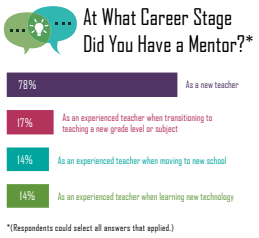
NSTA Reports
National Science Teachers Association



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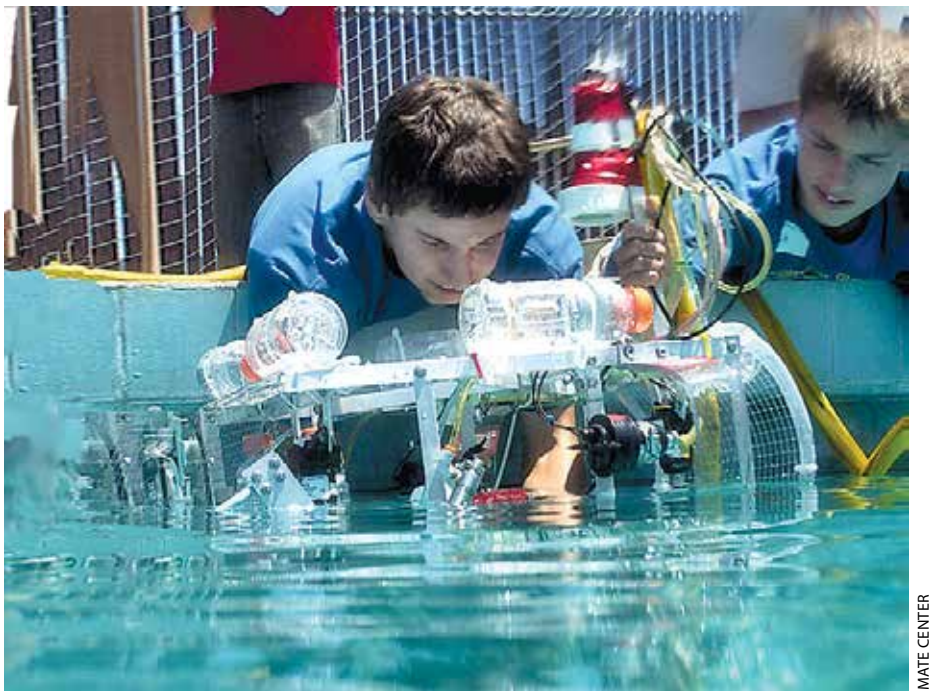
GRAB BAG
Pull-Out Section!

Teaching Students About Marine Technology

"We use marine technology as a hook to teach engineering and technology," says Deidre Sullivan, director and principal investigator of the Marine Advanced Technology Education (MATE) Center in Monterey, California. "There is a need for engineers, and especially technicians with applied engineering skills. There are a lot of these jobs in the marine field, but also in advanced manufacturing, renew[able] energy, and in many other sectors of the economy. We focus on getting students into the workforce by expanding the pipeline for [them] to enter science, technology, engineering, and math programs."

Funded by the National Science Foundation (NSF), the MATE Center works with secondary schools, community colleges, universities, research institutions, marine industries, professional societies, and working professionals to develop curricula and courses in marine technology, underwater robotics, marine geospatial technology, career awareness, and ocean observing systems. MATE provides professional development (PD) for faculty; conducts underwater robotics competitions for students; and offers internships for college students.

For MATE competitions, "we start with building simple underwater robots (Remotely Operated Vehicles, ROVs) to help students understand electronics and how to apply math to solve real-world problems," Sullivan relates. Students learn about "electronics, mechanics, hydraulics, and computer controls,...which are important to robotics and automation," she explains. "With many high-tech occupations, we see a convergence of these skills, and with this knowledge, students can go into many different fields."



MATE CENTER

Middle school students launch a Remotely Operated Vehicle at a Marine Advanced Technology Education (MATE) competition.

MATE and the Marine Technology Society, a nonprofit professional organization, hold international ROV competitions for students in grades 4–16. The competitions have a "strong entrepreneurial component," says Sullivan. Students form a company and serve as chief executive officer, chief financial officer, engineering lead, marketing lead, and in other positions, and solve real-world problems. "They learn how to follow timelines, budgets, and specifications. They produce technical documentation and marketing displays and give oral presentations to professionals. They learn how to communicate their knowledge of robotics and how to work together as a team," she relates.

Learn more and access free curricula at *www.marinetech.org*.

Building SeaPerch ROVs

By building an underwater ROV through the SeaPerch program, teach-

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NSTA National Science Teachers Association

COMMENTARY: **Tyraine "Grand Hank" Ragsdale**

Using the Powers of Hip-Hop and Kinesthetic Learning to Inspire

By Tyraine "Grand Hank" Ragsdale

Tyraine "Grand Hank" Ragsdale

Twenty-five years ago, I set out to create a way to inspire students to pursue careers in the sciences. The journey started at the Franklin Institute science museum in Philadelphia, where I was invited to speak to a group of middle school students about science careers. About 10 minutes into my talk, my audience began to tune me out and engage in unrelated side conversations. As a hip-hop DJ–turned-chemist, I understood my audience and started rapping a verse from a popular song.

Instantaneously the students' attention refocused on me and what I was saying. The students started rapping along. My epiphany: "We can use rap music to teach science."

I wondered, "How can we use what students like to teach them what we want them to learn, specifically science?" Traditional engagement methods were ineffective and at best subpar.

While pondering how to increase interest in science careers, I sought a universal key to unlock students' science learning potential. I noticed a missing link between students and universal learning: energy. Energy is defined as "the property of matter and radiation that is manifest as a capacity to perform work (such as causing motion or the interaction of molecules)."

Through rap and hip-hop, I inject energy into the audience "system," and an energy transformation occurs. I was radiating energy, and students were absorbing it and converting it into motion through physical movement and dissipating part of that energy as heat…literally heating up the room. Something critical was happening. The students were simultaneously learning while physically moving. They were engaged, their interest levels spiked, and participation was almost 100%.

I had tuned into the right frequency to broadcast my message. What was happening? What was making these students tune in? Was the energy solely due to the music, or was the information they were receiving energizing them?

Potential energy was being converted to kinetic energy. Kinesthetic learning is learning through physical movements. As the students moved, they learned. I put energy into the system, and the outcome was increased interest in learning what science had to offer.

The next question was how to scale this up and create an experience outside of school time to engage students, parents, and administrators. Taking a page from Hollywood and live concert performances, I added the atmosphere of a rap concert, creating event-based instruction. Event-based instruction takes advantage of a phenomenon psychologists call the "herd effect." Individuals learn more as a result of their peers' influence.

Energy is lost when students are not engaged and when teachers are not committed to students' learning. Some teachers love science, but not necessarily the students they teach. And some students love science, but not necessarily the teachers in charge of their learning. In both cases, learning is short-circuited, and we lose energy in the process.

The ideal energy circuit results from teachers who love science and the students they teach, coupled with students who love science and respect the educators who teach them. When students and teachers are on the same frequency, we get a double energy boost.

Can students get an energy boost from home? Absolutely! Parental participation is a critical component in a child's development and academic performance. So how can we energize parents to participate in their children's education, especially science?

One solution was to organize an "Evening of Science" at a Philadelphia middle school and invite the feeder elementary schools to participate. There was one catch for admission: All students had to be accompanied by a parent or guardian, no exceptions. The goal was to increase the cohesion of the bonds among the students, parents, and school administrators.

I used what advertisers have been using for years around the holidays: pressure. By holding an evening event and inviting the entire community, I ensured the students *wanted* to attend, so they pressured their parents to accompany them. The strategy worked, and we had more than 400 families participate. We had students working with their parents and teachers on science projects throughout the evening.

Talk about energizing science! This "Evening of Science" model has been adopted by schools and districts nationwide. The name may differ, but the underlying principle is the same: To energize science, we have to get the parents, teachers, and students working together cohesively.

By injecting energy into learning systems, teachers can bring science to life and use science as an action verb instead of a static noun. When teachers bring energy to science, students detect that energy and respond positively.

We are in a new age of distraction and accelerated learning in which information is moving at warp speed and attention spans are greatly shortened. We must use every tool at our disposal to move students toward science. We need a total team effort with everyone working toward the common goal: "Collaborations to improve expectations." When students see teachers, administrators, and their parents working together, and expectations are defined and supported, we get a triple boost of energy, which we will need if we are ever going to catch up to the fast-moving train of science. ●

Founder and president of Grand Hank Productions, Tyraine Ragsdale is a former research chemist. Ragsdale cofounded The Science of Philadelphia *and* Science Lab of Grand Hank *television series and is known for his high-energy interactive multimedia productions.*

NSTA Reports

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Marine Technology, from pg 1

ers and students from sixth grade through college can learn about naval architecture and ocean engineering. Funded by the U.S. Navy's Office of Naval Research and managed by the Association of Unmanned Vehicle Systems International Foundation, SeaPerch is "a national outreach program with a kit, an expanded curriculum, a website, and local and national challenge competitions," says Susan Nelson, Sea Perch's founder and executive director. The program has grown from "750 students in two school districts in 2007 to 300,000 students [nationwide], and has expanded into nine countries as of 2015," she reports.

Teacher PD is offered at sites around the country or online (learn more at *www.seaperch.org*). "SeaPerch is very flexible and maps well to many learning outcomes," Nelson notes, and can be used in after-school robotics clubs or taught in school. Building the ROV takes "an average of nine to 40 hours of class time," she reports.

Participation in SeaPerch competitions isn't mandatory; "we suggest that you just need to put the ROV in the water to test it," she maintains.

In surveys, says Nelson, 90% of students said SeaPerch "increased my confidence in my ability to participate in engineering projects or activities," 74% said it "made me decide to take different classes in school than I had planned to," and 83% said SeaPerch "made me decide to work harder in school."

A Year-Long Fellowship

Based at University of Rhode Island's (URI) Inner Space Center and University of Connecticut's Avery Point campus, the Marine Technology for Teachers and Students (MaTTS; *http://mattsproject.org*) Project aims "to encourage high school teachers to connect engineering and technology with marine science," says Project Manager Andrea Gingras. "We train teachers in how to build and use underwater ROVs, sensors, and hydrophones (microphones that detect sound waves underwater)."

Open to teachers in Rhode Island, Connecticut, and Massachusetts, MaTTS is in its third and final year of NSF funding. "We're hoping to expand the program nationally," notes Gingras.

During their year-long MaTTS fellowship, for which they receive a stipend, teachers engage with ocean scientists and engineers in person and virtually; build and deploy the technological instruments; and teach students how to build and deploy them during an intensive five-day summer institute. Students develop a cruise plan for a mock ocean expedition and participate in "scientist speed-dating," conversing one-on-one with marine scientists and engineers, says Gingras. "We expose students to the many careers associated with marine science, [such as] marine archaeologists, ocean engineers, and physical and geological oceanographers—not just marine biologists. There's a whole other world to explore."

Teachers and students share what they've learned with colleagues and students in their school and district. "Our goal is to develop teacher-leaders and student-leaders," Gingras asserts.

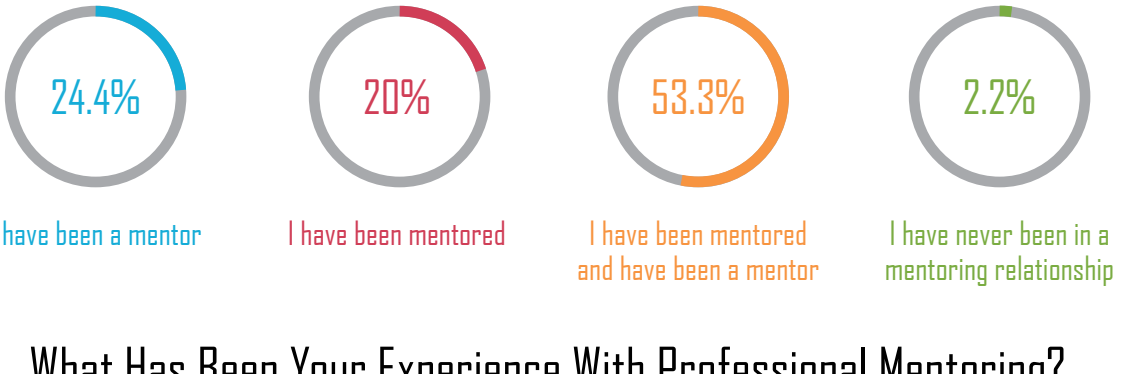
"Marine technology is part of the future everywhere. A large portion of our population lives on the coasts," says Alison Murray, science teacher at Central Falls High School in Central Falls, Rhode Island, a member of the second MaTTS cohort. "The more students know about the ocean, the better."

