit *http://bit.ly/2GOusJj.* Apply by **June 1.**

Ecology Project's International (EPI) Baja Teacher Workshop K12

This four-day workshop (June 4–7) takes teachers to the Gulf of California to help local conservationists re-establish coral reef species. Teachers develop lessons and methods supporting *NGSS* to make their experience relevant for their students. Register at *http://bit.ly/2v4uo5H.*

EPI *NGSS* Training Courses K12

EPI also hosts courses for science educators and administrators that blend field research, experiential learning, and practical methods teachers can use in their classrooms. Educators can participate in conversation projects at these locations:

- Costa Rica Rainforest Ecology, June 19–25 and June 29–July 5;
- Galapagos Islands, July 18–26; and
- Yellowstone Wildlife, August 8–15 and August 18–25.

Informal educators and students in education also may apply. Visit *http://bit.ly/2GOHDtA.*

Audubon Hog Island's Sharing Nature: An Educator's Week A

During July 12–17, educators will visit Maine's Hog Island to hear instructors share their favorite approaches, methods, and activities for engaging children and adults with nature. Workshops include techniques in journaling, art, music, theater, and other disciplines to help teachers develop methods to use with their students. Participants also will explore an Atlantic puffin and tern colony on Eastern Egg Rock and hike the island's unspoiled spruce-fir forest.

Scholarships for teachers of color and continuing education credits from the University of Southern Maine are available. Visit the following website: *http://bit.ly/2GTS1QX.*●

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

This year's STEM Forum offers the following strands of programming:

Lower Elementary/Early Childhood

Students in the lower elementary grades are beginning to understand the world around them and the role they play in it. Sessions in this strand will emphasize open-ended and active exploration, learning through play, and hands-on investigations of the real world through the lens of *NGSS*.

Upper Elementary

How do we respond to research that indicates that by the time our students reach the fourth grade, a third of them will lose interest in science? The sessions in this strand showcase hands-on, interactive programs and instructional strategies that support STEM and have been successfully integrated into the elementary core curriculum.

Middle Level

Engaging students through opportunities to explore STEM fields of study is a top priority at the middle school level. The sessions in this strand showcase learning environments where science, technology, engineering, and mathematics interconnect to serve as a vehicle for discovery, innovation, and independent problem solving.

High School

In preparation for entry to college and industry, students must be able to apply their understanding in the context of real-world problem solving. Workshops in this strand showcase the three-dimensional ways educators are addressing the challenges of engaging students with their communities in STEM while meeting science, mathematics, and computer science standards.

Building STEM Ecosystems: Community Partnerships

Students learn in many spaces outside of the formal classroom, engaging and interacting with science and technology in various places with a wide range of different people. The sessions in this strand highlight select successful preK–16 partnership initiatives.

Postsecondary

Join our community of postsecondary educators as they discuss important and relevant topics in STEM education in this unique Edcamp/unconference format. Sessions in this strand will highlight pedagogical and discipline-based research on STEM teaching and learning.

#STEMforum

REGISTER NOW AND SAVE!

JOIN US FOR THE

9TH ANNUAL

STEM Forum & Expo

LOUISVILLE, KY / JULY 22–24, 2020

Hosted by nsta

If you are searching for ways to immediately and effectively apply STEM education in a preK–16 setting or to implement STEM as a best practice, you should plan to attend this dynamic event. Educators and organizations who are actively implementing STEM programs in their school and districts will come together to share tactics that work.

NSTA Members receive a deep discount and, if you register before the May 8 Earlybird deadline, you'll enjoy the maximum savings.

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NSTA District Professional Learning Packages

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Bring NSTA to your district to guide your implementation of *A Framework for K-12 Science Education* and 3D standards. Transform classroom instruction with programs tailored for

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- Curriculum leaders
- Classroom teachers

"My teacher facilitators now have a much deeper understanding of what to look for when evaluating materials. I also have a much clearer vision for leading this work. Having this training before the curriculum review process is such a perfect sequence! I believe that this training will lead to continuing work in our region, and I hope to provide a structure to continue the work/learning. Thank you so much for working with me to bring this training to the region."

