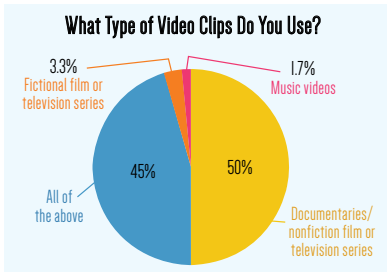

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Preparing Science Teachers for High-Need Schools

"Our challenge is recruiting and developing teachers for a mid-sized city and preparing teachers to serve in high-need schools. [Teaching low-income students requires] a specialized skill set beyond teaching content," says Mark Neal, director of Project Inspire, a teacher apprenticeship program serving Chattanooga, Tennessee, and the Hamilton County School District. "We have been solely focused on secondary math and science, but we're now expanding to [the elementary level]," he reports.

Project Inspire provides college graduates aspiring to teach with a year-long apprenticeship in a Hamilton County classroom and a stipend during that time. Higher-education partner Lee University of Cleveland, Tennessee, offers apprentices a 14-month degree program in which they earn a Masters of Arts in Teaching. Graduates are required to teach in a high-need school in the county for four years and receive coaching support and professional development (PD) from Hamilton County Department of Education and Lee University faculty.

"Secondary science is a difficult position to fill, and we have a number of priority schools that are difficult to teach in. We offer a one-year residency versus a student teacher practicum," explains Justin Robertson, Hamilton County Schools assistant superintendent of curriculum and instruction. Apprentices get to "see how students react, and they have permission to make mistakes. It's a good way to prepare teachers for any school system, and specifically for our school system."

DAVID HUMBER

Ella Bonah (left), a teacher at Tyner Academy in Chattanooga, Tennessee, completed an apprenticeship through Project Inspire, a program that prepares teachers for positions in high-need schools.

"We continue to see really committed candidates, people who didn't get this training as undergraduates," says Neal. "[Though] we tend to get more recent undergraduates as applicants, our network has a strong interest in attracting career changers," he observes, adding, "We're aiming to have a more diverse and talented teaching force."

Apprentices start planning with their mentors—known as "clinical instructors"—in June and spend several weeks during the summer with them. "Clinical instructors provide additional training and support throughout the year, and unstructured [PD] times as well…A lot of the best support comes from those sessions," says Robertson.

In Project Inspire's "gradual release model," clinical instructors gradually allow apprentices to assume more and more responsibility, to ensure they "have a full role and are not just observing," explains Robertson. "Side-by-side co-teaching and coaching is a great experience for [apprentices]."

Apprentices are taught "science methods used in our classrooms, our pedagogy and terminology," Neal emphasizes, "so they don't experience a disconnect when they hit the classroom." They learn about "teaching in the context of high poverty, what it looks like in our area," he explains.

As undergraduates, "a lot of our [apprentices] learned 'old-style' sci-

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NSTA National Science Teachers Association

COMMENTARY: **Jennifer Basalari, Andy de Seriere, Donna Hawkins, and Donna Miller**

Externships Transform Teaching Practice

By Jennifer Basalari, Andy de Seriere, Donna Hawkins, and Donna Miller

The opportunity to work with engineers at a major corporation isn't something most science, technology, engineering, or math (STEM) teachers receive. In 2016, we were among 25 teachers selected for the first Northrop Grumman Foundation Teachers Academy. Although we believed this would be a valuable experience that could make us better teachers, we knew little about how an externship could really help us.

The two-week externship followed a year of blended professional learning in STEM to prepare for the externship and a week-long summer conference at a Northrop Grumman facility, as well as access to NSTA's Learning Center and its professional learning tools. The two weeks of daily work at a local Northrop Grumman office was the true meat of the experience. We spent those days

- interviewing people at all levels in the organization;
- sitting in on project meetings;
- viewing demonstrations from experts on specific projects;
- meeting with human resources staff to discuss job requirements and hiring practices;
- participating in a 12-hour extreme work session called an "engineering hackathon";
- attending special events for employees, such as talks by outside speakers;
- editing scientific papers and researching topics assigned by our mentors;
- keeping a journal to document learnings throughout the experience; and
- developing lesson/unit plans to use in our classrooms and share with colleagues.

These types of partnerships with STEM professionals can be a huge benefit for STEM teachers. We finished the experience with a strong desire to give students the experiences and education that will prepare them to work at STEM companies. From our experience, communication and collaboration are key skills to success in creative fields like engineering and computer science.

During the externship, we evolved from feeling like outsiders, convinced we would never understand what was happening, to noticing patterns in how our new colleagues interacted, to experiencing a series of "aha!" moments when we would recognize techniques from our pedagogy being used by the engineers. We watched as teams of engineers gathered to share data and decide their next steps. We observed as problems requiring immediate solutions arose and were solved. And we watched engineers prepare presentations for everyone from stakeholders to incoming interns. You can learn about STEM skills and practices in professional learning workshop after workshop, but until you witness these skills applied, you can't imagine how critical they actually are in the STEM workplace!

As science and STEM teachers in diverse communities where most students qualify for free or reduced-price lunch and few parents have a college education, we know few of our students—many of whom love science—will follow that love to college, much less a career in a STEM field.

To prepare students for a STEM career, teachers need to know something about working STEM professionals. Our experience taught us quite a few new things, but also reinforced things we knew *intellectually* but didn't totally understand. We have often discussed the importance of collaboration, critical thinking, and communication with our students. The sheer amount of communication we witnessed among the working engineers was eye-opening; we knew STEM professionals discuss challenges and achievements (like we do as teachers), but examining how their interactions affected their work made us eager to create more opportunities for our students to document their work and collaborate with peers. Now we can give specific examples of what we saw engineers doing that required these skills. Our experiences validated these important themes in education. We should continue to focus on them to not only excite students about a possible STEM career, but also provide valuable, employable skills.

While a few days of observation or a few hours of meeting STEM professionals or inviting them into your classroom can be great, we recommend all teachers wanting to partner with a STEM corporation in their community to seek out longer experiences that will allow you to witness engineers doing the same type of work repeatedly. This is when you will start to see patterns emerge. Also, if you spend enough time with people, they will start to "let their hair down," and that's when you'll learn much more.

As teachers, we sometimes wonder: Are we really doing STEM or just fun activities? Are we making sure classroom activities reinforce the core disciplinary instructional practices in our lessons? The STEM professionals we observed and talked with demonstrated how they use their engineering and critical-thinking skills in real-world scenarios every hour, every day. This made what we teach less abstract and what we choose to teach that much more critical.

More information on the Northrop Grumman Foundation Teachers Academy is available online at *www.nsta.org/northropgrumman*. ●

Jennifer Basalari teaches fifth-grade science at Lakemont Elementary School in Winter Park, Florida. Charles "Andy" de Seriere is a STEM coordinator for Wiseburn Unified School District and teaches STEM and Project Lead the Way at Dana Middle School in Hawthorne, California. Donna Hawkins teaches science at Slauson Middle School in Azusa, California. Donna Miller teaches science at Windy Hill Middle School in Owings, Maryland. They were Northrop Grumman Foundation Teachers Academy 2015–2016 Fellows.

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ence, with a lot of lecturing. We try to stay with the cutting edge," Neal contends. "Tennessee is writing its own standards, and they'll be similar to the *Next Generation Science Standards* (*NGSS*). We refer [apprentices] to the [*NGSS*] during training."

Though they receive full certification that is portable, most graduates—"70%," says Neal—teach in the Chattanooga area. "Generally in urban areas, the retention rate is only about 50%," he points out.

In addition, Chattanooga is "known as 'gig city' because of all the tech startups; there's a lot of innovation and change happening...Our program attracts [aspiring teachers] who are intentionally working in math and science and working in a high-need school—all in one package," Neal contends.

Hired as Apprentices

Because of teacher shortages in Oklahoma, the Tulsa Public Schools (TPS) district was "having to [hire teachers] who were waiting on their certification...Some may be entering the teacher workforce for the first time; others may be coming from out of state and need time to have their current certification transferred; and others may be simply waiting on their certification to arrive, having just graduated from a teacher preparation program," says Bradley Eddy, TPS director of certified talent. "We were paying them as substitutes, which was the only option at the time."

But the substitutes "weren't paid adequately, and we couldn't keep enough substitutes. Asking someone to prepare lessons, deliver them, and handle connections with parents and community" for just $65 per day wasn't effective, he acknowledges. "So we offered them a chance to work hourly as a substitute, with overtime."

Though the numbers increased a little, those positions "didn't pay well enough [to make up for] the extra work. We [decided] to create an exempt position with a flat rate and a shorter-term contract" to ensure retention, Eddy relates.