MaTTS offered "a great opportunity to work with [scientists] at the forefront of the field," says Murray. For her inner-city students, "this was huge because they don't have access to lots of professionals and role models."

Murray has incorporated the sensors in her engineering classes. "I got up to date on the technology and how I could incorporate it in my classes. Working with elite marine scientists provided intellectual satisfaction," she contends.

"I learned an awful lot from the other teachers…The scientists answer our questions and help arrange field trips to their workplaces or field studies. It's a phenomenal opportunity," she concludes. ●

Reflecting on Mentoring



What Has Been Your Experience With Professional Mentoring?

Does mentoring play a role in many teachers' careers? More than half of respondents (53%) to a recent informal *NSTA Reports* poll said they had both received and provided professional mentoring, with only 2% reporting they've never been in a mentoring relationship. Twenty percent said they had been mentored, and 24% said they had been a mentor. Of those who had been mentored, 78% said it had been as a new teacher, with 17% reporting they had received mentoring when transitioning to a new grade level or subject, and 14% when moving to a new school or as an experienced teacher learning a new technology (respondents were allowed to select multiple answers to this question). Of those who have had a mentor, 67% reported having more than one; 39% had more than one at a time. The majority (85%) had not participated in a co-mentoring relationship.

Respondents who had never been mentored were evenly divided on their willingness to mentor another teacher, while a majority of those who had been mentored (85%) were willing to mentor another. In addition, 100% of those who had mentored another teacher said they would do so again.

Of those who had been in mentoring relationships, 19% said the relationships had been formal (arranged by the school and occurring during school hours), 22% said the relationships had been informal, and 59% said they had been in both formal and informal mentoring relationships. Unsurprisingly, 80% of the informal mentorships started when the mentor and mentee worked at the same school. Only 4% reported meeting through a professional association or during previous coursework. When in a formal mentor relationship, 38% reported periodic reports were required from the mentor only, while 30% stated periodic reports were needed from both.

Thirty percent of mentees reported their mentoring experience lasted a year or less, and 35% had experiences that lasted 2–3 years. A quarter of respondents said the mentoring relationship went on indefinitely. Fifty-three percent of mentors reported working with their mentees for two to three years, with only 3% saying the relationship continued indefinitely. Only 9% of participants reported ever using an e-mentoring service.

Here's what science teachers are saying about the benefits of mentoring:

[It's] a safe place to ask real questions!—*Educator, Institution of Higher Learning, California*

As a mentor, you must be able to articulate how methods work and explain the research behind them. Putting into words what you have perhaps never categorized.—*Educator, High School, Texas*

Being there to support their growth and struggles as they began to feel more comfortable and skillful in their role.—*Other, Institution of Higher Learning, Texas*

Building lasting relationships [in which] we both learn from each other.—*Educator, Elementary and Middle School, Massachusetts*

Getting to learn from new teachers as a mentor, or from more experienced teachers. My relationship with my mentor has been ongoing, but has evolved to one that is more like colleagues collaborating.—*Educator, High School, Arizona*

Great conversation and reflection; formal training to help me in my mentoring role; strong support from my school district.—*Educator, High School, Wisconsin*

Having someone to talk to, having support, being able to ask questions about non-teaching-related activities (routines and traditions of the school), having a first connection within the school, someone to "show you the ropes." —*Educator, Middle School, Rhode Island*

I strongly believe it benefits both parties; it helps mentee garner guided experience, and it helps the mentor reflect on [his or her] teaching. —*Educator, High School, California*

I think the protégé gets to understand what is expected and the climate and culture of the school.—*Educator, High School, New Jersey*

Improved instructional strategies and understanding of school culture. —*Other, Elementary and Middle School, Massachusetts*

Learning more yourself, based on helping someone else to learn.—*Other, High School, Massachusetts*

Learning from your mentee[s] as well as they from you. Having a professional friend/colleague.—*Educator, High School, Institution of Higher Learning, Colorado*

Seeing improvement in the classroom and the teacher excited to return the following school year.—*Educator, Middle School, High School, Idaho*

So much! Collegial interaction, getting to see another teacher at work, being forced to take time to reflect on my own teaching, learning together, and on and on.—*Educator, Middle School, Wisconsin*

The growth and ideas that two minds can generate together.—*Educator, High School, California*

The opportunity to share and reflect on teaching practices. Having to answer questions like "why do we do this?" allows a chance to reflect from a fresh perspective. In addition, building a close relationship with a new colleague and sharing experiences is rewarding.—*Educator, High School, New York*

To help retain good teachers. —*Educator, Middle School, Mississippi*

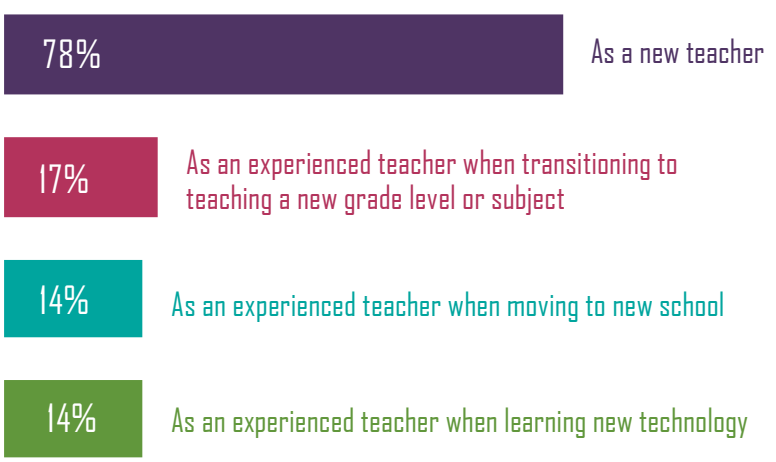
Watching mentees take ideas and run with them, seeing kids benefit from experience and enthusiasm.—*Educator, Middle School, Kansas*

Mentoring Challenges

Being a colleague without being bossy.—*Educator, High School, New Jersey*

Not telling the mentee what to do, but guiding [him or her] to suggest solutions or self-reflect on what they did/could do better/do differently/what worked.—*Educator, Middle School, Western Australia*

At What Career Stage Did You Have a Mentor?*



*(Respondents could select all answers that applied.)

Establishing a trusting relationship. —*Other, Institution of Higher Learning, Texas*

Finding common time for the mentor and mentee to meet and discuss topics and information. It may be difficult to find sufficient time if the schedules do not allow common planning time. —*Educator, High School, New York*

Finding the time to both meet and observe the mentee. It is very valuable, but hard to find "free" time in [one's] teaching schedule.—*Educator, Elementary and Middle School, Massachusetts*

Forced, formal mentorships are pointless.—*Educator, Institution of Higher Learning, California*

Giving feedback without seemingly criticizing a novice.—*Educator, High School, New Jersey*

Helping the mentee to see that all changes don't have to be implemented in all classes all at once.—*Educator, High School, Connecticut*

It can be difficult to know just what aspects to cover, and it can feel a bit presumptuous to have a discussion about best practices when I may feel that I do not necessarily use them consistently.—*Educator, Middle School, Wisconsin*

Knowing that the mentee can choose his/her own path and not always heed your advice.—*Educator, Middle School, Maryland*

Knowing when and how to suggest without sounding 1. nagging and 2. [saying] "you have to do this." Even with a solid trust foundation, need to know your mentee well for best communications.—*Educator, High School, Institution of Higher Learning, Colorado*

Not coming across as being pushy when making suggestions.—*Educator, Middle School, Mississippi*

Tailoring the instructional strategies and classroom management issues to fit that person's responsibility. —*Educator, High School, Texas*

Time to collaborate—our district offers paid [professional development] time for mentor/beginning teacher collaboration. It's invaluable! —*Educator, High School, Arizona* ●

Just a Science Teacher? I Don't Think So!

By Carolyn Hayes, NSTA President 2015–16

During the holidays, I was shopping at a big-box store for groceries. As I turned a corner from one aisle to the next, a young lady rushed up to me, calling, "Mrs. Hayes, Mrs. Hayes." Apparently she had seen me in another aisle and searched me out.

She was excited to see me and said she had to find me to say "Thank you," and that I was her favorite teacher from high school. She wanted to make sure I knew that I had made a difference for her. She remarked that "students don't always take the time to 'thank' their teachers," and she was glad that she could express her gratitude.

I asked her what she was doing now, hoping that it would be science-related. Instead, she informed me that she worked in marketing, and her family had moved back to her hometown because of the great schools and teachers. As we departed, I reflected on the impacts I had made on my students.

So why is it that some science teachers forget that they make a difference? When asked their occupation, their response is "'Just' a teacher." Has society impressed upon us that we need to apologize for who we are? I don't think so. I have mentored and observed teachers with varying years of experience who possess three qualities that I believe make them more than "just" a teacher: being curious, being a source of motivation, and having the ability to reflect.

Teachers are *curious* when their classrooms are filled with questions, not just from the teacher, but also questions originating from the students. I have watched teachers who implemented a process that makes sure that all students can be heard and all questions are welcomed in the learning process. These teachers use students' questions as a teachable moment and challenge students to find ways to determine answers to the questions. These students realize teachers welcome questions, so they are more willing to risk asking questions. When teachers demonstrate they are willing to learn something new, their students learn to value questions.

I enjoy watching teachers who allow their students to design their own experiments to solve science problems and questions. These teachers may already know that the experiment will not provide the evidence the students need, but they still *motivate* their students to try. They don't criticize their students if the experiment doesn't work, but encourage them to discover what may have happened, redesign their plan, and try again. When students obtain the evidence needed to answer their questions, teachers celebrate with the students and encourage them to share their accomplishments with the class.

I admire science teachers who do not just move from one lesson to the next but take the time to *reflect* on their students' learning as well as their instructional strategy. They use tools such as formative assessments to determine where their students are in the learning process and adjust their instruction to meet students' needs. If a lesson was successful, they reflect on the strategy used so they can apply it to other lessons.

For those of us who have been in the profession for a while, it is imperative that we instill in our preservice and new teachers the curiosity, motivation, and reflection practices that will enable their students to succeed. Having these qualities will help these teachers to not only be successful themselves, but also to realize they are *not* "just" teaching, but having a positive impact on their students. They are preparing their students to be better citizens in the future.

So next time you attend an event, do not introduce yourself as "just" a teacher. Know that you make a difference in the lives of preK–16 science students, regardless of their ultimate career path. You, too, may have a former student or even a parent find you in a store or at a park to thank you. In fact, if your favorite science teacher is still teaching, go back and thank him or her since he or she obviously impressed you enough to pursue a career in science education!

In the words of former NSTA President Hans Andersen, have "pride inside." Thank you for being one of my colleagues in science education! ●

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Fusing STEM Into Students' Interests

Students in Illinois, Ohio, and California are becoming Coaster Bosses, Jewelry Designers, Laser Defenders, and Wind Commanders—and learning about science, technology, engineering, and math (STEM)—as part of FUSE, a program developed by researchers and educators in the School of Education and Social Policy at Northwestern University in Evanston, Illinois.

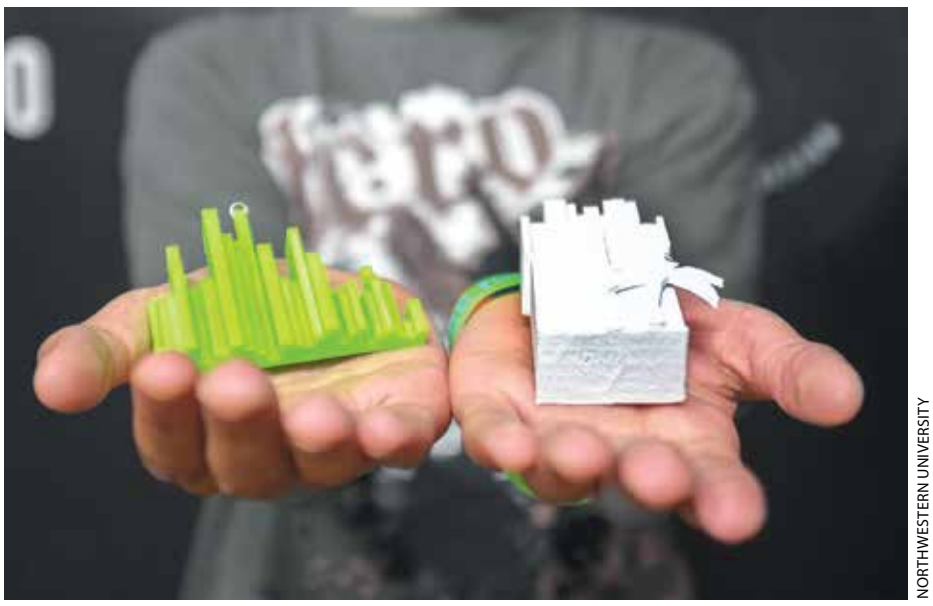
"We were inspired by YOUmedia in the Chicago Public Library, a space for high school students to drop in and get into digital media," recalls Kemi Jona, director of Northwestern's Office of STEM Education Parternships and FUSE co-creator. "We wondered: Could we do something similar to get kids interested in STEM, connect STEM topics to students' interests?"