—Educational Services District Leader

Ask Us About Professional Learning Training for Districts

- **Making Sense of Three-Dimensional Teaching and Learning:** Give teachers a foundational understanding of the standards and shows them what three-dimensional instruction looks like in classrooms (modeled for each grade and discipline).
- **Administrator Institutes:** Help administrators design professional learning around 3D science standards, assessing current capabilities of teachers, and setting goals for professional learning.
- **Designing Three-Dimensional Lessons and Units:** Build your team of experts by giving them a powerful tool kit of resources and a solid understanding of three-dimensional standards. This workshop also empowers participants to work with their colleagues around the new standards.
- **Online Book Study and Discussion Forum:** This series of four web seminars combines asynchronous thought activities with discussions in private forums to give districts a flexible option for learning about three-dimensional instruction.
- **Or let us tailor a program for your needs.**

For more information, visit *www.nsta.org/district* or email *ngss@nsta.org*.

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Changes at NSTA

By Dennis Schatz, NSTA President (2019–2020)

Major changes are happening at NSTA—all to better serve you. First, we changed our name to the National Science Teaching Association, shifting our focus from being a club of individuals to an interactive and supportive community of science educators with access to an abundance of resources. We will not only continue to meet the needs of the classroom teacher of science, but continue to expand our community to include a broader set of educators serving youth in museums, nature centers, afterschool programs, and even at home.

We also introduced a new logo. People interpret it many ways. Is it a butterfly or a flower? Maybe it is the path of planets orbiting a star, or electrons orbiting a nucleus? Individuals can find something representing their interests in the logo, which is indicative of the new way that NSTA will better serve you.

We will launch an updated website this spring, opening the door to everything we offer to serve your needs. You will be able to quickly find information and resources most relevant to what you teach. Once you provide some basic information, we will share the journal articles, books, lesson plans, and professional development opportunities most relevant to your needs. You will be the first to know of new resources in your areas of interest!

Those who prefer to interact with websites via tablets or phones will find the new website more readable and easier to navigate.

We've heard from many that you love our journals and books, with their in-depth descriptions of science experiences and their alignment to the *Next Generation Science Standards*. We also heard you want shorter lesson plans that focus on the materials and step-by-step implementation instructions. You will find a selection of these—with more to come—by searching the website using keywords related to your topic of interest.

Of course, you will be able to access the existing services and resources. The NSTA Learning Center will continue to offer Science Update web seminars and virtual conferences, and help organize the useful resources found across our redesigned website.

Be sure to share these wonderful changes with your colleagues who may not have experienced NSTA. New membership opportunities—including a free membership—may be of interest to them. The free membership will allow them to sample a limited number of the great NSTA resources relevant to their teaching.

Many members have said they believe receiving paper publications is environmentally unfriendly. For these members, the new digital membership option will send the journal of their choice to them electronically. They will be able to read the entire journal, as well as download articles of special interest. In addition, they will have electronic access to all five journals published by NSTA: *Science and Children, Science Scope, The Science Teacher, Connected Science Learning,* and *Journal of College Science Teaching*. The digital membership will also include all the benefits members now have, such as discounts on conference registration and publications.

We know some members still want hard copies of the journals, so the regular membership will continue to include a printed journal. There is a new school building membership that makes every educator a NSTA member with access to our journals, publications, and other resources.

I hope you'll spend some time exploring the new website when it launches and enjoy the reinvented National Science Teaching Association. Tell us what you think of the new options for interacting with NSTA and how we can continue to better serve you. ●

National Earth Science Teachers Association 2020 Boston NSTA Conference

We have a number of exciting sessions! To find our sessions, enter ***NESTA*** *as the keyword when searching events online at NSTA's session browser for the conference. On* ***Friday, April 3*** *and* ***Saturday, April 4,*** *we have a series of sessions all in* ***052AB*** *of the* ***Boston Convention and Exhibition Center.*** *Don't miss out on our Share-a-Thons and the events below!*