Under the current plan, uncertified teachers are hired as apprentices and are offered a one-semester contract. They earn a first-year salary of $25,000 with benefits, including health insurance, if their contract is renewed for a second semester.

"This saves [TPS] money because [constant teacher attrition] is financially unfeasible…and [we had] apprentices [with emergency certification, which] is only good for the year it's granted and isn't renewable. [And sometimes] there's a delay in time in which a principal [decides] to hire [someone]. We offer an apprentice contract so we can pay them as full-time classroom teachers," he explains.

Apprentices also receive up to two years of mentoring support, paid evening and Saturday PD opportunities, and certification test preparation. While they have to attain certification within one semester, their salary makes it easier for them to pay $400 for the certification tests, he points out.

Many apprentices express interest in teaching science. "We were able to fill all of our science and math positions this year," Eddy notes.

Promoting Best Practices

While Project Inspire and TPS prepare teachers for their own schools, the year-long Teacher Training Course (TTC) at independent Shady Hill School in Cambridge, Massachusetts, trains apprentice teachers to work in preK–8 classrooms at other schools. "We occasionally hire teachers from our program," says Tracy Polte, science department chair, but many apprentices "go on to public schools for their second year of teaching." TTC apprentices can train to teach early childhood and elementary classes, middle school humanities classes, or middle school science, math, and science/math classes.

About 50% of applicants come from outside the area. "We receive 50 to 55 applications each year," with 14 to 18 accepted into the TTC, Polte relates. The program attracts persons ranging from new graduates to those in their sixties, she reports.

Tuition for the TTC costs slightly more than $11,000. Shady Hill has financial aid and merit awards to help apprentices pay for the course, and many apprentices "coach after school or work in after-school programs," she notes.

While some apprentices enroll only in the TTC for their certification, many also participate in the master's degree program at nearby Lesley University. "They're [attending] Lesley all summer" and during the school year, says Polte.

Apprentices in the TTC work in the classroom for four days a week, and attend workshops on Fridays. They work with one teacher for the first half of the year and another during the second half, and learn about teaching various subjects and age bands before deciding which ones they prefer. "We give them experience with lots of different kinds of students," she observes.

"To be an effective teacher, you have to have more experience in the classroom than [what you'd have] in a student-teacher program," Polte contends. "As an independent school, we focus on multiculturalism, and every workshop has a multicultural component."

"We can't cover all the content [for every subject], so we hope their background has provided some of the content," she admits. In science, "we cover the main points for grades K–6 and help them understand the inquiry method and the engineering design process, how to integrate engineering into literacy, [along with] the joy students feel" in science classes.

Teaching apprentices "is written into our contracts," says Polte. "It keeps all of us fresh and new and makes us work harder to keep material up to date." ●

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Inventing Engages Students With Special Needs in STEM

By Joann Blumenfeld and Sheryl Sotelo, NSTA Special Needs Advisory Board

A 2012 study from the University of Minnesota found that students with disabilities are significantly underrepresented in science, technology, engineering, and mathematics (STEM) fields, both in higher education and the workforce, with as few as 11% pursuing STEM degrees and 4.8% working in STEM fields. Educators in North Carolina and Alaska have found invention can engage students with disabilities in STEM.

In North Carolina, the Catalyst Program: Creating Opportunities in STEM for Students with Disabilities, held by the Science House on North Carolina State University (NCSU), launched two years ago to provide hands-on opportunities to students from across the state. It is a week-long, nonresidential summer program, and also meets on Saturdays during the school year. The program has two sessions with only 12 students in each so students receive individualized attention. Some students commute up to three hours each way to attend.

Many NCSU professors and students volunteer time, expertise, and facilities to help the students learn STEM content in a very engaging way. Catalyst students observed research at the NCSU veterinary school, conducted their own research on a university research farm, learned about a cow's anatomy by painting the animal with body paint, and how dairy farms are managed—as well as engineering design, circuit building, sensor design, and pasture ecology. A team of 12 Catalyst students formed the Catalyst InvenTeam and entered the 2017 Lemelson-MIT InvenTeam competition. Based on their Catalyst experience, the students proposed a mat to screen cows for lameness and received a $10,000 Lemelson-MIT grant to develop a prototype. The Catalyst InvenTeam will be among 15 teams nationwide presenting their inventions at MIT in June.

"The invention process has taught Catalyst students a wide range of STEM skills," contends Joann Blumenfeld, special education teacher at Broughton High School in Raleigh, North Carolina, and director of the Catalyst Program. "They've learned topics across the STEM spectrum, from agriculture and anatomy to programing and coding. They learned basic skills sets, such as programing Arduinos, from graduate engineering students at NCSU. They applied this knowledge to create their sensor in the mat. This process allowed students to learn engineering design at work, the failures and problem solving [needed] to create an invention. This is the key to the best of STEM learning, learning content in a hands-on way, applying knowledge while solving a real-world problem. [This] really increases the engagement of the students. These students have worked eight hours on a Saturday, completely engaged."

Blumenfeld continues, "Of the three seniors in the group, two are applying to engineering school, and the other plans to attend community college. [Catalyst] helps encourage students to continue on STEM educational pathways after high school. The InvenTeam students worked together to [use] their [individual] strengths and accomplish a goal. We have seen in this process how their perseverance has paid off."

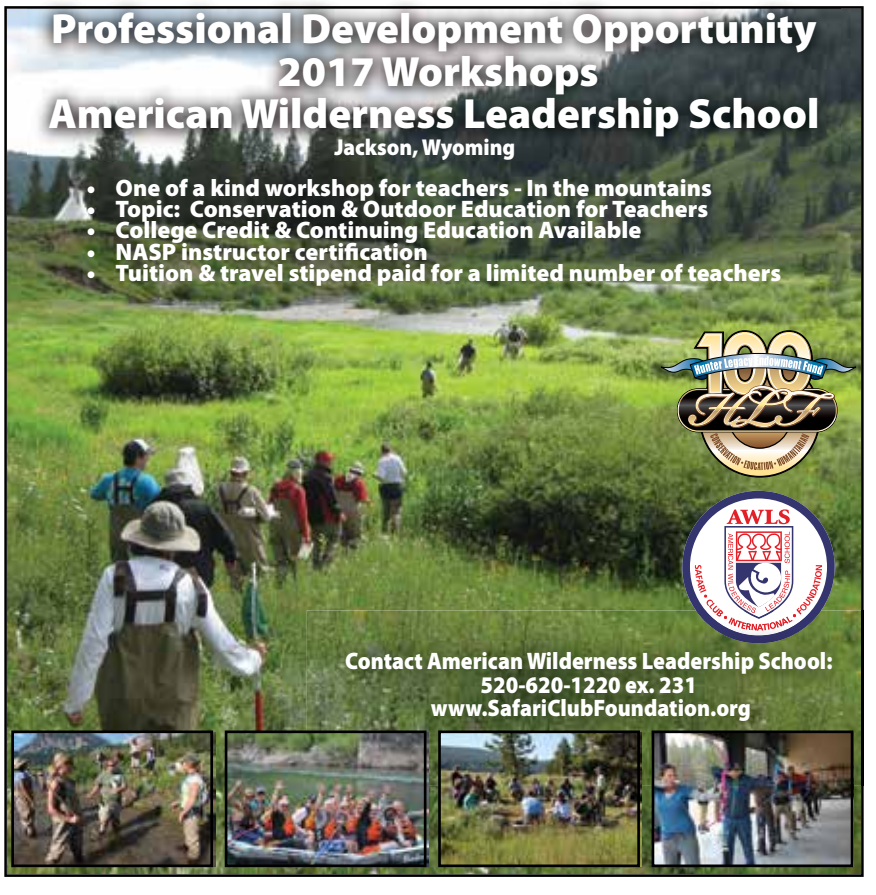
The relationships among Catalyst students, NCSU professors, and graduate students are integral to the program. "The connections they've made have allowed the students to gain access to a great deal of knowledge," Blumenfeld maintains. "The professors see that these kids can be successful scientists, the kids believe in themselves, and the parents get to see their children shine!"

In noting the overall effect of the program, she quotes one InvenTeam team member as saying, "'Team Catalyst shows me that everybody, even people with disabilities, can help the world!" Blumenfeld recommends *https://goo.gl/oOIIJO* for educators who want more resources for teaching the invention process. Educators can follow the invention process with students with disabilities as modeled on the Catalysts InvenTeam Facebook page, or check the blog at *https://goo.gl/EwIaER* for implementation ideas.