Funded initially by the MacArthur Foundation in 2011, and currently by the National Science Foundation (NSF), FUSE offers a series of STEM-related challenges, or core activities, at *www.fusestudio.net*. Upper-elementary through high school students in after-school or in-school FUSE Studios can choose challenges like 3D You (creating 3D models of themselves and printing them using 3D printers), Solar Roller (building mini-solar cars and putting them through distance tests), or Just Bead It! (creating gel beads using techniques scientists use to grow human cells).

"Student choice is a critical element of FUSE," says Reed Stevens, FUSE co-creator and Professor of Learning Sciences at Northwestern. "From two NSF-funded studies of FUSE, we've learned kids develop expertise when they have choice. Developing interest is important for keeping kids on the STEM path after the required schooling is over."

FUSE allows students to experience the challenges at progressively higher levels of difficulty because "we were also inspired by video games and how kids learn from them, and we leveraged this for STEM," Jona relates.

"FUSE is built on a metaphor of leveling up. When you try and don't succeed, you can try again with a different approach like kids do during game play," Stevens maintains. To show they've completed a level, students upload a picture or video of their work.



NORTHWESTERN UNIVERSITY

Inspired by an architecture theme, a student at a FUSE Studio created jewelry designs in 3D and printed them on a 3D printer. The green skyline on the left became a pendant; the white building on the right was later attached to a bangle.

"We wanted kids to have more opportunities to be creative problem-solvers and explore materials in creative ways," says Stevens. "[FUSE also can] help kids be more independent. Challenges offer a range of ways to solve problems; students are not told the 'right' way, so they need to find 'a' way that works."

Though students can work independently, "having peers in the room to help one another is really critical," contends Maggie Waldron, FUSE program director. "The word 'studio' [denotes] a collaborative, peer-supported environment." FUSE Studios "can be located in libraries, computer labs, classrooms; we suggest arrangements that promote collaboration," she notes.

"A lot of students will come out of their shells and work with others they're not used to working with," Waldron observes. "Students get to develop 21st-century skills, such as flexibility and teamwork."

"Students are up and moving, doing work in groups. There's a buzz in the classroom," reports Ben Loduha, STEM instructional coach for School District 54 in Schaumburg, Illinois. The district has implemented FUSE in 27 schools.

"We train [teachers] to embrace…a culture in which students share knowledge to be productive," asserts Henry Mann, FUSE program coordinator. And educators are trained "to make the transition from teacher to facilitator, how to ask the right questions to get students to help themselves."

"FUSE is more of a student-centered learning project," says Michelle Burke, STEM teacher at Jane Addams Junior High School in Schaumburg. "They're pretty much in charge all of the time. I just hang out with them [and] keep pushing them to find answers on their own."

Teachers "don't have to be STEM experts" to be FUSE facilitators, notes Waldron. Chicago-area teachers can attend a one-day professional development workshop at the start of the school year; teachers in other areas are trained via a series of online Skype sessions. "In March, we'll be doing a training for teachers in Finland," she reports.

Schools can purchase license packages ranging from $7,000 to $20,000, plus annual license renewal fees, Waldron explains. The license fee covers materials for the challenges, online accounts for students and facilitators, training, and year-round support for facilitators. FUSE has offered grants to some schools to help defray some expenses.

Building the Challenges

"We create an activity that is appealing to students and structured to make them want to stick with it," says Mann. "It has to be fun, STEM or STEM-based, and product-centered. [Kids don't want to] just learn to use a 3D printer; they want to know, 'What can you make?' Once you've had fun using a tool, you develop interest in that skill set in the future." The challenges "have concrete objectives with a clear achievement of the goal," he points out.

"We try to reach kids who aren't sure they like STEM," he explains, but "students who are more engaged in STEM will still enjoy [the challenges]; they may reach the higher levels faster."

In designing the challenges, "we wanted the materials to be as low-cost as possible," says Jona. "The most expensive [item] is a 3D printer, but the price of that is coming down, and often schools and libraries have them now. There are ways to do FUSE without the 3D printer," he contends.

"We're continuously testing materials and challenges with the students," Jona relates. "Kids' interests and the technology are constantly changing… We use data from the website to make fixes; we're constantly pushing out updates."

In general, says Jona, research and observations by Northwestern graduate students have shown that students cherish their FUSE time. When one teacher's students were misbehaving, "she threatened to cancel FUSE time instead of recess. We thought that was a pretty good sign," he observes.

Loduha reports that one group of students decided to enhance the speed of their solar cars and race them over the summer. "They ordered materials online and did it all themselves…It's neat to see where they take their ideas, places we didn't imagine they'd go."

Some students go farther into STEM studies. "Students get interested in STEM through FUSE, then are encouraged to sign up for engineering courses," says Waldron.

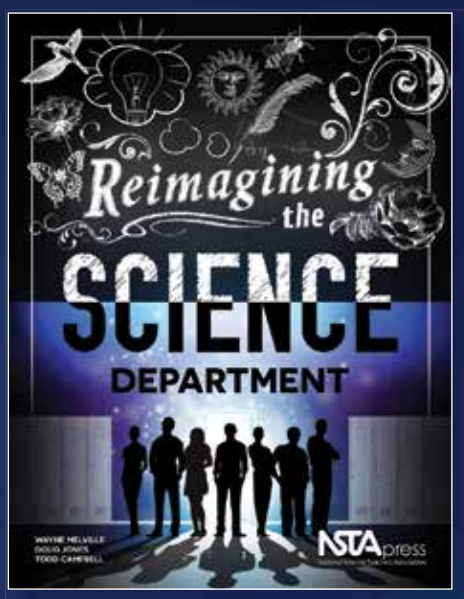
"FUSE leads into coding classes, rocketry clubs—it's a gateway to all of the STEM subjects," Loduha contends. "We can see where students' interests are and leverage those interests during the school day." ●

Quotable

Develop a passion for learning. If you do, you will never cease to grow.

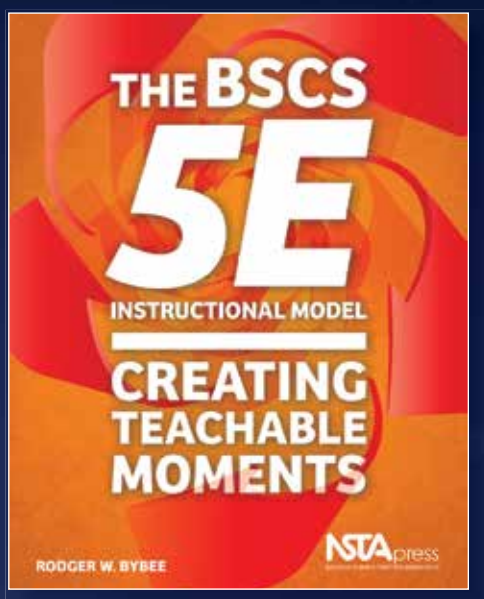
—Tony D'Angelo, founder, Collegiate EmPowerment

MARCH INTO *Success* WITH NSTA PRESS BOOKS



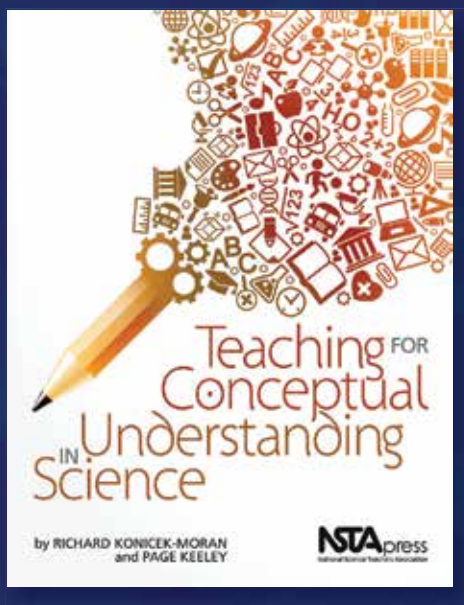
Grades K–12

Book: Member Price: $23.96 | Nonmember Price: $29.95
E-book: Member Price: $17.97 | Nonmember Price: $22.46
Book/E-book Set: Member Price: $28.75 | Nonmember Price: $35.94



Grades K–12

Book: Member Price: $27.16 | Nonmember Price: $33.95
E-book: Member Price: $20.37 | Nonmember Price: $25.46
Book/E-book Set: Member Price: $32.59 | Nonmember Price: $40.74



Grades K–12

Book: Member Price: $28.76 | Nonmember Price: $35.95
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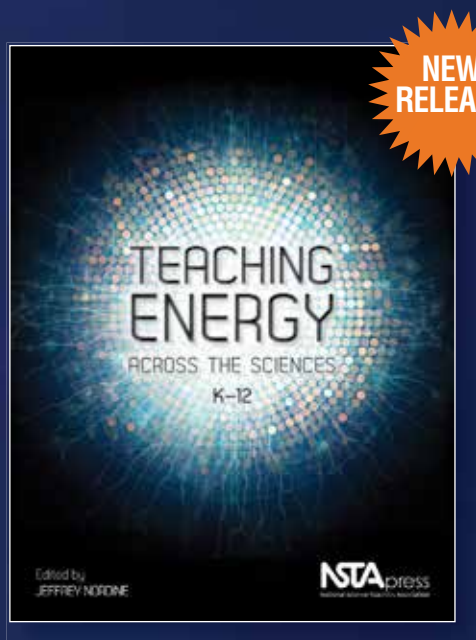
Book/E-book Set: Member Price: $34.51 | Nonmember Price: $43.14



Grades K–12

Book: Member Price: $27.96 | Nonmember Price: $34.95
E-book: Member Price: $20.97 | Nonmember Price: $26.21
Book/E-book Set: Member Price: $33.55 | Nonmember Price: $41.94

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www.nsta.org/store

NSTA National Science Teachers Association

PULL-OUT SECTION

SCIENCE TEACHERS' GRAB BAG

Inside this Convenient Pull-Out Section you will find:

Freebies for Science Teachers

Madden NFL: Football by the Numbers. This digital learning game produced by EA SPORTS™, the National Football League (NFL) Players Association, and Discovery Education uses football to spark middle level students' passion for math and science. The game has three sections: Explore, Learn, and Game Play. In Explore, students are introduced to football-related concepts, positions, and strategies. Next, students learn specific math and science concepts relating to various offensive and defensive strategies, then apply this knowledge in Game Play.

In an offensive scenario, for example, students receive a set of conditions of what is needed to execute a pass between two NFL players and must then select at what angle and velocity the ball should be thrown based on concepts explained earlier. In the defensive scenario, students act as the team's defensive coordinator and apply probability knowledge to make game-time decisions about what type of defense to use based on the yardage and downs of their opponents. Learn more and play the game at *http://bit.ly/1NEcdWO.*

Earth Science Journal for Kids. Middle level and high school teachers can access an online journal of cutting-edge Earth and environmental science research adapted for students. Several environmental topics are covered in each issue; for example, questions explored in the latest issue include these: What do trees know about rain? How much does it cost when cows burp? The Arctic is melting—so what? Each article features a summary of the research, an index of key terms, new vocabulary for students, and resources to help teachers integrate the content into their classroom, such as a video describing the research, scientific papers (one adapted for students and the original), and student activities and discussion questions. Read the journal at *http://sciencejournalforkids.org.*


POLLINATOR

Discover the Powerful Peanut! Produced by the American Farm Bureau and partners, this resource for students in grades 3–5 contains a dozen easy-to-implement activities exploring peanuts and peanut production. The activities address core subject areas, including science, math, social science, and language arts, and provide students with opportunities to crunch peanut production data, create maps, and dig into science as they learn about allergies, the plant life cycle, and nutrition. Refer to *http://bit.ly/1Ssqsjk.*

Endangered Species Day Toolkit. May 20 is Endangered Species Day. Prepare for the event with a toolkit and other resources for K–12 classrooms, available at *http://bit.ly/20n0fRX.* The toolkit contains event planning tips, stickers, bookmarks, fliers, coloring/activity sheets, and more. Visit the website's Teacher Resource Center for a lesson plan, adaptable for elementary to high school levels, that includes an endangered species slideshow and accompanying teacher script.