Friday, April 3

- 2:00 – 3:00 pm **NOAA-NESTA Sponsored Lecture**

Sea Level Rise Here and Now

Speaker: Dr. William Sweet. Due to decade's worth of sea level rise, high tide flooding is becoming more common in many U.S. coastal communities, adversely affecting infrastructure and public patience. Find out more about the science of sea level rise, the impacts coastal communities like Boston, MA may face in coming years, and the products and services NOAA has developed to help communities plan and prepare for next season, next year and for decades to come.
Location: **Boston Convention and Exhibition Center, 253C**

Saturday, April 4

- 3:30 – 4:30 pm **NESTA's exciting Rock, Mineral, and Fossil Raffle!**
  Location: **Boston Convention and Exhibition Center, 052AB**

Saturday, April 4

- 6:30 – 8:30 pm **Friends of Earth Science Reception** Location: **Harbor Ballroom I & II Room, Westin Boston Waterfront Hotel**

Visit NESTA at **nestanet.org**

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The NSTA Career Center makes finding the perfect job easy.

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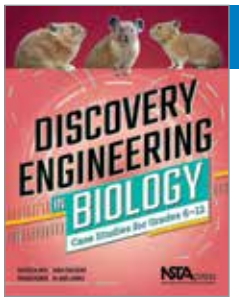

NSTA PRESS: *Discovery Engineering in Biology: Case Studies for Grades 6–12*

Quit Bugging Me: Controlling Mosquitoes to Stem Malaria Infection

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 Discovery Engineering in Biology: Case Studies for Grades 6–12, *by Rebecca Hite, Gina Childers, Megan Ennes, and M. Gail Jones, edited for publication here. To download this excerpt, go to* http://bit.ly/2OteEA1. *NSTA Press publications are available online through the NSTA Science Store at* www.nsta.org/store.

A Case Study Using the Discovery Engineering Process (Teacher Notes)

Lesson Overview

In this lesson, students learn how scientists discovered the way in which malaria spreads. The discovery of malaria transmission and subsequent human infection have led to attempts to control or eliminate malaria or transmission of malaria; however, billions of individuals are still at risk for malaria infection. Students will review malaria infection data and reported cases. Finally, students will create a plan that outlines a means to help reduce or eliminate malaria transmission and infections.

Lesson Objectives

By the end of this case study, students will be able to

- explain the life cycle of the malaria parasite, including transmission to humans;
- analyze data trends of malaria transmission and change in global temperatures; and
- create a proposal for a program to aid in the reduction or elimination of malaria transmission and infections.

Use of the Case

Due to the nature of these case studies, teachers may elect to use any section of each case for their instructional needs. The sections are sequenced in order (scaffolded) so students can think more deeply about the science involved in the case and develop an understanding of engineering in the context of science.

Curriculum Connections

Lesson Integration

This lesson may be taught during a unit on bacterial characteristics, infectious disease, transmission of disease, or epidemiology. It also fits well into a lesson on data interpretation.

Related *Next Generation Science Standards*

Performance Expectations

- MS-LS1-3. Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells.
- MS-ETS1-1. Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
- MS-ETS1-2. Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
- MS-ETS1-3. Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
- HS-ETS1-2. Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

TABLE 1.2

Teaching Organizer

Section	Time Suggested	Materials Needed	Additional Considerations
The Case	10 minutes	Student pages	Individual in-class activity or homework prior to start of lesson
Investigate and Explain	30 minutes	Student pages	In-class activity done individually or in pairs
Activity	30 minutes	Student pages, internet access	Small-group or individual activity
Apply and Analyze	20 minutes	Student pages, internet access	Small-group or individual activity
Design Challenge	45–60 minutes	Student pages, internet access	Small-group activity

Science and Engineering Practices

- Asking Questions and Defining Problems
- Developing and Using Models
- Planning and Carrying Out Investigations
- Analyzing and Interpreting Data
- Constructing Explanations and Designing Solutions

Crosscutting Concepts

- Patterns
- Cause and Effect
- Structure and Function
- Engineer Better Medicines
- Advance Health Informatics
- Engineer the Tools of Scientific Discovery

Lesson Preparation

It is helpful for students to have some understanding of prokaryotes, infectious disease, and disease transmission before starting the lesson. Review the concepts of infectious disease (like the life cycle of *Plasmodium*) so students can understand the various mechanisms by which diseases spread to humans. You will need to make copies of the entire student section for the class. Students will need internet access at various points in the lesson. Alternatively, you can project videos or print and distribute copies of online content for the class. Look at the Teaching Organizer (Table 1.2) for suggestions on how to organize the lesson.