Combining Making and STEM

STEMovations workshops have offered rural Alaskan students "tinkering experiences" by infusing principles from the Maker Movement into STEM education, according to Sheryl Sotelo, STEM educator at STEMovations. Sotelo started STEMovations in 2014 and has worked with approximately 1,000 K–12 students across the state, as well as across the United States and in San Salvador. "The design process and innovating to learn are beneficial and engaging pedagogies for all students, especially [those with] special needs," Sotelo states. "These students are often limited to remedial-style programs, [so] these experiences motivate and entice the most reluctant learners. They learn through this inventing process and through the rigor of designing and testing and redesigning their project. It is impressive to see students empowered through this engaging process. With the arrival of many new materials such as conductive adhesive tape, thread, and fabric; [LEDs (light-emitting diodes)] that can be integrated into sewn circuits or paper circuitry; and the use of hobby motors to create robots and spinning art creations, as well as 'drag-and-drop' computer coding designed for young learners, it is an especially exciting time to learn through the process of making and inventing."

In Homer, Alaska, Sotelo assisted an inclusive third-grade class as they explored weather and simple circuits. Students made "cabins" from cardstock and created circuits from a coin cell



battery, copper tape, and a 5-mm LED to light the cabins. "Some students added a switch that they pressed to light the cabin. Some students used multiple lights [to represent] a wood stove and a lamp, or two rooms in the cabin, lighting up independent[ly] of each other," she explains.

"This required some iterative circuitry and paper-construction work, designing, building, and back to the drawing board to do it again. All of the students wrote about how they would weatherproof their cabin to make it more energy efficient in the cold Alaska winter. The classroom teacher extended the lesson [by having] students talk with their families about how they winterize their homes. Students brought back new ideas for their cabins and contributed suggestions to [winterize their homes]. The teacher thought the project made the weather unit more relevant and engaging for the students, who wanted to know when they could do something like that again."

Recently, Sotelo helped Homer and Fairbanks, Alaska, middle school students make an interactive page in their science notebooks depicting cell respiration as the culmination of their unit of study. The students, including some with special needs, designed circuits using different colored circuit LED stickers, copper tape, and a coin cell battery. The circuits lit up strategically when placed under diagrams they individually designed and drew. The drawings showed energy coming from the Sun, going to chloroplasts, and combining glucose and oxygen to make an adenosine triphosphate molecule in the mitochondria.

"It's a complicated process, but students understood cellular respiration better when they had to design and display it electronically on a physical page," she asserts. "Sunlight had to shine all of the time, but the other components had to light up one at a time, and only could light up if the previous step had been activated. The circuit illuminated their thinking in their personal diagrams, which added another layer of rigor to their conceptual understanding."

Sotelo adds that all learners, regardless of whether they have special needs or not, love creating something that will produce art, or making something that moves independently, often with supplies from her "possibility box" that includes recycled materials, simple hobby motors, wires, LEDs, batteries, and art tools. Sotelo has used these types of open-ended projects with inclusive, multi-grade classes in rural communities across Alaska, including some accessible only by air. "Students love these open-ended endeavors and work hard on designing, creating, collaborating, improving," she says. "It is exciting to see the students' engagement and the teachers' enthusiasm when the activities are accessible and possible for them to continue."

Sotelo recommends resources from the Exploratorium's Tinkering Studio *(http://tinkering.exploratorium.edu)* and MakerEd.org to educators who want to explore inventing and making with their students. She also encourages educators to consider participating in competitions, setting up makerspaces, and using multiple intelligence learning strategies in the classroom for learning STEM content so everyone can succeed. ●

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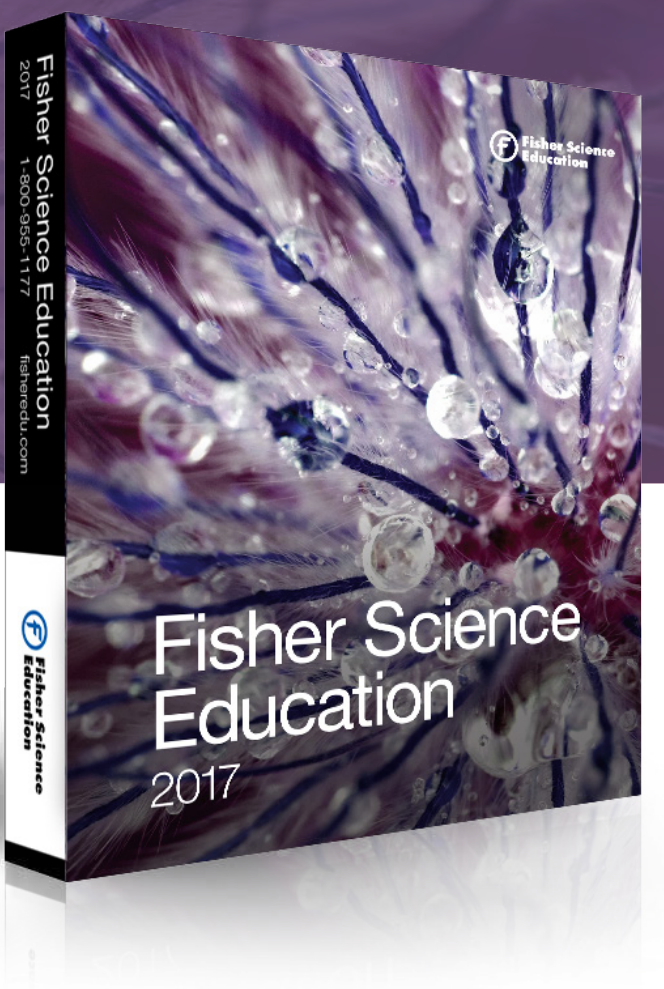

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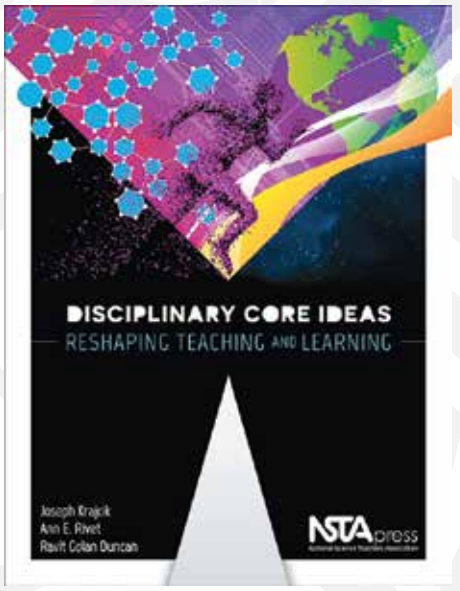

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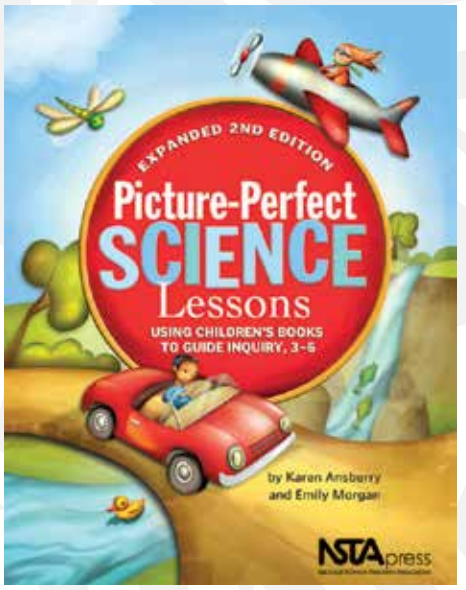

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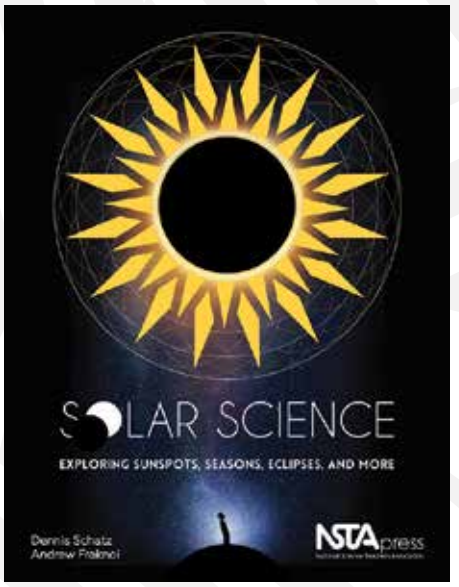

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NSTA National Science Teachers Association

Royce Elected NSTA 2018–19 President

NSTA members recently elected Christine Anne Royce, professor and co-director of the Master of Arts in Teaching in Science, Technology, Engineering, and Mathematics (STEM) Education at Shippensburg University in Shippensburg, Pennsylvania, to serve as the association's 2018–19 president.