I'm a Scientist USA! In this online *American Idol*–style competition for scientists, students talk online with scientists over a two-week period and vote for which scientist they think should win. As students interact with the scientists, students become more enthused about science, learn that science and math lessons relate to real life, and see that scientists are normal people. Targeted for students ages 9–18, but most commonly used with middle school students, the website offers a Teacher Pack with lesson plans and a science debate kit to help students prepare for their participation in the event. In addition, teachers can watch an introductory video to see the program in action. To learn more and to register to participate in an upcoming event, visit *http://bit.ly/20TZPEP.*

Science Snacks. Developed by the Exploratorium museum in San Francisco, California, the Science Snacks website presents more than 150 scientifically accurate, teacher-tested activities for curious explorers. Targeted for students in grades 6–12, but adaptable for younger grades, Science Snacks help teachers replicate in the classroom the concepts and natural phenomena explored in the museum's exhibits. Each "snack" includes a photo and/or video, a short introduction, and a list of materials. Other sections provide assembly instructions, describe how to use the activity, and explain relevant science concepts. Science Snacks support the *Next Generation Science Standards* (*NGSS*); teachers can search for snacks by discipline (e.g., Biology, Chemistry, Perception, Nature of Science, and others) or category (e.g., Edible Snacks, Snacks With Mirrors,

See Freebies, pg G2

Freebies, from pg G1

Exhibit-Based Snacks, Snacks to Build Upon, and more). See this website: *http://bit.ly/1Qq6Wxo*.

XUAXO

Sustainability and Energy Lessons. The GreenLearning Canada Foundation provides online education programs about energy and sustainability that empower students from fourth grade to high school to create positive change for our evolving world. The programs require no special software and include lesson plans, teachers guides, video tutorials, and assessment rubrics. Selected modules include EnerAction (all levels), in which students use an online carbon calculator to assess current energy use in their classrooms, calculate reductions, and track success; eCards (middle level), a cross-disciplinary activity in which students research a current energy topic and create and send their own digital eCard; and Re-Energy.ca (high school), in which students build a working model of a renewable energy technology, such as a wind turbine, solar oven, hydroelectric generator, or biogas generator. For these and other resources, visit *http://bit.ly/1SGEMVx*.

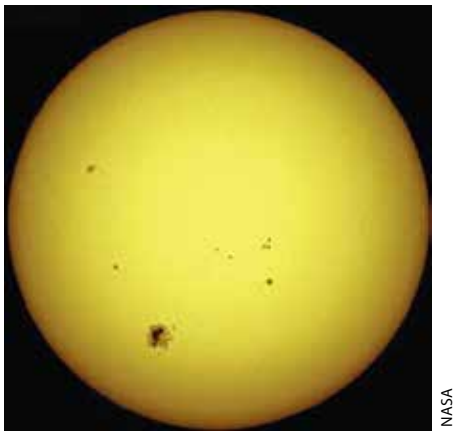
What's My Next? An interactive website/curriculum from the American Society of Clinical Pathology introduces high school students to career opportunities in laboratory medicine and pathology and showcases the lifesaving roles that lab professionals play. The website describes various disciplines within the laboratory profession and the education requirements of each one. The program also includes Lab Hero Challenge, an e-learning module that gives students a behind-the-scenes glimpse of the lab roles and related work completed to diagnose and inform the treatment path for a breast cancer patient. Visit *www.WhatsMyNext.org*.

Elementary Adventures in Chemistry. Elementary educators, grab your favorite electronic device and start exploring the Secret Science of Stuff! The American Chemical Society developed this "Stuff" collection to give elementary students a safe place to explore chemistry on their own terms. At *www.acs.org/kids,* you can access interactive animations and other chemistry resources for students in grades K–5. The animations highlight the chemistry behind kid-friendly "stuff" such as ice cream, braces, glue, flames, and more. Other resources include videos, multi-leveled games, and science experiments.

Let's Code Physics! A YouTube channel created by Jacksonville University physics professor Brian Lane is modeled after Let's Play videos, a popular phenomenon in the gaming world in which a gamer-celebrity records his or her progress through a video game, offering entertaining commentary along the way. Through these "playthroughs," the viewer learns how to accomplish either all of or critical aspects of the game while being entertained. On Let's Code Physics!, Lane applies this concept to high school science, offering commentary and providing learning resources along the way to videos based on his programming projects, which study physics situations such as police car chases, planetary orbits, and projectiles. Learn more at *http://bit.ly/20sE3eB*.

UV Kid! Who said scientists aren't crafty? In this K–8 activity from the Lunar Planetary Institute, students construct a person (or dog or imaginary creature)—dubbed UV Kid!—from common craft materials and ultraviolet (UV)-sensitive beads. Next, they use sunscreen, foil, paper, and other items to test materials that might protect UV Kid (and hence ourselves) from being exposed to too much UV radiation. Upper-elementary and middle school students can conduct the activity independently, but younger students may need assistance from an adult, older child, or teen. Access the activity at *http://bit.ly/1PBxFe4*.

CASES Online. These investigative lessons, or "cases," are targeted for K–12 and undergraduate science educators. Developed by science educators at Emory University, the cases use the principles of Problem-Based Learning and Investigative Case-Based Learning (and related student-centered pedagogies) to engage students in exploring the science behind real-world problems. The cases address a range of learning objectives across the sciences and mathematics. Search by subject or grade level to find cases that best meet your students' learning needs; teachers are also encouraged to submit cases of their own to the collection. Check out the cases at *http://bit.ly/1Q7MGXh*.



NASA

Solar Dynamics Observatory Project Suite. This comprehensive, *NGSS*-supported curriculum for middle school students presents an interactive, real-world exploration of solar science and space weather. Through four learning modules, students explore the structure of the Sun (Module 1); how and why the Sun is studied via the electromagnetic spectrum and magnetism (Module 2); the significance of solar activity on Earth's habitability and the effects of space weather on Earth (Module 3); and how to collaborate to design, produce, and curate a 3D Solar Exhibit. The modules can be completed in succession or as individual activities. Access the material at *http://bit.ly/1VSKbq3*.

Engineering is Elementary (EiE) Video Snippets. These short videos take you inside the elementary engineering classroom. The clips illustrate relevant processes in the teaching and learning of engineering through vignettes of hands-on classroom engineering. Teachers can use the collection of more than 50 vignettes to explore the science and engineering practices of the *NGSS;* to see firsthand examples of how developing "engineering habits of mind" supports learning across the curriculum; and to observe real students and teachers engaged in the five steps of the EiE Engineering Design Process (i.e., ASK–IMAGINE–PLAN–CREATE–IMPROVE). Find the vignettes at *http://bit.ly/1T7Hb9T*.

The 30 Most Amazing Higher Ed Natural History Museums. Colleges and universities play an important role in preserving history and education. Many function as hubs of research, art, and education, and some are home to amazing natural history museums, harboring fossils, scientific records, and incredible displays of our world's history. Best College Reviews, a ranking service for American colleges and universities, recently published a list of the top 30 college natural history museums in the United States. The list features an image from each museum, along with a brief description of what can be found there. View the list at *http://bit.ly/1nyJQxy*.

Online Course on Grant Writing for Educators. Developed by the NEA Foundation, this course introduces participants to all facets of grant research, writing, and stewardship. Intended as a self or small-group study, the five-session course covers everything from identifying grant resources, assembling a proposal preparation team, and writing a winning proposal to understanding the grant review process and then following through with reporting requirements and other expectations after receiving a grant. Access this course and others at the website *http://bit.ly/20JtLXL*. ●

News Bits

- **Three new children's TV programs with strong science content will debut this year.**

The animated series *Thomas Edison's Secret Lab* follows 12-year-old prodigy Angie and her science club as they discover Edison's "tricked-out" lab, featuring a hologram that brings the scientist back to life. In each half-hour episode, Edison leads the kids through experiments and adventures that help them learn and enjoy science. A live version of the series will travel the country in 2017.

"Our mission for *Thomas Edison's Secret Lab* is to help kids discover how much fun science can be through comedy, hijinks, adventure, and music that kids can relate to," says Stone Newman, president of Genius Brands International (GBI), which licenses the series. It will air on public television stations and on GBI's Kid Genius channel. Learn more at *http://mwne.ws/1TtnoSQ*.

In addition, Xploration Station, a block of science, technology, engineering, and math programming for kids, will feature two new series this year: *Xploration Experiments,* hosted by YouTube's Steve Spangler, and *Xploration: Nature Knows Best,* an engineering and technology series. These programs will extend the block—which currently features *Xploration Awesome Planet, Xploration Outer Space, Xploration Earth 2050,* and *Xploration FabLab*—to three hours.

The programs will air on FOX stations, Hulu, and Amazon Prime later this year and in early 2017. Learn more at *http://bit.ly/1UxoMlL*.

- **Students in one Missouri school district are one step closer to attending a project-based elementary school. The Choice School of Innovation has gained preliminary approval from the Mehlville School District's school board to open in 2018.**

The school will offer self-paced curriculum in which students learn math and other core subjects by solving real-world problems with students of similar skill levels—not necessarily of similar ages. Choice will use technology and differentiated instruction to customize learning for students.

"We're not blowing up what folks might consider as traditional schooling," Mehlville Superintendent Chris Gaines says. "We're still going to have those opportunities for kids. We're just going to have some other opportunities for [those] who may not be successful in a traditional setting, but might find this more engaging, more exciting, more relevant to what they're interested in."

Students can opt into this school, which has no admission requirements and will be modeled after the EPiC School in Liberty, Missouri, which has students address water, hunger, or other community issues as part of the curriculum. Read more at this website: *http://bit.ly/20dLKoW.*

- **Massachusetts Institute of Technology's (MIT) Sandbox Innovation Fund will support 11,000 students with innovative ideas or projects at any stage of development, offering grants of up to $25,000, mentoring, and tailored curriculum to nurture students' creativity.**

"The primary aim of Sandbox is to develop people, not necessarily start-ups or products…," says Ian A. Waitz, dean of MIT's School of Engineering and the program's creator. "[It] is designed to help students develop the knowledge, skills, and attitudes to be more effective when they go off in the world and practice MIT's brand of deep scientific and technological innovation."

Undergraduate and graduate students are eligible for the program and receive support throughout their time on campus. Learn more at the website *http://bit.ly/1WTDOnv.* ●

The NSTA Learning Center

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 exclusive to your area of instruction

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

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

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.

Wildlife Conservation Society

Free Teacher Webinar & Student Webcast Series. Learn real-world science through WCS research and experts. Receive training to introduce core science concepts to your students. Connect your students with science experts through interactive, TV-style webcast programs. Monthly webinars and webcasts begin September 2015. Visit *wcs.org/teacherpd* for more information.

NSTA Virtual Conferences

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

http://learningcenter.nsta.org/onlinecourses

National Science Teachers Association

What's New

FROM U.S. GOVERNMENT SOURCES

National Park Service (NPS)

Science Minute Movies

Working unobtrusively and mostly out of sight, NPS scientists do the rigorous science needed to document park ecological health and conserve historical riches. Give middle and high school students a glimpse of science in action—and introduce them to science, technology, engineering, and math (STEM) careers they might not know about—through Science Minute Movies. In these short videos, students will meet a diverse group of scientists who love their work. Visit with a forest monitoring team as they measure tree mortality at Mount Rainier National Park; follow along with scientists restoring native prairies in San Juan Island National Historical Park; and see North Cascades NPS biologists snare mammal hair for DNA analysis. Access the videos at *www.nwparkscience.org/video.*

U.S. Department of Agriculture (USDA)

Preserving Natural Heritage

The USDA's Animal and Plant Health Inspection Service (APHIS) Safeguarding Natural Heritage (SNH) program—a collaboration of the APHIS and Tribal Colleges and Universities—promotes opportunities for Native American youth ages 14–17 to learn how to preserve natural heritage through agriculture, natural resources, and wildlife biology. This two-week outreach program connects students with experts (e.g., APHIS employees, Tribal elders, Tribal professionals, university professors) for hands-on labs, workshops, discussions, and field trips focused on preserving natural heritage. Student activities may include assisting elders with sheep, cattle, or other animals; visiting zoos or bison and wolf sanctuaries; participating in water quality/soil testing; and learning how geospatial mapping can be used to track invasive species. Learn more at *http://1.usa.gov/1WVdB80.*

National Oceanic and Atmospheric Administration (NOAA)

To Make an Archipelago!