Time Needed

Up to 150 minutes

Extension

You could follow this lesson with a discussion on the importance of community engagement in addressing public health issues.

Assessment

Use the Teacher Answer Key to check the answers to section questions. You can evaluate the students' research proposals to assess the Design Challenge. Proposals should include a description of a new strategy to prevent malaria transmission, how the strategy will reduce or eliminate malaria transmission, materials needed for implementation, the makeup and number of people affected by the strategy, and how problems with the strategy will be addressed. Proposals should also describe how students would collect data to test and evaluate their strategy. Students should be able to report or state any constraints or drawbacks they can foresee with implementing this design. ●

ASK A MENTOR, **Advice Column**

Handling Issues of Privacy, Misconceptions, Absences, and Reading Level

by Gabe Kraljevic

I use social media, but I am unsure of the best way to incorporate it into teaching. Do the rules for student confidentiality vary from school to school, and is it best to create a page focused entirely for teaching and teaching resources only?

—H., North Carolina

Only use social media with your students if you plan to use it educationally. In addition, class blogs are great places to host discussions, share research, upload presentations, post deadlines, and store worksheets or homework.

I categorically oppose using private or personal e-mail addresses, Twitter feeds, blogs, or Facebook pages to communicate with students or families. Set up specific accounts strictly for professional use and ensure your administration knows about them. As much as possible, enable password access to your social media and school web pages and limit who has access. Inform administration and parents about how you use social media. However, even allowing parents direct access to pages featuring identifiable student work may be problematic.

Confidentiality policies may vary slightly between school districts, but in general, we all need to follow federal and state statutes on privacy. In short, people outside your classroom should not be able to identify your students in pictures or words and should not have access to communicate with individual students. Most districts will have media release forms for families to grant or deny the school permission to post their children's photos, work, or names. Your administrators will be well versed in the school district's policies regarding what and how you can communicate digitally with your students.

Keep your students safe. Keep yourself safe.

I am looking for some opinions about how to handle situations in which students have misconceptions about the material. I was wondering how to determine the amount of time needed to clear up a misconception, and when to move on to other material.—*R., New Jersey*

My answer is, "It depends!"

As you progress in your career, you will likely amass a library of common and not-so-common misconceptions. My biggest advice is to always address them, or they may spread among your students. You can handle misconceptions in many ways as you teach science. I caution against scoffing or ridiculing some outlandish claims. It might be better to say, "I haven't heard of that. Shall we find out more?"

Addressing misconceptions can and should become an integral part of teaching and offers excellent learning opportunities! One way is to preempt them by discussing the more common ones in your general instruction. A better way is to gauge your students' prior knowledge when you introduce a topic or ask them to supply you with three questions on an exit slip. In your follow-up discussions, you can directly address common misconceptions that

arise, or turn them back to the students as small research activities.

The most powerful way to handle misconceptions, particularly egregious ones, is to design entire lessons as "Fact or Fiction" or in the *Mythbusters* style. Have students research, explain, demonstrate, and correct for themselves. When doing so, students also learn about the nature of science and how we handle discrepancies in our knowledge.

I was wondering how to reintroduce a lesson interrupted by unexpected days off (such as due to weather). If the majority of the class is absent, do you do an alternative lesson and finish the planned one when all the students have returned?

— L., South Dakota

Interruptions are the norm, not the exception, in education!

How you deal with interruptions will ultimately depend on several factors: the timing in your lesson plan, complexity of the topic, number of students absent, and even which day of the week can all influence your choice.