During her term, Royce hopes to help develop tools that will assist science educators in effectively advocating for science education.

"One of the things I would like to focus on is bringing science to the forefront," she says. "NSTA serves as a dissemination source for information pertinent to teachers. I want to encourage teachers to share that information forward by providing additional tools that will allow them to do that."

Royce continues, "Teachers are and will continue to be the leaders in bringing the importance of science education out into the overarching areas they serve. They need to be advocates for science at all levels and contact their local and state legislators about policies affecting science education. By being the advocates, they become the overall voice for the importance of science education."

Also elected to the NSTA Board of Directors are Natacia Campbell, curriculum director for the Lyons School District 103 in Lyons, Illinois (Multicultural/Equity Division Director); Paul Adams, dean of the College of Education at Fort Hays State University in Hays, Kansas (Preservice Division Director); and Emily Schoerning, director of research, National Center for Science Education in Oakland, California (Research Division Director).

Elected to serve on the NSTA Council as district directors are Carolyn Higgins, District I (Connecticut, Massachusetts, and Rhode Island); Cindy Smith-Walters, District VI (North Carolina, South Carolina, Tennessee); Sheila Smith, District VII (Arkansas, Louisiana, Mississippi); Nicole Vick, District XII (Illinois, Iowa, Wisconsin); Deb Novak, District XIII (New Mexico, Texas, Oklahoma); and Gabe Kraljevic, District XVIII (Canada).

NSTA Board and Council members serve three-year terms, beginning on June 1, 2017. For more information on NSTA's leadership and governance, including district maps, advisory boards, and bylaws, visit the website at *http://goo.gl/WGbFrs.* ●

Christine Anne Royce

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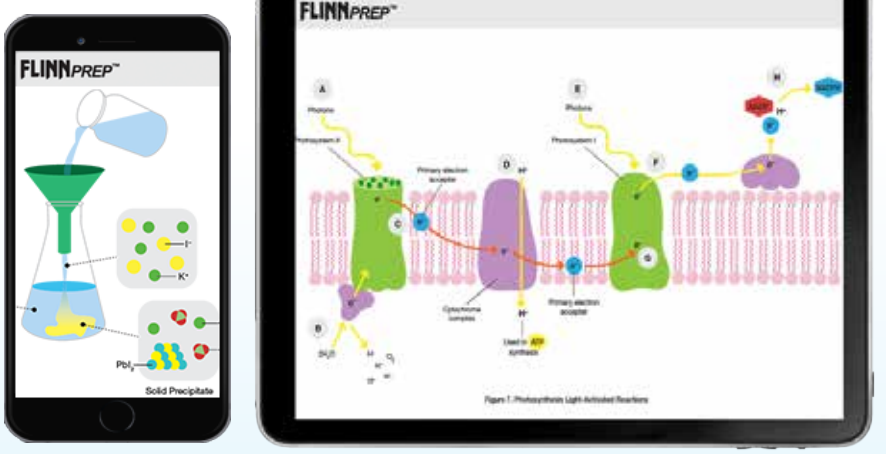

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Science Museums 'Pop Up' Near Schools

New science museums that haven't found permanent sites have been holding "pop-up museum" programs in the interim in various locations. These programs offer benefits for teachers and students, especially those in schools not located near a museum. "Schools are limited by money and time. Buses are expensive, and students have to be back at school on time. [Our pop-up programs] come to the schools, [so] schools don't have to worry about transportation and permission slips," says Bonnie Epstein, interim executive director and founder of Rhode Island Museum of Science and Art (RIMOSA).

"We go to libraries and schools all over the state," she adds, as well as "festivals, maker faires, summer camps (parks and recreation), Boys and Girls clubs, after-school programs, film festivals for kids, and the Rhode Island School of Design (university level)." RIMOSA offers physical exhibits and programs led by museum educators for nominal fees.

Exhibits include Flight Tube, which allows children to experiment with the movement of items in turbulent air, and Bubble Wall, in which visitors create a large wall of bubble film. Teachers can use this exhibit to teach about surface tension, optics, and nanoscale science. "If a library chooses to host an exhibit, [its staff] encourages schools to come see it," Epstein points out.

Among RIMOSA's facilitated programs are Flight, which combines the science of aerodynamics and art of kite making, and Nano and Color, in which students learn about the nanoscale and do hands-on nanotechnology experiments. "The *Next Generation Science Standards* [*NGSS*] encourage teachers to make science more student-directed, hands-on, and experimental,…[but] some teachers are uncomfortable teaching science this way, especially elementary teachers. Our educators have expertise and enthusiasm. They show teachers different ways of looking at problems," Epstein relates.

RIMOSA

Students attending a Rhode Island Museum of Science and Art pop-up museum program create nature-inspired art.

In addition, "teachers can refer to our experiments and exhibits to help students dig deeper," she contends.

RIMOSA's pop-ups have greatly benefitted students in underserved and

ELEMENTARY EXTRAVAGANZA

Friday, March 31, 2017
8:00–10:00 AM • West Hall B-1
Los Angeles Convention Center

- Hands-on activities
- Preview science trade books
- Learn about award and grant programs
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Organizations participating in the Elementary Extravaganza include the Association of Presidential Awardees in Science Teaching, the Council for Elementary Science International, the NSTA Committee on Preschool–Elementary Science Teaching, *Science & Children* authors and reviewers, and the Society of Elementary Presidential Awardees.

NSTA National Science Teachers Association

rural districts in Rhode Island. "We get to see populations that we wouldn't if we required that they come to us," she asserts. Even when RIMOSA acquires a permanent location, "we'll continue doing pop-ups off-site because of our success in reaching other populations that we wouldn't otherwise."

Enrichment Experiences

"Pop-Up Museum events allow us to bring what we believe to be valuable curriculum and experiences to students from our local community. These events also currently serve the purpose of promoting our growing organization," says Christina Schueler, programming director of the Children's Museum of Central Oregon (CMCO). CMCO's pop-ups are free of charge, "though we do use the event as a fundraiser by asking for donations."

CMCO has also offered "a handful of science activities at events hosted by our community partners. These include a windmill play station, where kids could see how wind could translate to work, [along with a station on] lemon batteries, chemistry demonstrations, and a bicycle that generates energy, just to name a few," Schueler relates.

"We try to choose activities that kids can explore on their own with minimal adult supervision, but we have provided activities such as chemistry demonstrations or large pulley-like contraptions that require more safety precautions," such as "an adult leading the activities and explaining safety to each new participant," she reports.

"We think providing hands-on, experiential learning opportunities for young students exposes them to ideas and ways of thinking that they might otherwise not encounter. Schoolteachers have the important job of covering all subjects in elementary education, and we want to supplement that learning with science and art projects that might not make it into the classroom, which benefits both teachers and students," she maintains.

"We are undecided about how pop-up events will change with the opening of the physical museum," she allows. "As we currently see it, pop-ups are 'tasters' of the curriculum that we'll provide at the museum when it's built. So the events we host now will likely change a bit. I could see pop-up events turning into something that we provide as outreach events to the greater Central Oregon area or more as a community engagement event [during which] attendees are asked to contribute and collaborate in some way."

Macomb Children's Hands-On Museum of Mount Clemens, Michigan, is a pop-up Museum Without Walls focused on science, technology, engineering, art, and math and early childhood learning. "We popped up at six events in 2016, from June through November," says Monika Rittner, museum board president, "at a community college, at two local elementary schools, and at three family festivals." While the pop-ups held at the festivals drew lots of parents and children, the ones that took place at the elementary schools allowed "parents, teachers, and children to work together," she reports.

The pop-ups included interactive activities for children ages one to 10 such as "Itsy Bitsy Spider in the Water Spout, [in which] children can play with water and learn about physics and friction" and a competition in which children built boats from tinfoil and plastic wrap and competed to see which boat could hold the most pennies, Rittner relates. The activities were designed by "an early childhood development education professor," she notes, and some of the art-oriented ones "have open-ended outcomes to help children think abstractly and create patterns."