In this lesson from NOAA's Okeanos Explorers Series, students in grades 6–8 explore eight stages in the formation of islands in the Hawaiian Archipelago and how hotspot activity and tectonic plate movement can produce the arrangement of seamounts observed there. The lesson module, which supports the *Next Generation Science Standards* (*NGSS*) and the Ocean Literacy Essential Principles and Fundamental Concepts, is based around the 2015 Okeanos expedition, Hohonu Moana: Exploring Deep Waters Off Hawaii. Consult *http://1.usa.gov/1QnRQIF.*

U.S. Environmental Protection Agency (EPA)

Environmental Publication Repository

Looking for environmental education materials for your classroom? EPA's National Service Center for Environmental Publications offers resources including activity books, lesson plans, posters, and other materials grouped by grade range or level (e.g., K–3, K–12, elementary, middle, and high school, and teacher resources). Click on each order form to read annotated descriptions of the items in the group, along with the quantity limit that can be ordered. Consult *www.epa.gov/nscep.*

National Aeronautics and Space Administration (NASA)

Carbon Cycle Visualizations

NASA recently released a series of new visualizations related to one of Earth's key cyclical flows of energy and matter: the carbon cycle. The visualizations—available from NASA Wavelength, NASA's portal to digital Earth and space science resources for educators of all levels—will help high school students understand the role of carbon in the future of climate. Titles include A Breathing Planet, Off Balance; Yearly Cycle of Earth's Biosphere; and $C0_2$ Sources From a High-Resolution Climate Model. Access the visualizations, along with teaching tips and curated lists of carbon cycle lessons, at *http://bit.ly/1RjLJtQ.*

Aeronautics for Introductory Physics

With You When You Fly: Aeronautics for Introductory Physics is a collection of inquiry-based interactive demonstrations, labs, and data/literary analysis activities for students in high school and introductory college science. These activities were developed from peer-reviewed, teacher-contributed articles in *The Physics Teacher* magazine and combined with NASA aeronautics education resources and current research. The activities, which showcase real-world applications, may be used to teach fundamental physics concepts and inquiry skills. Access the curriculum at *http://go.nasa.gov/1TvkTj2.*

U.S. Department of the Interior

STEM Careers Video: Wildlife Conservationist

Do you know a student who loves animals and exploring outside? Introduce him or her to a career as a wildlife conservationist. In this TEDx Talk at *http://on.doi.gov/1MqJUEJ,* Jennifer Owen-White, a manager with the National Park Service's Valle de Oro National Wildlife Refuge in New Mexico, shares her transition from pre-medical studies—which her family and teachers wanted her to pursue—to a career in conservation.

Now at the refuge, she helps protect wildlife, wildflowers, and water. Her story is a testament to the importance of following your career passion, especially for young women. Share the video with middle and high school students.

Kids.gov

Kids.gov Asks NASA

Are your elementary and middle level students crazy about *Star Wars* spaceships and technology? Kids.gov asked a few scientists at NASA to share their thoughts about the future of space and space communications—since they happen to know a thing or two about aerospace engineering. Among the intriguing tidbits you'll learn at *http://bit.ly/1VzFJfB* is the kind of spaceship Acey Herrera, mechanical engineer at NASA Goddard Space Flight Center, would design for the *Star Wars* universe. Herrera is currently working on the James Webb Telescope, which will replace the Hubble Space Telescope in 2018.

Other kid-friendly questions addressed include these: What kind of communications tool would you design for the movie *Star Wars?* Can people live on the Moon? ●

In Your Pocket

Editor's Note

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

March 22–31

Agronomic Resident Education Award

This American Society of Agronomy (ASA) award honors in-resident educators with demonstrated excellence in classroom teaching, student-teacher interactions, graduate performance, and contributions to the field. Awardees receive a $2,000 honorarium and a certificate. Nominators must be ASA members, though nominees need not be. Begin the nomination process by **March 22;** learn more at *http://bit.ly/1m1h2fQ.*

Advancing Student Achievement Grant

These grants support math enhancement programs for groups of 20–25 students in grades 4–12 in the United States that open their minds to the practical power of math. Grants aim to bridge the gap between classroom and real-world mathematics. Up to $5,000 annually is available. Apply by **March 31** at *http://bit.ly/1VITxEw.*

Bright House Networks Classroom Innovators Grants

This program helps innovative educators who teach K–12 curriculum at public and private schools or at an after-school nonprofit program within Bright House Networks service areas (Alabama, California, Florida, Indiana, and Michigan). Recipients can be awarded up to one grant per year of no less than $250 and no greater than $500 to assist in their efforts to move students toward a brighter future through innovative learning. Apply by **March 31** at *http://bit.ly/1IvtU2r.*

The Gerald C. Corcoran Education Grant

The North American Native Fishes Association (NANFA) provides these $1,000 grants for projects that educate the public about native North American fishes and their environment. Such projects might include teacher training workshops, school materials and displays, stream surveys, or the production and distribution of educational materials. The award is presented in memory of former NANFA president Gerald C. Corcoran, who stressed public education about native fishes. Applicants must be NANFA members. Submit proposals by **March 31;** see *http://nanfa.org/corcoran.shtml.*

Verizon and PLTW Computer Science Grant

These $20,000 grants support the implementation of two Project Lead the Way (PLTW) Gateway curriculum units—Introduction to Computer Science I (ICS I) and Introduction to Computer Science II (ICS II)—over two years at middle schools nationwide. In these units, students design their own apps, explore text programming, and crowdsource and analyze data on a topic of their choosing.

Funds may be used to cover PLTW Gateway participation fees, ICS teaching training, or equipment such as tablets, computers, wireless internet, and related accessories. Participating schools must have a free and reduced-price lunch population of 70% or more. Apply by **March 31.** Consult *www.pltw.org/grant-opportunities.*

April 1–13

ACS-Hach Post-Baccalaureate Teacher Scholarship

This American Chemical Society (ACS) award goes to recent graduates and professionals with limited work experience who want to become high school chemistry teachers. Recipients must have an undergraduate degree in chemistry or a chemistry-related area, have less than one year of work experience, and be pursuing a master's degree in education or certification as a chemistry or science teacher. Awardees receive $6,000 for full-time study or $3,000 for part-time, which can be renewed for up to three years. Funds can be used for tuition, room and board, and other education-related expenses. Apply by **April 1** at *http://bit.ly/1ZYOroR.*

ACS's Dorothy and Moses Passer Education Fund

The ACS provides up to $1,000 to support continuing education activities for teachers at two- and four-year colleges and universities with no advanced degree programs in the chemical sciences. Grants support activities that directly relate to the recipient's teaching and take him or her off campus. Applicants must be full-time faculty members at their college or university; funds can be used for transportation, housing, and meals. Apply by **April 1;** consult *http://bit.ly/XFpNZT.*

Frances R. Dewing Foundation Grants

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 educational methods for young children, ages two to sixth grade. Grants range from $1,000 to $20,000, though the average is $5,000. Programs must be located in the United States and have tax-exempt status. Submit proposals by **April 1;** see *http://bit.ly/Nj43la.*

NiSource Charitable Foundation Grants

The foundation provides these grants to encourage volunteer support and benefit communities in which NiSource employees and customers live and work in Indiana, Kentucky, Maryland, Massachusetts, Ohio, Pennsylvania, and Virginia. Nonprofit organizations with programming in these areas are eligible: learning and science education, environmental and energy sustainability, community vitality and development, and public safety and human services. Apply by **April 1;** consult *http://bit.ly/1EZGQxv.*

The Safeway Foundation's Grants

These grants fund nonprofit organizations dedicated to Safeway's four priority missions: education, hunger relief, health and human services, and assistance to persons with disabilities. Applications are accepted year-round from organizations located near Safeway stores; to determine whether your community qualifies, see the website *http://local.safeway.com.*

Grants of up to $25,000 are available. The next application review takes place **April 1.** For more information, visit *http://bit.ly/1LiLQmi.*

AWG Outstanding Educator Award

The Association for Women Geoscientists (AWG) honors college or university educators with 20 or more years of experience who have played a significant role in educating and supporting women geoscientists. Awardees should demonstrate excellence in mentoring, instruction and curriculum, and outreach; winners are selected based on their contributions in at least two of these three areas. Nominations are due by **April 1** and must include six letters from students or colleagues; see *http://bit.ly/1m53pfA.*

Bernard M. Gordon Prize for Innovation in Engineering and Technology Education

This National Academy of Engineering award recognizes new modalities and experiments in education that develop leaders in engineering. The $500,000 cash prize rewards innovative curricular design, teaching methods, and technology-enabled learning that enhance students' capabilities and spark their desire to lead.

U.S. citizens who are substantively engaged in engineering and scholastic work in U.S. institutions are eligible. Half of the award funds go directly to the recipient, and half go to his or her institution to support continued work in this area. Submit nominations for anyone but yourself by **April 1.** Learn more at *http://bit.ly/1TrP1fc.*

Spring 2016 Carton2Garden Contest

This contest rewards K–12 schools that repurpose milk and juice cartons for their gardens in creative ways. Fourteen schools will receive a garden essentials package, a $500 Gardner's Supply gift card, and $4,500 in cash for soil, plants, and gardening supplies; three will receive a $2,000 cash prize; and 10 will get $900. Schools do not need an existing garden to apply.

Submit your entry by **April 13.** Get an entry kit at *http://bit.ly/1SghANx.*

What's My Next Contest: Win a 3D Printer

In this contest, students demonstrate what they know about the role medical laboratory professionals play in diagnosing patients. Students complete the Fighting Breast Cancer challenge, in which three lab heroes help diagnose a patient with breast cancer; take the 10 Surprising Facts About Cancer quiz; and complete the contest entry form. The 2,500th student to do so will win a 3D printer for his or her school.

To compete, students must be age 13 or older and currently attending high school. The winning school must agree to participate in a photo and video shoot in a classroom setting. Have your students enter the contest by **April 13** at *www.whatsmynext.org.*

April 15–18

Dorothy Stout Professional Development Grants

The National Association of Geoscience Teachers (NAGT) provides these grants for faculty and students at two-year colleges and K–12 teachers who wish to

- participate in Earth science classes or workshops;
- attend a professional scientific or science education meeting;
- participate in Earth science field trips; or
- purchase Earth science materials for classroom use.

One grant of $750 and a one-year NAGT membership will be awarded to one community college faculty member, one community college student, and a K–12 teacher. Educators who teach one or more Earth science courses or students who are actively pursuing a career in the Earth sciences are eligible. Submit applications online by **April 15** at *http://bit.ly/1wSdue8.*

McCarthey Dressman Education Foundation's Academic Enrichment Grants

The foundation provides these grants to help develop in-class and extracurricular programs that improve learning and nurture the intellectual, artistic, and creative abilities of students from low-income households. Educators with unique project ideas who need additional resources may apply. Those who have regular contact with preK–12 students from low-income households, are employed by a school or nonprofit organization, and have the background experience to successfully complete the project are eligible.

Grants of up to $10,000 per year are available for up to three years. Apply by 11:59 p.m. Mountain Time (MT) on **April 15** at *http://bit.ly/1gu6gLu.*

McCarthey Dressman Student Teaching Scholarships/Mentoring

These one-year scholarships are awarded to preservice educators in their final year of teacher education programs at New Mexico State University; the University of California, Santa Cruz; The University of Texas at Austin; or Stephen F. Austin State University. The scholarship provides $6,000 of financial support and one-on-one mentoring from an exemplary teacher. Full-time students in elementary or secondary education with good academic standing may apply by 11:59 p.m. MT on **April 15** at *http://bit.ly/19Tcfqc.*

McCarthey Dressman Teacher Development Grants

These grants are for individuals or small teams of teachers who want to develop and implement groundbreaking K–12 instruction. Projects should incorporate fresh teaching strategies that encourage critical inquiry and allow teachers to observe their effects on students. Recipients reflect and write about their projects and share their results with other teachers.