You should anticipate interruptions during the times of the year you're likely to encounter them. Include some make-up days into your unit planning for those months. If you're lucky and don't get any interruptions, then you have some "spare" days to do more intensive lessons or labs, show videos, build in a field trip, review for assessments, and so forth.

I feel it is best to wait until you have most, if not the entire class back before you finish a lesson. Students should not be put at a disadvantage because they missed class for an unforeseen and excusable event. For students who do make it to school, you could have an enrichment activity, additional videos, a work period, or an impromptu review and discussion. It may also be a good time to introduce a longer-term research project you may have planned and allow some work time. Absent students can easily pick up the project instructions during the next class while the others continue to work.

A quarter of my seventh-grade students are reading at a beginning level. None are on grade level for reading. Can you help me help them?

— K., Alaska

Unfortunately, this is not uncommon. To answer your question, I consulted with a colleague, Rita MacDonald, co-leader of the NSTA-WIDA program, Making Science Multilingual. She says, "Students who are not yet able to read and who will take a long time before they can read still have a need and a right to learn science. So we need to

- Reduce the reliance on text as a way of conveying important information…[by sharing it] through a variety of ways—not just [text].
- Immerse them in hands-on activit[ies] to experience science concepts.
- Surround activity with oral language, supported by writing key words and phrases on the board. Most meaning comes from immersion in an activity, to which we later attach language (spoken or written), so shared activity and conversation about it is a powerful way of conveying information.
- Set up student working groups to [discuss] ideas, so your non-readers hear the ideas without textbooks.
- Use video to convey info[rmation], and later, use a short, simplified reading to reinforce the idea."

MacDonald concludes, "A test that depends on reading will *never* give an accurate portrayal of what non-reading or non-English-fluent students know."

Talk with these students' English Language Arts teachers or school resource teachers, and perhaps check their school records for insights and ideas to help you. Don't be dismayed. Just do your best to improve their reading; you won't likely get them to grade level in one year, but any improvement is great.

Hope this helps!

Check out more advice on diverse topics or ask a question of Gabe Kraljevic and Sharon Delesbore from Ask a Mentor at https://bit.ly/35LMFS1, *or e-mail* mentor@nsta.org.

BLICK ON FLICKS

Space Science and *Troop Zero*

By Jacob Clark Blickenstaff

Birdy Scout leader: We'll be seeing what you girls are made of.
Christmas Flint: We are made of organs and tissues.

I discovered this film almost by accident, since it was not released in theaters, but is streaming on Amazon Prime Video. *Troop Zero* is based on a play written by Lucy Alibar, who also wrote the screenplay, and the movie is directed by an all-female team known as Bert and Bertie. McKenna Grace delivers an amazing performance as Christmas Flint, and the film has some great connections to the history of space exploration.

Christmas lives in rural Georgia in the 1970's with her widowed father Ramsey (played by Jim Gaffigan) in a trailer park with an array of colorful neighbors. Ramsey is an unsuccessful lawyer who has just one employee, Miss Rayleen (played by Viola Davis). Christmas is fascinated by space and the idea of communicating with aliens. She usually ignores the local troop of Birdy Scouts, who bully her both in school and in the neighborhood. When Christmas learns the Birdy Scout Jamboree will have a competition to get your voice recorded by NASA for the Golden Record, which will go into space, she decides to create a new troop.

Her group is unusual for including an African American member (the other troops are not integrated), a girl with one eye, and a boy. The local Birdy Scout leader, Miss Massey (played by Alison Janney), requires every member of the new Troop Zero to earn a badge before they can attend the Jamboree. They also need an adult leader, and Christmas recruits Miss Rayleen, who agrees despite some negative history with Miss Massey. Earning the badges is just the start for *Troop Zero,* as they also need to create a performance for the Jamboree. I won't reveal the outcome, but will say that my children appreciated the fact that it did not follow the standard kid movie formula.

Christmas's interest in space focuses on three main topics: meteor showers, how her voice can travel out into space, and communication with aliens. All of these are worthy topics for a school science class, and the story is funny and touching enough to appeal to elementary and middle school kids.