A grant from a local financial institution enabled the museum to hold pop-ups free of charge, says Rittner. "Our area has [primarily] blue-collar workers and underserved minorities; that's where we fit in," she asserts. "The infrastructure of our area has minimal public transportation, [so having pop-ups at different locations] impacts those with limited transportation options…We plan to continue pop-ups as an outreach program to attract more people and reach out to those who can't come to the museum" when it acquires a permanent site. ●

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PULL-OUT SECTION

SCIENCE TEACHERS' GRAB BAG

Inside this Convenient Pull-Out Section you will find:

Freebies for Science Teachers

Computer Science First Clubs. E M Targeted to students in grades 4–8, and designed for use in both classroom and after-school settings, this enrichment program from Google teaches basic coding and computer skills through a series of theme-based computer science activities, or clubs. The themes address a range of real-world interests—sports, animation, art, fashion, friends, music and sound, storytelling, and game design—and offer about 10 hours of instructional lessons and activities in each one. Each activity includes instructional videos and a lesson plan; students can also access a solution sheet that provides one way to successfully complete each club's core project. Consult *https://goo.gl/pmo1YE.*

Afterschool STEM Hub. K12 Advocates for high-quality K–12 science, technology, engineering, and math (STEM) after-school programming will find useful tools to make the case for expanding and supporting innovative and engaging informal STEM at this website. The materials are designed to influence policymakers at the federal, state, and local levels and include talking points, communication strategies, videos, infographics, presentation slides, and fact sheets. See *https://goo.gl/4e9RVt.*

Science Fair S.O.S. K12 This combination website, e-mail chat, and telephone hotline can help students of all levels create innovative science fair displays. Produced by ArtSkills, the website features project ideas, planning calendars, design tips, presentation advice, and a gallery of effective and inspiring science fair displays. Students can also receive e-mail or telephone advice from "poster pros." Visit *www.sciencefairsos.com.*

STILFEHLER

Vernal Pool Middle School: Learning the Mysteries of a Vernal Pool. M This video essay celebrates some of northern Michigan's most threatened wetlands and the young citizen scientists working to better understand and preserve them. Produced by Nature Change, a multimedia magazine dedicated to building conservation literacy among citizens and local officials, the video follows a group of middle level students as they participate in a vernal pool mapping and monitoring project to learn about these quickly disappearing habitats. Share the six-minute video in elementary and middle level science classrooms to inspire other groups of young citizen scientists. Refer to *https://goo.gl/zpn0QZ.*

Biodiversity Course. H HE Produced collaboratively by the California Academy of Sciences and Khan Academy, this online course for high school (and adult) learners takes students on a virtual expedition investigating the diversity of life on Earth. Through more than 30 tutorials, students explore all aspects of biodiversity: what it is, why it's important, where it's found, how it comes into existence, how it can be studied, why it's threatened, and how it can be protected. Each tutorial includes videos, articles, a glossary, quiz questions, activities, and an annotated list of references to delve deeper into the content. Learn more and access the course tutorials at *https://goo.gl/OqIa1Y.*

Exploring Ecosystems. H This three-part series of video-based resources for AP Biology students was produced by the California Academy of Sciences. The series addresses a different theme in each video: Coral Reef Symbiosis, Tropical Rainforest Diversity, and Coastal Food Webs. In addition to showcasing live footage of a unique ecosystem, each video incorporates an interactive problem-solving exercise based on an ongoing research project of an academy scientist; students are directed to pause at key points to answer questions or analyze data presented in the video. The videos also include footage and commentary from the researchers studying each ecosystem. Visit *https://goo.gl/8Nr0ig.*

Progressive Science Initiative (PSI) Materials. K12 The New Jersey Center for Teaching and Learning provides editable course materials for K–12 science and math instruction. The materials are based on the Progressive Science Initiative (PSI) and the Progressive Math Initiative (PMI), integrated learning approaches that incorporate the use of collaborative problem-solving activities as a way to develop science and math understandings and present science courses in a new sequence at the high school level. PSI uses the physics-chemistry-biology sequence, with the rationale that to understand modern biology, students

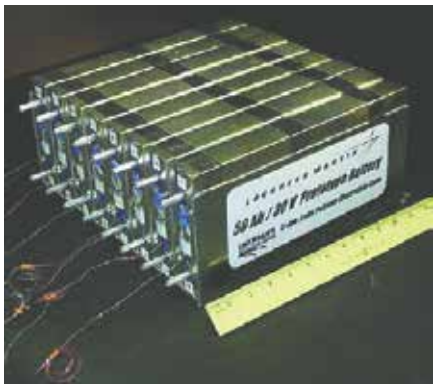
See Freebies, pg G2

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

Freebies, From pg G1

need to understand chemistry, and to understand chemistry, students must understand physics.

In addition to providing science course materials for every grade level from kindergarten to high school (including Advanced Placement courses), the PSI curriculum also includes methods courses to help educators facilitate the implementation of the curriculum. Find the courses and learn more about PSI at *https://njctl.org/courses.*



NASA

UL Xplorelabs. M This module-based online learning platform encourages middle school students to find solutions to real-world engineering challenges in science safety. Designed to complement existing science, engineering, and technology curricula, the first module, Portable Electrical Power, explores the science of lithium-ion batteries and the safety challenge of potentially "exploding" batteries. The module begins with an interactive video that introduces the phenomenon of thermal runaway, presents tests scientists conduct to evaluate the safety and durability of batteries, and requires students to complete virtual safety tests to see how a battery in a hovercraft performs under adverse conditions. Students then do hands-on activities in the classroom, investigating questions pertinent to battery safety: Can the heat energy in a battery be seen? What is the best material to protect a battery pack from the outside world and the battery's own heat? Can you design a hoverboard that's not too hot to touch?

The module concludes with synthesizing challenges for the entire class—Design and Sell a Personal Transportation Device to the World and Design a Hoverboard Safety Public Service Announcement for the World—the results of which students can share online with the Xplorelab community. See *http://ulxplorlabs.org.*

CrossCut Symbols Printables. K12 Cause and effect; patterns; scale; systems; energy and matter; structure and function; and stability and change—these crosscutting concepts are the frames through which scientists think about the natural world. K–12 students who understand crosscutting concepts can develop a deep framework for integrating and understanding science ideas. At *https://goo.gl/jb5UGM,* teachers can access an informational page about each crosscutting concept and a set of printable CrossCut Symbols. The symbols present each crosscutting concept as a simple, easy-to-remember illustration, such as a bat and ball to represent cause and effect, or a magnifying glass to represent scale. Teachers can use the symbols to help students visually recognize and identify the crosscutting concepts in the *Next Generation Science Standards* (*NGSS*).

The Argumentation Toolkit. M A collection of video and other resources developed by the Lawrence Hall of Science and Boston College can help middle level teachers understand and teach scientific argumentation, a key practice in the *NGSS* and the *Common Core State Standards* for English language arts. The toolkit breaks down the practice of scientific argumentation into four elements—Evidence, Reasoning, Student Interaction, and Competing Claims—and provides a series of instructional videos about each one. The videos present an overview of each element alongside classroom activities showcasing the element and strategies teachers can use to build student understanding through the element. In addition, teachers can access text-based strategy guides offering lesson plans to integrate argumentation into science lessons. Consult the website *www.argumentationtoolkit.org.*

Visionlearning. H HE These peer-reviewed online learning modules explore STEM topics from a process perspective. The *NGSS*–supported modules—targeted for high school and introductory college learners—address topics in biology, chemistry, Earth science, general science, inside science, math in science, physics, and the process of science. Each module embeds online assessments and has an interactive animation associated with it to provide background information and help convey core concepts on the topic. Registered teachers (free registration) can also customize the modules to create courses to meet their students' needs. See *https://goo.gl/SgxBMs.*

The Comic Book Periodic Table of the Elements. M H Middle and high school students who like chemistry and comic books will enjoy this innovative periodic table of the elements at *https://goo.gl/zTYfCB.* Created by University of Kentucky chemistry educators Jim Holler and John Selegue, the resource features scanned pages from decades of comic books illustrating characteristics of the elements, such as the "Metal Men" series of comics from the 1960s. Though not every element has an accompanying scanned comic book page (yet), the table offers a novel way to generate excitement about chemistry and to motivate students to learn about the elements.