Grants of $10,000 per year for a maximum of three years are available for licensed K–12 teachers in public or private schools who have the background and experience to implement their projects successfully. Apply by 11:59 p.m. MT on **April 15;** for details, visit *http://bit.ly/1BM0d9J.*

The Sparkplug Foundation Grants

This foundation provides funds for start-up organizations or established organizations with new projects in education, music, or community organizing. Grants should help spark change and make projects more sustainable. Preference is given to "smallish" organizations with small budgets that are less likely to receive corporate, government, or institutional funding. Projects anywhere in the United States, Israel, or Palestine are eligible.

Visit *http://bit.ly/1E19Q7i* to answer the preliminary application questions by **April 15.** If the foundation determines you are eligible, letters of intent are due on April 22.

The Snapdragon Book Foundation Grants

This foundation provides funds to improve school libraries for disadvantaged children. Any public, private, or experimental school library that serves this population at the preK through 12th-grade level may apply. Grants of between $800 and $20,000 are available and must be used specifically for books.

Apply by **April 18.** Learn more at *http://bit.ly/1RRdiLT.* ●

Summer Programs

Editor's Note

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

DIG Field School. K–12 teachers will go fossil hunting July 28–August 1 in Montana's badlands as part of University of Washington (UW)/Burke Museum's Discoveries in Geoscience (DIG) Field School. DIG Field School connects teachers with Burke and UW scientists at active field research sites. Teachers will learn fundamental geologic science and research methods and contribute to UW paleontological research.

DIG provides ongoing support and access to tools and resources so teachers can bring project-based learning into their classrooms. Food, equipment, and transportation during the program are free. Apply by **March 31;** see the website *http://digfieldschool.org.*

NEED National Energy Conference for Educators. National Energy Education Development (NEED) Project's conference brings together educators who are passionate about energy education. This five-day event—taking place July 17–21 in Arlington, Virginia—will train participants and provide the necessary materials to implement hands-on energy units in their classrooms. Attendees receive a NEED kit, NEED infobooks, curriculum guides, and supplemental resources. Topics covered will include the science of energy, energy sources, transportation, electricity, efficiency, and environmental and economic impacts.

Scholarships are available. Apply by **April 1** at *www.need.org/summertraining.*

Patterns Around Us Summer Institute. This two-day (June 28–29) institute at the University of Massachusetts, Amherst, is open to eight general science, biology, physics, technology, and engineering teachers at the middle or high school level. Participants will explore pattern recognition, analysis, and prediction through activities that align with the Massachusetts State Frameworks for Science and Technology. Stipends, parking, professional development points, lunch, and housing for those outside the commuter area are provided. Apply by **April 1;** visit *www.umassk12.net/patterns.*

Stone Lab Science Courses for Educators. At Stone Laboratory, Ohio State University's island campus on Lake Erie, educators learn innovative ways to incorporate the natural environment into their classrooms and earn two semester credits in a week, though the courses may also be taken as noncredit workshops. Designed for classroom teachers, informal educators, and education majors with a junior rank or higher, these courses cover science content and teaching methodologies.

Offerings include Field Geology for Educators: Geologic Setting of Lake Erie (July 16–22); Field Ecology (July 24–30); Group Studies: Water and Wildlife Training for Educators (July 24–30); and Ornithology for Teachers (July 31–August 6). Apply by **April 10** at *http://bit.ly/YoDr94.*

HabitatNet's A Field Course in Measuring and Monitoring Biodiversity. During August 2–9, participants conduct biodiversity research in the Nuevo Durango Maya community, located in the central region of the Yucatan Peninsula. They stay in traditional Mayan cabins and have access to a secondary growth forest that is home to more than 400 species of birds, jaguars, pumas, ocelots, spider monkeys, and trees. Participants will publish a field report on their findings.

Apply by **April 15.** For more information, refer to the following website: *www.habitatnetfieldstudies.com.*

Bermuda Six-Day Educator Training Workshop. During this six-day (June 20–25) workshop offered by the Bermuda Institute of Ocean Sciences (BIOS), 12 teachers, curriculum specialists, administrators, and informal educators will learn how to plan and execute field study courses for their students at BIOS. Participants will explore coral reefs, use Glider technology for ocean study, and visit Whalebone Bay, Cooper's Island, and Fort St. Catherine, among other attractions, to learn how to incorporate them in educational experiences for their students. Middle and high school educators may apply.

Tuition must be fully paid by **June 3.** For details, visit *http://bit.ly/1PxLjvr.*

Summer Institute for Climate Change Education. This institute focuses on the *Next Generation Climate* middle school curriculum, which has students investigate the causes of global climate change, research the repercussions of such change, and explore how they can track and mitigate those effects. Participants will learn how to incorporate each of the six multidisciplinary lessons in their classrooms and how the activities support the *Next Generation Science Standards* as they work with climate change experts and other environmental educators. Those who implement climate change in formal or informal settings also have an opportunity to present and share their stories.

The institute takes place at Macalester College in St. Paul, Minnesota, June 21–24. Informal and formal educators at all levels may attend. Curriculum for grades 3–12 and some meals are provided; 26 continuing education credits and two graduate credits from Hamline University are also available.

To receive the early bird rate, register by **April 1** online at the website *http://bit.ly/1PUFVrF.* Registration for the institute closes on **June 7.**

Sharing Nature: An Educator's Week, Audubon Hog Island Summer Program. Educators will gather at Maine's Hog Island during July 17–22 to hear experienced instructors share their favorite approaches, methods, and activities for engaging children and adults with nature. Participants will explore an Atlantic Puffin and Tern colony on Eastern Egg Rock and hike the island's unspoiled spruce forest. They will also create inquiry-based lessons and experience both low- and high-tech teaching methods intended to excite and engage students. Workshops will include techniques in journaling, art, music, theater, and other disciplines.

Continuing education credits from the University of Southern Maine and scholarships are available, and spouses and friends are welcome to attend. Learn more at *http://bit.ly/1KfAFwi.*

Summer Modeling Workshops. The American Modeling Teachers Association (AMTA) will conduct a series of modeling workshops for high school and postsecondary physics, chemistry, biology, and physical science teachers. Participants receive a full set of course materials and work through the activities as they practice guided inquiry and cooperative learning.

More than 60 workshops will be held in 22 states and Bangkok, Thailand. At most workshop sites, teachers receive stipends or tuition waivers and reduced-rate housing. Participants also qualify for a free one-year AMTA membership.

Most workshops run for three weeks, though program dates vary by location. For more information, check *http://bit.ly/1UKmFeo.*

Chemistry Collaborations, Workshops, and Community of Scholars. These free workshops for university and college faculty focus on bringing a modern perspective to topics in the chemical sciences. Sessions provide hands-on activities and ways to introduce these perspectives into the college curriculum. This year's topics include Computational Chemistry for Chemistry Educators, Forensic Science, and Renewable Energy.

Accommodations, meals, and tuition are provided. Visit the website *www.ccwcs.org/upcomingworkshops.* ●

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BLICK ON FLICKS

Finding Science in *Labyrinth*

By Jacob Clark Blickenstaff

David Bowie passed away in early January, leaving behind an array of pop culture touchstones like the films *Ziggy Stardust and the Spiders From Mars* and *The Man Who Fell to Earth* and the hit song and album Let's Dance. As a teen in the 1980s, I was most familiar with him as Jareth the Goblin King in *Labyrinth* (1986). A musical fantasy film with puppets by Jim Henson and Frank Oz of Muppet fame, starring Jennifer Connelly and featuring David Bowie—what's not to like?

Connelly plays Sarah Williams, a teen who resents babysitting her half-brother Toby and wishes the Goblin King would take him away. To her great surprise, Toby vanishes, and the Goblin King appears to tell Sarah that she has just 13 hours to find her way through the labyrinth to his castle if she wants her brother back. Along her journey, she meets many fantastic creatures including a dwarf named Hoggle, a huge hairy creature named Ludo, and Sir Didymus, a fox who rides a sheepdog. Sarah shows intelligence, determination, and loyalty as she overcomes all the obstacles Jareth puts in her path on the way through the maze.

You are probably wondering what use a teacher could possibly make of a movie like this. I have suggestions for math, life science, and physical science that I think will connect with students who enjoy fantasy and films of the 1980s.

Liars and Truth-Tellers

A classic logic problem is built into the movie when Sarah approaches two doors guarded by two two-headed creatures. (The creatures remind me of face cards in a deck of playing cards with one head pointed up, the other down, and a shield in the middle.) One door leads farther into the labyrinth, while the other leads to "certain death."

One creature tells Sarah that they will answer a question, but one of them always lies, and the other always tells the truth. The problem is she doesn't know which is which, and with only one question allowed, she has to phrase it very carefully. For example, if she just asks the creature on the left, "Is this the door that leads to the castle?" she can't be sure if his answer is truthful or not. If he is the liar, his answer will be wrong, but she can't be sure.

Teachers could show the setup of the riddle, then stop the video and have students work individually or in pairs to try to solve it. The solution comes quickly in the film, but would likely take students much longer to sort out. Sarah asks the creature on

the left, "If I asked him [pointing to the creature on the right] if this was the door to the castle, what would he say?" After a bit of consideration, his answer is "Yes." Sarah then says she knows that the other door is the one to the castle. If you'd like to read a mathematician's explanation, check out *http://bit.ly/1PZRv4E*.

What's That Smell?

Later in the film, Jareth punishes Sarah, Hoggle, and Ludo by dropping them into the Bog of Eternal Stench, a place where mud loudly erupts with foul-smelling gas. This scene would be very popular with students who enjoy flatulence jokes, and while that's a bit unsavory, a life science teacher could use this in several ways to teach about decomposition and digestion. The movie scene combines two smelly things that seem unrelated: swamps and flatulence. It turns out that one compound is primarily responsible for the unpleasant odors of both, and that is hydrogen sulfide.

A swamp has an abundance of standing water and decaying plant material. Since the water doesn't flow or mix much, very little oxygen is dissolved in it, and the kind of bacteria that thrive in that environment are anaerobic (*an*-without, *aerobic*-oxygen). When anaerobic bacteria break down carbohydrates (like plant material), they produce a lot of hydrogen sulfide gas, which smells like rotten eggs. Similar chemistry happens in our large intestine where anaerobic bacteria contribute to digestion of our food, and the synthesis of some essential vitamins and nutrients. So as smelly as they may be, anaerobic bacteria do a great deal to make our planet livable and sustain us in our daily lives. Teachers who want a memorable way to begin a discussion of anaerobes could show a short clip of the Bog of Eternal Stench.

Motion by Moschen

Several times we see Jareth manipulating beautiful crystal spheres in his hands, passing them back and forth, or spinning four spheres stacked in a pyramid on one hand. As amazing as David Bowie was, he did not do these juggling tricks for *Labyrinth*. Instead, a well-known juggler, Michael Moschen, had to do the hard work while hiding behind Bowie and reaching around his body. Even more impressively, Moschen had no video feed, so he did all the manipulations without any visual cues at all.

Juggling is a great example of applied physics: The exchange of kinetic and potential energy as a flying ball follows a parabolic path, manipulating friction and rotation of the spheres to keep them in a constantly shifting pyramid. If you'd like to see more of Moschen's work, check out his TED talk at *http://bit.ly/1R69iWU*.

As strange as it may sound, middle and high school teachers can use scenes from *Labyrinth* to introduce mathematical logic, anaerobic bacteria, or the physics of juggling. ●

Note: Labyrinth *is rated PG.*

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

NSTA, CBC Announce Outstanding Science Trade Books

Trade books serve an important role in engaging students in science, engineering, and technology. NSTA and the Children's Book Council (CBC) have made finding trade books to use in conjunction with the *Next Generation Science Standards* (*NGSS*) easier with the release of the 2016 Outstanding Science Trade Books for Students K–12.

The review panel, composed of nine science educators, selected trade books that teachers can use to support the Scientific and Engineering Practices (SEPs), Crosscutting Concepts (CCCs), and Disciplinary Core Ideas (DCIs) outlined in *A Framework for K–12 Science Education*, the basis for the *NGSS*. The full reviews include information on the most relevant standards for each book, as well as appropriate reading levels as suggested by the reviewers. The books are listed by the most prevalent DCI, with notations of secondary DCIs, SEPs, and CCCs included at the end of each review.