Meteors

Christmas anticipates a spectacular meteor shower throughout much of the film (and a payoff occurs at the end). While meteors can happen at any time, they are most common when the Earth passes through especially dusty patches of space. Usually those dusty areas are remnants of comet tails. Those active times are usually called meteor showers, and are named for a constellation close to where the meteors are seen in the sky.

The Perseid Shower happens every August, so it is particularly popular

to view in the United States, since the weather is warm overnight. The Perseids in 1977 were very active, with a peak rate of 150 meteors per hour. For more information about meteors and how to observe them, check out the American Meteor Society website at *www.amsmeteors.org*.

Voyager Golden Records

Setting *Troop Zero* in 1977 also links the film to NASA's *Voyager* program, an amazingly successful project to investigate the four gas giant planets of our solar system. Jupiter, Saturn, Uranus, and Neptune were in an arrangement in 1977 in which the gravitational pull of each planet would send a spacecraft on to the next with very little extra fuel. Even today, no other probes have visited Uranus and Neptune, and both *Voyager 1* and *Voyager 2* have continued to transmit data to Earth. They are now the human-made objects that have traveled the greatest distance from Earth.

NASA scientists and engineers knew these probes would eventually leave our solar system, and imagined that one day, intelligent beings might find one of them. To tell these aliens about the people who built *Voyager,* two "golden records" were made that contain photographs, examples of music, human speech, and the sounds of nature on Earth. Christmas hopes that by winning the Birdy Scout Jamboree, her voice will be included on the record and travel out into space to perhaps be heard by aliens. Check out the *Voyager* page (*https://go.nasa.gov/2RUpHnM*) to learn more about how the records were made and their contents. I find the idea of the golden record to be one of the most hopeful projects NASA has undertaken, and I appreciate again Carl Sagan's contributions to making science accessible to the general public.

Making Waves

Though the *Voyager* probes are rapidly moving into interstellar space (at roughly 20 kilometers per second), the radio waves humans have produced in large quantities since the early 20th century far outpace them. A kind of electromagnetic radiation, radio and television signals travel at the speed of light (about 300,000 kilometers per second), and thus have traveled many tens of light years away from Earth since they were first produced.

This explains another way that intelligent life on another planet could learn of the existence of human beings. Christmas remembers her mother telling her that her voice travels out into space forever, and if her voice gets onto the golden record, or is broadcast by radio or TV, that is true. The sound waves of speech cannot get to space, though, since sound requires a medium to carry it. On Earth, the atmosphere generally carries voices from person to person, but liquids and solids also can conduct sound waves. Since both sound and light can be described as waves, it is easy to confuse some of the important differences, and Christmas's ideas could help teachers sort them out for students. Christmas may have an idea that sound isn't the best way to reach aliens, as she also builds an array of lights that she flashes on and off in patterns she hopes aliens will see.

Troop Zero offers a great way to introduce upper-elementary and middle school students to space science. For those wishing to link this film to more recent history on the International Space Station, check out Chris Hatfield's performance of *Space Oddity,* available at *http://bit.ly/2OqSCxK*. ●