U.S. NAVY PHOTO BY CHIEF INTELLIGENCE SPECIALIST MICHAEL ROUSE

Tumble. K12 This science podcast series for children and their families was produced by teacher Marshall Escamilla and science reporter Lindsay Patterson. Each 10- to 20-minute podcast explores a different science mystery and features an interview with a scientist in the field. Appropriate for all ages, the kid-friendly podcasts tackle more than the what of science: They discuss the how and why of it. Recent episodes have explored ocean trash, bugs and bats, and an invisibility cloak. An accompanying blog encourages listeners to extend the learning from each episode. Visit *https://goo.gl/oA6ODw.*

Science Journal App. M H Turn your phone into a pocket science lab. Targeted for students in grades 6–12, this Google app allows students to measure sound, light, and motion data in real time using the sensors in an Android phone or tablet. The sensors can record ambient light (lux), intensity of sound in decibels (dB), and acceleration of the phone moving in three planes (m/s2). The app includes several short "Getting Started" activities, including an experiment in which students build and test Wind Spinners to familiarize themselves with how the tool works. Once comfortable, students can design their own experiments and use the app to collect and annotate data. Learn more and read a product review at *https://goo.gl/IuOLlJ.*

Jefferson Lab's Science Education Resources. M H HE Jefferson Lab, a world-class nuclear research facility, offers STEM resources for middle to college-level teachers and students. Organized by user (Teacher or Student) and by resource type (Games and Puzzles, Science Cinema, and Programs and Events), the web page at *http://education.jlab.org* has something for everyone interested in physics, whether you're a new teacher looking to strengthen understanding of physics topics; a veteran educator seeking games, hands-on activities, and videos to energize classroom science instruction; or a student searching for homework help or internship opportunities. Notable resources include Physics Out Loud, a video glossary of common words and terms used in nuclear physics research, explained by Jefferson Lab scientists and other experts; and Frostbite Theater, a collection of short, fun video experiments and demonstrations exploring liquid nitrogen, radioactivity, electricity, and the Jefferson Lab. ●

News Bits

- **Engineering majors can expect to make more money than their counterparts in fields like English or business, but it also costs more to educate them, says a new paper published in *The National Bureau of Economic Research*.** **HE**

In examining Florida's public universities, the authors found it cost more than $62,000 to educate an engineer and roughly half that to educate an English or business major. The authors attribute the difference to higher salaries for engineering professors and fees for facilities and administrative resources engineering students need. The authors also found that engineering graduates make more money over time, when controlling for demographic and institutional factors and subtracting the cost of their degrees.

Learn more at *http://goo.gl/6Cse1T*, or read the paper at *http://goo.gl/7J3h0N*.

- **In South Carolina, new standards may require K–8 students to learn computer science.** **E M**

"It's not about making every kid a computer scientist," Quinn Burke, an education professor at the College of Charleston who helped write the standards, told the *Post and Courier*. "It's about giving them a better understanding of the way these devices operate and how they compute."

The new standards are based on the K–12 Computer Science Framework, a set of grade-level guidelines created by educators and technology experts. Under the new standards, kindergartners would learn the difference between a smartphone and a laptop and the vocabulary they need to use a computer; third-graders will learn word processing and how to perform a safe internet search; and by high school, they'll have a basic understanding of algorithms, networks, and computer systems and programming.

After eighth grade, students not planning to major in computer science "would definitely be more adept at using these computer science skills in other career fields," says Darwin Shorters, a computer science teacher who helped write the standards. He adds that the new standards will also help bridge the digital divide between students in wealthy and poor communities. "When you push an initiative like K–8 standards for everyone in public schools in South Carolina, yes, you do start to balance things out," he says. "You start to have more equitable access to these digital tools."

If approved, the new program would take effect in the 2018–2019 school year. Read more at *http://goo.gl/7we6f2* and an editorial at *http://goo.gl/FLb0r9*.

- **Sandboxes aren't just for the playground anymore. In Bay Village, Ohio, they also help teach science.** **M**

Eighth-grade science teachers at Bay Middle School built a sandbox that uses augmented reality to teach concepts like topography, watersheds, hydrology, erosion, and land formations and geology. The sandbox uses motion sensors, kinetic sand, a computer, a projector, and bright colors to help students visualize—and interact with—topography. They can pile sand to make mountains, or make indentations in it for water. They can even move their hand under a sensor to fill those indentations with rain. Wheels on the sandbox allow it to move from room to room.

Before the sandbox, students learned about topography using sheets of paper. The teachers built it at a workshop sponsored by NORTH2H, a Northern Ohio research and training technology hub based in Elyria. Learn more at *http://goo.gl/FZwrhQ*. ●

What's New

FROM U.S. GOVERNMENT SOURCES

U.S. National Nanotechnology Initiative (NNI)

Nanotechnology 101 H HE

Do you teach nano science or want to know more about it? Check out Nanotechnology 101. The site features nanotechnology basics, breakthroughs and accomplishments in nanotechnology, a glossary, a timeline of nanotechnology, and frequently asked questions to inform high school and college students and teachers about this emerging, rapidly changing science and its potential. Of particular interest is the downloadable brochure, "Nanotechnology: Big Things From a Tiny World," which explains nanotechnology in everyday language with colorful infographics.

Share these resources with students to generate excitement about nanotechnology and career possibilities in engineering and nanotechnology. Refer to *https://goo.gl/A0QpOs.*

National Aeronautics and Space Administration (NASA)

Who Is Katherine Johnson? K12

In the 1960s, the United States was on an ambitious journey to the Moon, and Katherine Johnson and her fellow "human computers" helped get NASA there. Two NASA resources—a written profile (*https://goo.gl/8EAeaM*) and the Modern Figures Toolkit (see *https://goo.gl/MMrrhH*)—bring Katherine Johnson's inspiring story to K–12 classrooms.

The profile, Who Is Katherine Johnson?, has versions for grades K–4 and grades 5–8 and discusses Johnson's early life, her college career, her role at NASA, and what she did after NASA. The K–4 version includes a Things to Know section with facts that will surprise young learners (e.g., there were no computers in the 1950s; people like Johnson solved hard math problems by themselves). The 5–8 version focuses on Johnson's passion for learning and her achievements at NASA, while presenting links to videos and other resources to learn more.

The Modern Figures Toolkit is a clickable guide to K–12 videos and science, technology, engineering, and math (STEM) materials related to the achievements of Katherine Johnson and the "human computers." The guide features annotated descriptions of each resource, information about how each supports *Next Generation Science Standards* and *Common Core* learning standards, and a link to download the resources.

Highlights include activities such as Moon Phases, in which elementary students learn about the phases of the Moon and act out one complete 30-day Moon cycle in 30 minutes, and What Is an Orbit, in which middle level students learn about the shape of an orbit, the effect of gravity on an orbit, and where satellites orbit the Earth. The interdisciplinary activity NASA Langley and Human Computers (high school) examines the social impact of human computers at NASA Langley during the 20th century and can be incorporated into science and history lessons.

Expeditionary Skills for Life K12

Most people know that astronauts use technical skills during their missions, but do your students know astronauts also rely on "expeditionary skills" such as cultural competency, self-care/team care, teamwork, leadership/followership, and communication? Expeditionary Skills for Life, a website created by NASA and the USDA's 4-H Youth Development Program for K–12 audiences, provides lessons and videos built around expeditionary skills and the training astronauts receive for long-duration space expeditions.

Currently, teachers can access materials exploring cultural competency, or a person's ability to appreciate and learn from perspectives differing from their own. Content relating to other expeditionary skills will be added soon. Watch a video featuring astronaut and 4-H alum Peggy Whitson discussing the website and how it can help students learn and practice skills to apply to STEM studies and future careers at *https://goo.gl/yKQbp1*.

Think Green—Using Renewable Solar Energy H

Switching to cleaner forms of energy is a complex issue. Explore this topic with high school students using a lesson plan from NASA's Jet Propulsion Laboratory. The lesson breaks down the use of solar energy into manageable concepts and action steps that students can easily understand. For example, the lesson requires students to model solar energy inputs at different locations, analyze the cost effectiveness of installing solar panels, and determine the appropriate locations for solar panels. The lesson plan includes everything needed to conduct the activity, including a lesson overview, materials list, management tips, background information and vocabulary, student procedures, discussion questions, assessments, and extensions. See *https://goo.gl/zU6PxM*.

U.S. Geological Survey (USGS)

27 Ideas for Teaching With Topographic Maps K12 HE

The USGS publishes approximately 57,000 different topographic maps covering the United States. Topographic maps show contour lines (elevation and landforms), hydrography (rivers, lakes, marshes), transportation (roads, trails, railroads, airports), vegetation, boundaries, survey markers, urban areas, buildings, and other features. Teachers from elementary to college levels can use topographic maps to enhance instruction in their science, math, geography, and history curricula.

At *https://goo.gl/WE7GnD,* the USGS has an annotated list of 27 suggested classroom activities incorporating topographic maps. The annotations include each activity's targeted grade level, time required, materials needed, and a description.

Activities range from basic exercises teaching students how to read and work with topographic maps (e.g., Analyzing Physical Features of Topographic Maps, Looking at Streams and Rivers on Topographical Maps) to more complex activities exploring geography concepts (e.g., Geographic Coordinate Systems—Convergence, Absolute vs. Relative Location, Site vs. Situation). Other activities provide opportunities for students to make their own maps (e.g., Creating Maps From Aerial Photographs, Construct 3D Models, Create Aspect Maps).