The 2016 list, as well as lists from preceding years, is available online at *www.nsta.org/publications/ostb*.

Matter and Its Interactions

Hurricane Watch. Melissa Stewart. Illustrated by Taia Morley. (K–2)
Raindrops Roll. April Pulley Sayre. Photographs by April Pulley Sayre. (K–2)

From Molecules to Organisms: Structures and Processes

Animal Mouths. Mary Holland. (K–2)
Bilby: Secrets of an Australian Marsupial. Edel Wignell. (K–5)
Dirty Rats? Darrin Lunde. Illustrated by Adam Gustavson. (3–5)
Fire Birds: Valuing Natural Wildfires and Burned Forests. Sneed B. Collard III. Photographs by Sneed B. Collard III. (3–8)
High Tide for Horseshoe Crabs. Lisa Kahn Schnell. Illustrated by Alan Marks. (K–2)
How to Swallow a Pig: Step-by-Step Advice from the Animal Kingdom. Steve Jenkins and Robin Page. Illustrated by Steve Jenkins. (K–2)
Spit and Sticks: A Chimney Full of Swifts. Marilyn Grohoske Evans. Illustrated by Nicole Gsell. (K–2)
The Walking Fish. Rachelle Burk and Kopel Burk. (3–5)

Ecosystems: Interactions, Energy, and Dynamics

Birdology. Monica Russo. Illustrated by Kevin Byron. (3–8)
The Call of the Osprey. Dorothy Hinshaw Patent. Photographs by William Muñoz. (3–8)
Eyewitness Explorer: Nature Ranger. DK Publishing. (3–5)
The Great Monkey Rescue: Saving the Golden Lion Tamarins. Sandra Markle. (3–8)

Little Puffin's First Flight. Jonathan London. Illustrated by Jon Van Zyle. (K–2)
Mrs. Carter's Butterfly Garden. Steve Rich. Photographs by Brian Becnel, Tom Uhlman, ThinkStock, Conni Crittenden, The Carter Center, Jimmy Carter Presidential Library and Museum, Stephen Cord (The Carter Center), and Ward Pix. (K–2)
Next Time You See a Spiderweb. Emily Morgan. Photographs by Tom Uhlman, Judd Patterson, Steven David Johnson, Clay Bolt, and Nicky Bay. (K–2)
The Octopus Scientists. Sy Montgomery. Illustrated by Keith Ellenbogen. (3–8)
A Passion for Elephants: The Real Life Adventure of Field Scientist Cynthia Moss. Toni Buzzeo. Illustrated by Holly Berry. (K–5)
The Pier at the End of the World. Paul Erickson. Illustrated by Andrew Martinez. (3–5)
Sand Swimmers: The Secret Life of Australia's Desert Wilderness. Narelle Oliver. (K–2)
Small Wonders: Jean-Henri Fabre and His World of Insects. Matthew Clark Smith. Illustrated by Giuliano Ferri. (3–5)
Welcome to Mars: Making a Home on the Red Planet. Buzz Aldrin and Marianne Dyson. (3–8)
Welcome to New Zealand: A Nature Journal. Sandra Morris. (3–8)

Heredity: Inheritance and Variation of Traits

Emu. Claire Saxby. Illustrated by Graham Byrne. (K–2)
Spidermania: Friends on the Web. Alexandra Sly. Illustrated with photographs by Dennis Kunkel. (3–5)

Biological Evolution: Unity and Diversity

Egg: Nature's Perfect Package. Steve Jenkins and Robin Page. Illustrated by Steve Jenkins. (K–2)
The Fruits We Eat. Gail Gibbons. Illustrated by Gail Gibbons. (K–2)

Earth's Place in the Universe

Smithsonian: Space! DK Publishing. (6–12)

Earth's Systems

About Habitats: Polar Regions. Cathryn Sill. (K–2)
After the Ashes. Sara K. Joiner. (6–8)
Ancient Earth Journal: The Early Cretaceous. Juan Carlos Alonso and Gregory S. Paul. Illustrated by Juan Carlos Alonso. (3–5)
Ocean: A Visual Encyclopedia. DK Publishing. (3–8).
When Earth Shakes: Earthquakes, Volcanoes, and Tsunamis. Simon Winchester. (6–8)

Earth and Human Activity

Home Address: ISS: The International Space Station. James Buckley Jr. (3–5)
Wild at Heart: Mustangs and the Young People Fighting to Save Them. Terri Farley. Photographs by Melissa Farlow. (5–12)

Engineering Design

The Fantastic Ferris Wheel: The Story of Inventor George Ferris. Betsy Harvey Kraft. Illustrated by Steven Salerno. (K–2)
Flying Cars: The True Story. Andrew Glass. (3–8)

Links Among Engineering, Technology, Science, and Society

Ada Byron Lovelace and the Thinking Machine. Laurie Wallmark. Illustrated by April Chu. (3–5).
Chocolate: Sweet Science & Dark Secrets of the World's Favorite Treat. Kay Frydenborg. (9–12)
Food Engineering: From Concept to Consumer. Michael Burgan. (6–8)
Inside Biosphere 2: Earth Science Under Glass. Mary Kay Carson. Photographs by Tom Uhlman. (6–8)
The Inventor's Secret: What Thomas Edison Told Henry Ford. Suzanne Slade. Illustrated by Jennifer Reinhardt. (3–5)
Magnificent Minds: 16 Pioneering Women in Science and Medicine. Pendred E. Noyce. (9–12)
Remarkable Minds: 17 More Pioneering Women in Science and Medicine. Pendred E. Noyce. (6–12)
Sally Ride: A Photobiography of America's Pioneering Woman in Space. Tam O'Shaughnessy. (3–8)
So, You Want to Work with the Ancient and Recent Dead? Unearthing Careers from Paleontology to Forensic Science. J.M. Bedell. (3–8)
Steve Jobs: Insanely Great. Jessie Hartland. (6–8)
Terrible Typhoid Mary: A True Story of the Deadliest Cook in America. Susan Campbell Bartoletti. (5–8) ●

National Earth Science Teachers Association Events at 2016 Nashville NSTA Conference

All NESTA sessions are in Music City Center, Davidson B, unless otherwise indicated

Friday, April 1

- ➢9:30 – 10:30 am **Earth System Science Share-a-Thon**
- ➢11:00 am – noon **NESTA and HHMI Share: Multimedia Tools and Resources for Teaching Earth Science**
- ➢12:30 – 1:30 pm **NESTA and TERC Share: EarthScope Chronicles: The Newberry Volcano**
- ➢2:00 – 3:00 pm **Geology Share-a-Thon**
- ➢3:30 – 4:30 pm **Rock, Mineral, and Fossil Raffle**
- ➢6:30 – 8:00 pm **Friends of Earth Science Reception** ***Hilton Garden Inn, Skyline Junior Ballroom***

Saturday, April 2

- ➢9:30 – 10:30 am **Astronomy Share-a-Thon**
- ➢11:00 am – noon **American Geophysical Union Lecture, Dr. Linda Kah, Kenneth Walker Professor *at* UT-Knoxville, *Music City Center, Grand Ballroom C2***
- ➢12:30 – 1:30 pm **NESTA and CIESIN Share: Exploring a Compendium of Online Resources for Teaching Earth Science**
- ➢2:00 – 3:00 pm **Atmosphere and Ocean Share-a-Thon**
- ➢3:30 – 4:30 pm **Innovative Ways to Teach about Weather Observation and Weather Hazards**
- ➢5:00 – 6:00 pm **NESTA Annual Membership Meeting**

MS. MENTOR, **Advice Column**

‘Flipped’ Meetings; My Students Don’t Study!

As the science chairperson, I’d like to change the format of our monthly after-school meetings. Do you have any ideas about what we can do in terms of professional development or other projects? It seems like we don’t get much accomplished.

—C., Virginia

Let’s face it: At the end of the day, most teachers are tired and concerned with evaluating student work, getting home to their families, heading to another job or a graduate class, and/or preparing a lesson. The after-school time is too precious to spend on mundane informational issues or idle chatter.

My experience included meetings in which we read information items (deadlines, changes in policy, upcoming events). We complained about situations without reaching any decisions. Some colleagues graded papers or watched the clock. We often left these hour-long contractual meetings with a list of tasks to accomplish individually on our own time (e.g., strategic planning, supply orders, professional development plans). I’m glad to hear that you want to facilitate something more productive.

For your monthly meetings, e-mail an agenda in advance. The agenda should include an issue to discuss, resolve, or plan for that is important to science teachers or to the district (e.g., lab safety, grading policies, instructional strategies, *Next Generation Science Standards* topics, technology, inventories, parent communications, assessments). Include information items here so the actual meeting time can be spent on more important issues.

Rather than a bulleted list of agenda items, phrase them in the form of a question for your colleagues to discuss. For example, instead of “Safety,” ask, “What do you do to ensure that students work safely in your lab?” Set aside a few minutes before adjourning to recognize new issues and celebrate any successes or accomplishments.

I’ve also participated in meetings modeled on the “flipped classroom” strategy. The participants were given readings to do or video segments to watch before the meeting. (The NSTA journals and web resources would be good sources for these.) The real-time meeting then focused on active discussion, decision-making, hands-on experiences, or teacher reflection. Teachers can use the time to work collaboratively on tasks that they would otherwise have to do on their own, rather than taking them home for later.

For example, in the December 2015 issue of *The Science Teacher*, the Science 2.0 column "Did They Really Read It?" (*http://bit.ly/1nMOCaz*) addresses how to assess student understanding of a reading assignment or video. The authors also posted a five-minute video blog post (*http://bit.ly/1T3nkdj*) that demonstrates how the two tools described in the article work. In a flipped meeting or workshop, the participants can read and watch the materials in less than 10 minutes in advance and use the meeting time to explore the options and consider how this would apply to their classes.

Other options

- Use the meeting time to model strategies that would apply to the classroom, such as gallery walks, cooperative learning, and technology tools for brainstorming, sharing, and visualizing. For example, I was at a meeting in which the chair gave us each an article on a relevant topic. We had a few minutes to read it, and we were directed to highlight three statements that resonated with us or about which we had a question. We shared them via an online tool, then discussed the highlighted issues. The presenter noted that the strategies for critical reading, technology, and think-pair-share could be applied in the classroom.
- Vary the location of the meetings, asking a different teacher each month to "host" the meeting in his/her lab. The host would describe some of the activities that the students do, giving the other teachers a chance to learn more about what happens in other classes.
- Have a combined meeting with another department to discuss common interests or questions, or conduct a virtual meeting with Skype to interact with a scientist, museum curator, or other resource person.

You may encounter some resistance from teachers accustomed to the status quo. Being expected to participate in discussions or group activities may take some time for them to get comfortable with, and you might have to prepare some discussion-starters at first. If meetings were seen as a waste of time, you'll have to be persistent to show that things are going to be different.

I struggle with getting my biology students to prepare for assessments. What are your thoughts?

— J., Arizona

This problem is not uncommon, and J. was able to provide some additional details:

"I give them study 'helps' that outline the concepts to be tested, and extra points if they complete them. I do flashcards each day with the vocabulary. I give them a daily study tidbit: It might be re-reading a section, or highlighting and annotating their notes. I also use games such as Jeopardy and online tools such as Quizlet (see the website https://quizlet.com*) and Kahoot (*https://getkahoot.com*). I have even developed an online site where I can electronically host study sessions with students prior to a test. But they still seem unprepared."*

It sounds like you do a lot of work for the students: creating study guides, hosting review sessions, and designing vocabulary games. Perhaps students become dependent on teachers for these materials and don't realize what they could or should do themselves. I suspect many students, even in high school, are unsure how to study or review. So you make a key point when you asked about ways for students to help themselves prepare for assessments.

Review games can be helpful, assuming students understand their purpose and relate their performance in the game to their learning. These games may be fine for vocabulary and factual knowledge, but I wonder about their value in preparing for higher-order assessments.