Rated PG for thematic elements, language, and smoking throughout

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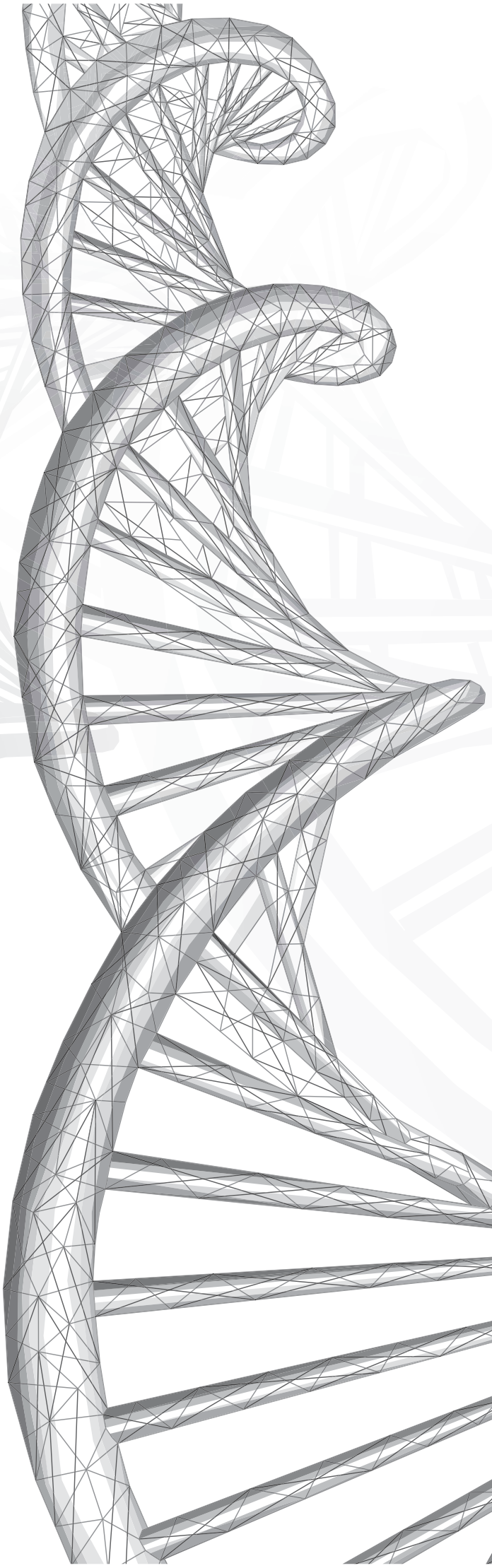

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(All dates are deadlines unless otherwise specified.)

March 18—Look at the different ways scientists define planets during **NSTA Science Update: What Is a Planet? How Scientists Classify Pluto and Other Worlds in Our Solar System and Beyond**, a free NSTA Web Seminar. Presenters Alan Stern, Jim Bell, Kirby Runyon, and Philip Metzger will discuss the Geophysical Planet Definition, which is based on intrinsic factors. The session will be held at 7–8 p.m. Eastern Time (ET). For more information on NSTA Web Seminars or to register, visit *http://bit.ly/2RGhr8N.*

April 1—The **Assessing Three-Dimensional Learning Workshop** in Boston, Massachusetts, will empower you with a set of tools you can use to evaluate and improve existing assessment tasks, as well as analyze student artifacts using a student work analysis protocol. Registration includes *The NSTA Quick Reference Guide to the* NGSS, *K–12*. Registration for the workshop costs $575 for NSTA members; combined member registration for the workshop and the **NSTA National Conference on Science Education** costs $675. For more information or to register, visit *https://bit.ly/2XTi6rc.*

April 2—Take your professional development to the next level during the **NSTA National Conference on Science Education**, 20/20 Science: Expanding the Vision, opening today in Boston, Massachusetts. Visit *www.nsta.org/boston* for more information and to register.

April 15—Session proposals for the **NSTA 2021 Chicago National Conference on Science Education** must be submitted by 11:59 p.m. ET today. The conference will be held April 8–11, 2021. For more information on submitting a proposal, visit *http://bit.ly/2uNtbzD.*

May 5—Don't miss the start of this two-day **Picture-Perfect Workshop,** as authors Karen Ansberry and Emily Morgan delve into using picture books to teach elementary science, technology, engineering, and math (STEM). Attendees also will receive *Picture-Perfect STEM Lessons, K–2*; *Picture-Perfect STEM Lessons, 3–5;* and *Even More Picture-Perfect Science Lessons.*The workshop will take place at 8:30 a.m.–3:30 p.m. at the Arizona Science Center in Phoenix, Arizona. Early bird registration by **April 14** costs $449 for the basic workshop; with the train-the-trainer component and materials, the early bird price is $999. For more information or to register, visit *https://bit.ly/2zOlVTx.*