U.S. Department of Education (ED)

Early Learning and Educational Technology Policy Brief P E

Produced by ED's Office of Education Technology, the brief presents four guiding principles for early educators and families on using technology with young children:

- Technology—when used appropriately—can be a tool for learning;
- Technology should be used to increase access to learning opportunities for all children;
- Technology may be used to strengthen relationships among parents, families, early educators, and young children; and
- Technology is more effective for learning when adults and peers interact or watch along with young children.

The brief also includes a call to action for researchers and media and app developers, suggesting topic areas for further research and encouraging the development of research-based

products. Download the report at *https://goo.gl/aj9mLj*.

U.S. Department of Agriculture (USDA)

Getting a School Garden Blooming K12

Jeff Raska, a school garden specialist with the AgriLife Extension in Texas, works with numerous programs and offers practical advice to schools establishing a school garden. In a recent post on the USDA blog, Raska discusses why it's important to have a strong school garden committee to maintain a successful garden program. Refer to *https://goo.gl/R8f4af*.

U.S. Environmental Protection Agency (EPA)

Air Quality and Climate Change Teaching Resources E M H

EPA offers hands-on activities to teach middle and high school students about air quality and climate change. Build Your Own Particle Sensor (grades 5–12) introduces basic information about particulate matter air pollution and electronics and gives students opportunities to develop problem-solving and other STEM skills. Generate! is an interactive board game and teaching tool developed by EPA scientists that explores the costs and benefits of the energy choices we make; what happens if the mix of energy sources changes; and how energy choices affect climate, air, water, and overall environmental quality. Access both resources and their supporting materials at *https://goo.gl/NEgY8l*.

The Life of a Soccer Ball M

Use this document to help middle level students deepen their understanding of how everyday products like a soccer ball impact the environment in different ways. Most people—adults and students alike—don't give much thought to manufacturing processes and are unaware of the effects on the environment.

With this resource, students follow a soccer ball through four stages of development—Gathering and Processing Materials; Assembly; Transportation; and Use and Beyond—to learn how the ball is made and what can be done to reduce its environmental impacts. The document also has ideas for recycling used soccer gear and discussion questions for students to consider regarding the environmental impacts of other everyday products. Download the document at *https://goo.gl/baZ8qg*.

National Oceanic and Atmospheric Administration (NOAA)

Invent a Robot! M

Targeted for the middle level, this lesson and activity from the NOAA Ship Okeanos Explorer Education Materials Collection offers a hands-on way to introduce students to the engineering design process and help them learn how underwater robots are used in scientific exploration. After learning about Remotely Operated Vehicles and reviewing some basics of hydraulics and simple mechanics, students are challenged to design a robotic arm capable of picking up objects about the size of a soda can from the ocean floor using the mechanism of a hydraulic actuator. Find the complete lesson plan—including Learning Objectives, Materials, Background, Learning Procedure, Extensions, Other Relevant Lesson Plans From NOAA's Ocean Exploration Program, and Student Worksheet—at *https://goo.gl/WxYXTi*.

National Marine Sanctuaries Webinar Series K12 HE

Hosted by the NOAA Office of National Marine Sanctuaries, this webinar series for formal and informal educators (K–college) offers an inside look at our nation's "underwater treasures" and provides scientific expertise, resources, and training to support ocean and climate literacy in the classroom and community. Visit *https://goo.gl/4aBgQf* to register for the upcoming webinar Explore Your Own Watershed With Underwater Remotely Operated Vehicles (ROVs), scheduled for March 22. The program will show educators how ROVs are used to explore our national marine sanctuaries and provide a basic overview of designing and building ROVs with students.

Educators who can't participate on that date can view past presentations in the webinar archives. Previous webinars have explored the Coral Communities of the West Coast National Marine Sanctuaries; Rivers to Reefs: Understanding the Vital Connections Between Rivers and the Ocean; Great Ships on the Great Lakes; and other topics. Archived webinars offer supplementary materials from the events, such as curriculum, student activities, and presentation slides.

Exploring Deep-Sea Coral Communities H

In Deep-Sea Coral Communities: Sentinels of a Changing Ocean, a lesson for grades 9–12 from NOAA's National Marine Sanctuaries, students investigate the unique biology of deep-sea corals and learn to identify soft corals, hard corals, invertebrates, and fish found in these communities. To identify the organisms, students view scientific transects taken with ROVs and learn how to record data on the presence of specified species. Next, they graph and analyze the data to evaluate the composition of deep-sea coral communities according to habitat type, depth, and temperature. Students learn about the human-caused threats these animals face and what can be done to protect them. Consult *https://goo.gl/QSdyJQ*. ●

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

In Your Pocket

Editor's Note

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

March 31

The Gerald C. Corcoran Education Grant A

The North American Native Fishes Association (NANFA) provides $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.

This award is presented in memory of former NANFA president Gerald C. Corcoran, a proponent of public education about native fishes. Applicants must be NANFA members. Submit proposals by **March 31;** see the website *http://goo.gl/I80V8s.*

The Meemic Foundation's Grants K12

These $500 grants go to teachers in Illinois, Michigan, and Wisconsin for classroom projects, field trips, school assemblies, and professional development. Teachers in most subject areas, including science and STEM (science, technology, engineering, and math), are eligible. Projects should have a lasting impact on students and be easily replicated. Apply by **March 31** at *http://goo.gl/UI8713*.

Escalante–Gradillas Prize for Best in Education K12

This $20,000 prize goes to one outstanding K–12 administrator who has made a real impact on students. Nominees should work in the United States and demonstrate a commitment to learning, discipline, character building, and high expectations for his or her students. Superintendents, principals or assistant principals, school counselors, and curriculum designers who have made the most of limited resources, generated a marked increase in student and teacher performance, nurtured a love of education in others, or have overcome obstacles in innovative ways are encouraged to apply.

The awardee will receive $10,000, as will his or her school. Nominate an outstanding administrator by **March 31** online at *http://goo.gl/XyEjWA*.

April 1

ACS–Hach Second Career Teacher Scholarship HE

The American Chemical Society (ACS) awards this scholarship to working chemists pursuing a master's degree in education or certification as a chemistry or science teacher. Awardees receive up to $6,000 for full-time study or $3,000 for part-time study. Funds can be used for tuition, books, room and board, and other education-related expenses and may be renewed for up to three years.

Applicants must have a bachelor's degree or higher in chemistry or a chemistry-related field, at least one year of work experience in a chemistry-related profession, be accepted into a master's or teacher-certification program, and be a U.S. citizen or permanent resident. However, they cannot have more than one year of experience as a high school chemistry teacher. Apply by **April 1** at the website *http://goo.gl/Vctr3J.*

ACS's Dorothy and Moses Passer Education Fund HE

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 directly related to the recipient's teaching and take him or her off campus. Applicants must be full-time college or university faculty members; funds can be used for transportation, housing, and meals. Apply by **April 1;** consult *http://goo.gl/UcevTr.*

Frances R. Dewing Foundation Grants P E

These grants fund projects or programs focused on early childhood education. Of particular interest are those at new, untried, or unusual educational organizations that aim to introduce new methods for young children, ages 2 to 12. 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://goo.gl/V7UooA.*

NiSource Charitable Foundation Grants P K12

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 the following 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://goo.gl/sDXHcn.*

Westinghouse Charitable Giving P K12

Westinghouse gives grants of up to $5,000 to nonprofit programs that support STEM education; environmental sustainability; or community safety and vitality. STEM programs should enhance the subject matter and encourage career interest in the field among youth. Environmental programs should help preserve or restore land, water, air, or biodiversity.

Grantees must be within 50 miles of Westinghouse sites in Alabama, Arizona, California, Connecticut, Florida, Georgia, Illinois, Kansas, Maryland, Michigan, Minnesota, Missouri, New Hampshire, New Jersey, New York, North Carolina, Pennsylvania, Tennessee, Texas, Utah, Virginia, Washington, Wisconsin, or Washington, D.C. (View the list of Westinghouse locations at *http://goo.gl/J6UJE4.*) Submit proposals by **April 1;** consult *http://goo.gl/nQxr3l.*

April 7–15

Theodore William Richards Award for Excellence in Teaching Secondary School Chemistry H

This ACS award goes to an outstanding chemistry teacher in the Northeastern Section who has inspired potential chemists, communicated chemistry to non-chemists, or influenced other chemistry teachers. The winner will receive $1,500 and a certificate of recognition at the section's High School Night in May. Nominations are due **April 7;** learn more at *http://goo.gl/ZmOh0H.*

The Sparkplug Foundation Grants P K12

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

Visit *https://goo.gl/yR8Lez* to answer the preliminary application questions by **April 10.** If the foundation determines you are eligible, letters of intent are due on April 17.