Rather than, or in addition to, a review at the end of the unit, try spacing formative assessments throughout so students can monitor their learning. Several teachers on the NSTA e-mail lists and forums have described their use of practice quizzes as a preview of the types of tasks on an assessment:

— *I give students a single-page review sheet. Students answer what they can, then collaborate on responses to the remaining questions, while I circulate around the room to observe the students at work. We then regroup and review. Students who volunteer the correct response get extra credit for that question. Students have a record of the questions they struggled with and can review again before the test.*

— *I use Quia (*www.quia.com*) to create practice quizzes. After every test, I share the average scores for students who did and did not complete the practice quizzes. There is usually a 10% difference (not surprisingly). It shows students something concrete they can do to improve. To them, studying is sitting down and reading the notes; practice quizzes force them into a more focused review.*

— *I recently [began] giving five extra points on their tests only if they had done a quiz that I put online three separate times. I wanted them to study at least three days on their own. They had to complete the quiz each time and could not have done all three in one day. My objective was to get them to not study just the one night before and…develop a more patterned form of studying.*

What worked for my high school and middle school students was having them create an index card study guide. Students wrote whatever they thought was important on a 4×6 card. The students soon realized that they had to actually review their notes to create the card. Very few of my test items required students to recall information, and by having some information available to them during the test, the students' responses to open-ended questions were much improved. They were not allowed to share their cards during the assessment, and I collected the cards with the test papers so that students could not give them to others.

I discovered that looking at the cards gave me feedback on what the students considered important. The students attached the cards to their notebooks for future reference and review.

When creating these cards, students actually engaged in some higher-level thinking: determining what they knew, what they didn't know, and what they thought was important, as well as prioritizing information to fit on the card. Yes, there were students who didn't take advantage of the opportunity. But I had a student who said, "You sly dog! I spent more time creating the card than I would just studying by paging through my notes—and I did well on the test!" ●

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

NSTA PRESS: *Introducing Teachers and Administrators to the* NGSS

Exploring the Practices and Crosscutting Concepts

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 Introducing Teachers and Administrators to the *NGSS*: A Professional Development Facilitator's Guide, *by Eric Brunsell, Deb M. Kneser, and Kevin J. Niemi, edited for publication here. To download the full text of this chapter, go to* http://bit.ly/1KFsMey. *NSTA Press publications are available online through the NSTA Science Store at* www.nsta.org/store.

Activity 5: Integrating the Three Dimensions

Objectives

During this activity, participants will

- identify disciplinary core ideas, science and engineering practices, and crosscutting concepts in a model activity;
- revise a model activity to focus on one or more practices and crosscutting concepts;
- reflect on connections of the three dimensions in the model activity;
- identify a unit they already teach and plan to modify the unit to incorporate the three dimensions; and
- develop an action plan to increase student focus on the use of specific practices and crosscutting concepts.

Evidence of Learning

- Summarization of work on chart paper
- Graphic organizer "Integrating Crosscutting Concepts"
- Graphic organizer "Integrating Science and Engineering Practices"

At a Glance

In this activity, participants will experience a model activity as they develop an understanding of the three dimensions of the *Framework* and *NGSS*. After experiencing the model activity, participants will identify related disciplinary core ideas, science and engineering practices, and crosscutting concepts. This activity ends with participants suggesting ways that they could make instruction more explicit for one or more practices and crosscutting concepts. This activity assumes that participants have a beginning understanding of the structure of the *NGSS* and that the *NGSS* performance expectations were developed to include the three dimensions from the *Framework*.

Facilitator's Notes

Perhaps the largest and most exciting difference between the *Next Generation Science Standards (NGSS)* and other current standards is the integration of content, practices, and crosscutting concepts. The *NGSS* performance expectations guide assessment toward considering content within the context

of using practices and making connections with crosscutting concepts. For example, the *NGSS* say that

State standards have traditionally represented Practices and Core Ideas as two separate entities. Observations from science education researchers have indicated that these two dimensions are, at best, taught separately or the Practices are not taught at all. This is neither useful nor practical, especially given that in the real world, science and engineering is always a combination of content and practice. It is important to note that the Scientific and Engineering Practices are not teaching strategies—they are indicators of achievement as well as important learning goals in their own right. As such, the Framework *and* NGSS *ensure the Practices are not treated as afterthoughts. Coupling practice with content gives the learning context, whereas practices alone are activities and content alone is memorization. It is through integration that science begins to make sense and allows students to apply the material. This integration will also allow students from different states and districts to be compared in a meaningful way.* (p. 2)

In addition, the *Framework* states

that crosscutting concepts have value because they provide students with connections and intellectual tools that are related across the differing areas of disciplinary content and can enrich their application of practices and their understanding of core ideas. (p. 233)

Procedure

Setup: Participants should be organized into groups appropriate for the model activity you will be using. The "transfer" component of this activity works best when participants are in grade-level or content-alike groups. Materials for the model activity should be prepped in advance.

Introduction: Explain that participants will first experience a model activity and then use this experience to identify how the three dimensions of *NGSS* can be integrated into instruction.

Model Activity: Participants should experience the model activities as students.

Model Activity Wrap-up: Transition participants from engaging in the model activity as a student back to thinking as a teacher by using a Think-Pair-Share approach focused on the question, "What aspects of good science teaching were evident in this model activity?"

Integrating the Dimensions: This component of the activity is divided into the following four parts:

Disciplinary Core Ideas: Participants should use the disciplinary core idea progressions in *NGSS* Appendix E to identify the disciplinary core ideas used in this activity.

Crosscutting Concepts: Pass out the handout, "Integrating the Crosscutting Concepts." Participants should use the "Crosscutting Concepts" matrix (*NGSS*, Appendix G) to identify the crosscutting concepts related to this activity. In addition, participants should select one crosscutting concept and describe how they could make the connection between the disciplinary core idea and crosscutting concept more explicit for students.

Science and Engineering Practices: Pass out the "Integrating the Science and Engineering Practices" handout. Participants should use the "Science and Engineering Practices" matrix in Appendix F of the *NGSS* to identify the practices that they engaged in during the model activity. Participants should also describe what they were doing as they engaged in that practice. Finally, participants should select one practice and describe how they could make the use of that practice more explicit for students.

Gallery Walk: Participants summarize their work on chart paper for display. Provide groups with time to view one another's work. Encourage participants to comment in writing on the posters created by other groups.

Transfer: Participants work either in grade-level or topic-alike groups to identify an activity in an upcoming unit that they can modify to incorporate the three dimensions of the *Framework*. Participants should be encouraged to develop an action plan to increase student focus on the use of specific practices and at least one crosscutting concept during that unit.

Debrief: Use a "knowledge café" approach to provide closure to this activity. In a knowledge café, participants engage in multiple informal discussions and record notes on chart paper. To do this, create groups of four to five. These groups should be different from those used in previous parts of this activity. Each group will discuss the following three prompts:

- What are your two to three biggest insights from this activity?
- What are your biggest concerns after completing this activity?
- What questions do you have?

Write one prompt at the top of each sheet of chart paper, and spread the prompts around the room. Each group should start at a different prompt. After discussing their initial prompt (and recording their big ideas) for seven to eight minutes, groups should rotate to the next prompt. Groups should quickly read the notes from the previous group, discuss the prompt, and add their ideas to the chart paper. Continue until every group has discussed each prompt. After the groups discuss the last prompt, they should take a few minutes to summarize the notes from all groups related to that prompt. Post the summarized chart paper and allow participants to browse.

Next Steps

This activity illustrates a practical example of how disciplinary core ideas, science and engineering practices, and crosscutting concepts should be integrated into instruction. The remaining activities in this chapter help science teachers gain a deeper understanding of the crosscutting concepts and science and engineering practices.●

(All dates are deadlines unless otherwise specified.)

March 31—The **64th NSTA National Conference on Science Education opens** in Nashville, Tennessee. The conference runs through April 3. Join science education colleagues from across the country as they participate in more than a thousand sessions, workshops, and other activities to gain insight into the latest trends in science education. Participants can follow four strands—Setting the Stage: Scientific Literacy; Building the Band: Involving Community Stakeholders; Harmonizing Concepts: Integrating Instruction; and Stringing It All Together: Three-Dimensional Learning—to focus their professional development experience or attend sessions targeted to particular needs. For more information or to register, visit *www.nsta.org/nashville*.

April 13—What is the role of a watershed, and how can you identify a healthy one? Learn how to answer these questions and more, and discover some hands-on investigations to conduct with your students during **Global Precipitation Measurement Mission: Watersheds, a free NSTA Web Seminar**. The session will run from 6:30 to 8 p.m. Eastern Time (ET). Participants receive a certificate of participation and 100 Learning Center activity points after completing the post-program evaluation. An archive and presentation slides will be available when the program concludes. For more information on NSTA Web Seminars or to register, visit *http://bit.ly/1Iwpg4w*.

April 15—**Session proposals** for the **2017 NSTA National Conference on Science Education** are now due. The conference will be held March 30–April 2, 2017, in Los Angeles, California. For more information or to submit your session proposal, go to *http://bit.ly/1wI4iQg*.

May 5—Explore the types of weather, how weather is monitored by satellites, and opportunities to have your students participate in weather data collection during **Global Precipitation Measurement Mission: Weather, a free NSTA Web Seminar**. The session will run from 6:30 to 8 p.m. ET. Participants receive a certificate of participation and 100 Learning Center activity points after completing the post-program evaluation. An archive and presentation slides will be available after the program ends. For more information on NSTA Web Seminars or to register, visit *http://bit.ly/1Iwpg4w*.

May 13—It's your last chance to take advantage of early bird discounts on your registration for NSTA's **2016 STEM Forum & Expo** in Denver, Colorado, July 27–29. Derek Muller, creator of the science YouTube channel Veritasium, will present the keynote address on July 27. For more information or to register, visit *www.nsta.org/conferences/stem.aspx*. ●

NSTA Launches *Connected Science Learning*

Later this month, NSTA's new online journal *Connected Science Learning* (*CSL*) will be launched to help educators "bridge the gap between in-school STEM [science, technology, engineering, and mathematics] learning and that happening out of school," explains *CSL* field editor Dennis Schatz. "*CSL* will offer a media-rich experience for readers, including embedded videos and more."

The first issue focuses on "Successful Formal–Informal Science Education Collaborations," including contributions on museum-school collaborations across the country, and connections between schools and after-school programs. Regular departments include the Research to Practice, Practice to Research column, which will inform educators on current research and connect researchers to educators' concerns and needs; and the Emerging Connections column, which will include recently created efforts that connect out-of-school STEM programs and preK–12 classrooms. The Diversity and Equity column features connected STEM learning efforts to increase participation and interest in STEM by underserved groups, and *Connected Science Learning* Briefs will highlight in-school and out-of-school STEM learning resources, curriculum considerations, and more.

"Learning isn't something that happens just in school," Schatz observes. "With that in mind, we are making *CSL* available to anyone interested in connecting in-school STEM education to what happens out of school." Visit *http://bit.ly/1PPWjDm* for more information or to sign up to be notified when the journal publishes.

Submissions for the second issue of *CSL* are being accepted on the theme "Professional Development: Building the Capacity of STEM Educators to Enhance Collaboration Between Formal and Informal Environments." For more information on how to submit an article, go to *http://bit.ly/1nL3s23*. *CSL* is a joint initiative of NSTA and the Association of Science-Technology Centers (ASTC), with support from the National Science Foundation to produce and evaluate the initial issues. ●

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Crowther Elected 2017–18 NSTA President

NSTA members elected David Crowther in February to serve as the association's 2017–18 president. An educator for more than 25 years, Crowther now serves as the executive director of the Raggio Research Center for STEM Education and a professor of science education at the University of Nevada, Reno.

"We are at a critical time for science and STEM [science, technology, engineering, and math] education to catch up with the skills needed for the 21st-century workforce," says Crowther. "We need to rejuvenate science education. One of our biggest challenges is to move from what was the traditional approach to [STEM] instruction to align it with the three-dimensional approach of the *Next Generation Science Standards*. We need to create a cultural shift that would include science in every grade every day."

Also elected to NSTA leadership positions are Elizabeth Allan (College Division), John Olson (Coordination and Supervision Division), and Carrie Jones (High School Science Teaching Division). Elected to serve on the NSTA Council as district directors are Mary C.H. Weller (District III: Delaware, the District of Columbia, and Maryland), Zoe Evans (District V: Alabama, Florida, Georgia, Puerto Rico, and the Virgin Islands), Brenda Heck (District IX: Minnesota, North Dakota, and South Dakota), Joe Myers (District XI: Kansas, Missouri, and Nebraska), Tom Cubbage (District XV: Idaho, Montana, and Wyoming), and Midge Yergen (District XVII: Alaska, Oregon, and Washington). ●