June 18—Join authors Karen Ansberry and Emily Morgan for this two-day **Picture-Perfect Workshop** as they share strategies for using picture books to teach elementary STEM. Attendees also will receive *Even More Picture-Perfect Science Lessons; Picture-Perfect STEM Lessons, K–2*; and *Picture-Perfect STEM Lessons, 3–5*. The workshop will take place at 8:30 a.m.–3:30 p.m. at the Fulton County North Learning Center in Atlanta, Georgia. Early bird registration by **May 28** costs $449 for the basic workshop; with the train-the-trainer component and materials, the early bird price is $999. For more information or to register, visit *https://bit.ly/2zOlVTx.*

July 22—Join your STEM colleagues at the Kentucky International Convention Center for the start of the **Ninth Annual STEM Forum & Expo** hosted by NSTA! You'll experience three days of professional learning, with many sessions aligned with one of six strands: Lower Elementary/Early Childhood; Upper-Elementary; Middle Level; High School; Building STEM Ecosystems: Community Partnerships; and Postsecondary. Early bird registration by May 8 costs $210 for NSTA members. Graduate credit is available for an additional fee. For more information or to register, visit *www.nsta.org/stemforum.* ●

Share Your Expertise!

Have a lesson that nailed the performance expectations? An activity that engaged your students' interest and paid off in higher assessments? *Science Scope*, NSTA's award-winning middle level journal, is seeking general manuscripts on any topic of interest to middle school teachers. Submissions do not have to relate to a specific theme. See the call for papers at *http://bit.ly/38jVlkn,* or contact *Scope*'s field editor, Patty McGinnis, at *pattymcginnis1@gmail.com.* ●

#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.*

"Integrating Social Studies With Science and STEM"
By integrating history with science, students can learn how our tools and technology have evolved, how our understanding of the human body has advanced medicine, and how our quest for the Moon has brought us beyond what we thought possible. Most importantly, our students can gain a clear understanding that success is achieved through mistakes and perseverance.
—*The STEM Classroom*, Elementary Edition (February 2020, *http://bit.ly/2He0lev*)

"*NGSS*: Planning for Science Success for All Students"
Eighth-grade science teacher Hallie Booth explains why she believes all students can be successful when lessons are designed to use the three dimensions to make sense of phenomena.

"Achieving Equity Through Assessments"
Boone County High School science teachers Laura Littrell and Kevin Williams discuss how they implement multimodal, phenomenon-based assessments to ensure educational equity in their classrooms.
—*Next Gen Navigator* (January 2020, *https://bit.ly/2Yr2PAD*)

Integrating STEM for Our Youngest Learners
In September 2019, Education Commission of the States (ECS) convened a group of experts in early childhood and/or STEM education to discuss policies and actions a state might implement to support STEM programming for preschool through third grade. The report, *Enhancing STEM in P-3 Education,* focuses primarily on state and regional policy, but there are implications for STEM leadership more broadly, particularly at the school district level.
—*NSTA Express* (February 4, 2020, *https://bit.ly/2NmwiEK*) ●

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Using Coronavirus as a Phenomenon

Students' engagement increases when they see the relevancy of what they're learning. The recent media coverage of the novel Wuhan coronavirus outbreak has raised concerns across the globe among government officials, health care workers, and the general population. Will Reed, a high school science, technology, engineering, and math (STEM) teacher at Gwendolyn Brooks College Preparatory Academy in Chicago, Illinois, recently shared a lesson plan on the virus on the NSTA Blog and a collection of related resources in the NSTA Learning Center.

"Supporting student use of the science and engineering practices in classrooms to make sense of current events has the potential to function as a bridge (one among many, hopefully) for students to connect school science learning and their ongoing sensemaking of the world outside of school," Reed notes in his blog post accompanying the lesson plan.

Access the lesson plan, Novel Wuhan Coronavirus: What's the Real Story?, on the NSTA Blog at *http://bit.ly/2SiI7ik,* and Reed's guest post, Leveraging Science in the News, at *http://bit.ly/2UIdep9*. ●