ACS–Hach High School Chemistry Classroom Grant H

The ACS provides grants of up to $1,500 to high school chemistry teachers wishing to enhance the learning in their classrooms, foster student development, and reveal the wonders of chemistry. Funds can be used for lab equipment and supplies, instructional materials, professional development, field studies, or science outreach events. Apply by **April 14;** see *http://goo.gl/aFZV8l.*

McCarthey Dressman Education Foundation's Academic Enrichment Grants P K12

These grants help develop in-class and extracurricular programs that improve

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

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 and 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 **April 15** at *http://goo.gl/nSTNm4*.

McCarthey Dressman Teacher Development Grants K12

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

Licensed K–12 teachers employed by public or private schools who have the background and experience to successfully complete the project and are willing to collaborate with the foundation are eligible. Awards of up to $10,000 per year are available for individual teachers for up to three years. Apply by **April 15** at *http://goo.gl/WOsLIR*.

April 18–30

Snapdragon Book Foundation Grants P K12

The foundation provides funds to improve school libraries for disadvantaged children. Any school library that serves disadvantaged youth may apply. Grants will be awarded to public, private, and experimental schools. Schools should plan to spend all of the grant money on traditional books.

Grants have ranged from $800 to $20,000. When Snapdragon is unable to fulfill the complete request, it offers a partial grant. Applications must be submitted by **April 18.** Visit the website at *https://goo.gl/99emC5*.

AFCEA STEM Teachers Scholarships HE

The AFCEA Educational Foundation offers scholarships of $5,000 each to students actively pursuing a graduate degree or credential/licensure for teaching STEM subjects at a U.S. middle or high school. Students must be U.S. citizens with a minimum overall GPA of 3.0 (or equivalent). Graduate-level candidates must be enrolled in at least two semester-equivalent classes at an accredited U.S. college or university. Credential and licensure students must have completed a bachelor's degree in a STEM major. Apply by **April 22;** consult *https://goo.gl/CkFD3J*.

Stepping Stone Grant for Grades K–5 E

These grants go to teacher-initiated projects employing an arts-infused approach to inquiry-based education. Projects should include all learners and incorporate the 5 Cs of inquiry-based learning: collaboration, community, creativity, critical thinking, and communication. Up to $450 is available to K–5 teachers with such projects at Title I schools. Apply by **April 30** at *https://goo.gl/61JtEj*.

Patagonia Environmental Grants A

These grants support small grassroots activist organizations with provocative direct-action agendas, working on multi-pronged campaigns to preserve and protect the environment. The typical grant ranges between $2,500 and $15,000.

If you are not applying to a retail store, applications must be submitted by **April 30.** All applications received by that date will receive a reply in August. Only one proposal from an organization will be considered per year. See *https://goo.gl/v6s2ER*. ●

National Earth Science Teachers Association 2017 Los Angeles NSTA Conference

*We have a number of exciting sessions! To find our sessions, enter **NESTA** as the keyword when searching events online at NSTA's session browser for the conference. On **Friday, March 31** and **Saturday, April 1,** we have a series of sessions all in **Petree Hall D** of the **Los Angeles Convention Center.** Don't miss out on our Share-a-Thons and the events below!*

Thursday, March 30

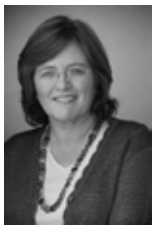
- 6:00 – 10:45 pm **Field Trip to Griffith Observatory. Requires purchase of a ticket.** When Griffith Observatory opened in 1935, it was one of the first institutions in the U.S. dedicated to public science and possessed the third planetarium in the U.S. On this field trip, explore the Observatory, star gaze, enjoy spectacular views of Los Angeles and the Hollywood Sign, and watch the 8:30 PM *Centered in the Universe* show!

Saturday, April 1

- 5:00 – 6:00 pm **NESTA's exciting Rock, Mineral, and Fossil Raffle!**

Friday, March 31

- 2:00 – 3:00 pm **American Geophysical Union (AGU) Lecture: The Fault Lies Not in Our Stars. Speaker: Dr. Lucy Jones.** Seismology shows us that on human time scales, the timing of big earthquakes is random and the best way to manage the risk is to consider it probabilistically. Most people do not really believe in randomness—trying to find patterns even when they don't exist and then expecting scientists to find the real cause and remove randomness from the equation. Dr. Jones will probe how science education can do a better job of empowering everyone to understand and use hazards information.



Friday, March 31

- 6:30 – 8:00 pm **NESTA Friends of Earth Science Reception, JW Marriot Hotel L.A., Platinum Ballroom Salon C**

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

Summer Programs

Editor's Note

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

EinsteinPlus Summer Workshop H

This one-week intensive workshop for Canadian and international teachers focuses on modern physics and covers quantum physics, special relativity, and cosmology. Participants will learn about the latest developments in physics from expert researchers, take lab tours, and interact with teachers from around the world. Session topics include

- innovative teaching strategies for all areas of physics;
- quantum physics—wave-particle duality and the electron double-slit experiment;
- Geographic Positioning Systems (GPS) and relativity;
- dark matter as an application of uniform circular motion; and
- measuring Planck's constant using a simple electronic circuit.

EinsteinPlus will take place July 9–15 at the Perimeter Institute in Ontario, Canada. Apply by **April 7;** see *http://goo.gl/zGD70q*.

NASA's Texas Space Grant Consortium LiftOff E M H

This institute for science teachers takes place June 26–30 at NASA's Johnson Space Center in Houston. The workshop provides hands-on, inquiry-based science, technology, engineering, and math (STEM) activities as well as opportunities to work with NASA scientists and engineers and conduct field investigations on this year's space science theme: "Starry Night." Teachers of grades 4–12 with at least one year of teaching experience, a willingness to share information with others, and U.S. citizenship are eligible. The program is free for Texas teachers. Apply by **April 14** at *www.tsgc.utexas.edu/liftoff*.

Science and Our Food Supply: Investigating Food Safety From Farm to Table M H

The Food and Drug Administration (FDA) and NSTA sponsor this workshop and related curriculum on food safety and nutrition for middle and high school teachers. Participants will learn about foodborne illness from industry experts and how to incorporate the Science and Our Food Supply curriculum (see *http://goo.gl/rXGZsW*) in their classrooms. Travel, lodging, and meal expenses are provided for the workshop, to be held in Washington, D.C., July 16–23.

The following fall, participants will implement the curriculum in their classrooms, then conduct a six-hour workshop for other teachers in their respective school, district, or region during the 2017–2018 academic year. An honorarium and materials are provided for these workshops.

Certified middle or high school teachers of science, health, or family and consumer science in U.S. schools with three or more years of teaching experience are eligible. Fifteen middle and 15 high school educators will be selected to participate. Apply by **April 18;** see *https://goo.gl/874Ryg*.

REcharge Academy K12

K–12 teachers and maker, tinkerer, or fablab educators interested in renewable energy, basic circuits, and modeling can participate in this week-long (July 17–21) academy at Colorado State University in Fort Collins, Colorado. Teachers will hear from industry experts, tour facilities, and develop hands-on lessons for teaching about wind and solar power in their classrooms. After the institute, teachers become REcharge Instructors who are certified to teach REcharge programming in their own locations. Apply by **May 1** at *http://goo.gl/H8CnYZ*.

Teachers Institutes on Wireless Technology K12

American Radio Relay League (ARRL), the national association for amateur radio, will offer sessions in July on Introduction to Wireless Technology (TI-1), an expenses-paid, intensive professional development opportunity for educators at all grade levels who want to receive training and resources to explore wireless technology in the classroom. Topics include basic electronics, radio science, microcontroller programming, and basic robotics. ARRL will also hold an advanced Teachers Institute on Remote Sensing and Data Gathering (TI-2) in July.

Learn more and download an application at *www.arrl.org/ti*. Apply by **May 1.** If you have questions or wish to request a brochure, contact Debra Johnson at *djohnson@arrl.org*.

Stone Lab Science Courses for Educators K12

At Stone Laboratory, Ohio State University's island campus on Lake Erie, educators learn innovative ways to incorporate the natural environment in 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

- Workshop in Environmental Education and Technology Education: Enhancing Earth Science Education With Technology (June 15–17);
- Field Geology for Educators: Geologic Setting of Lake Erie (July 15–21);
- Workshop in Environmental Education: Water and Wildlife Training for Educators (July 23–29); and
- Field Ecology (July 23–29).

Apply at *http://goo.gl/pGAQd2* by **May 23.**

GEEO Teacher Travel Programs K12 HE

Sponsored by the Global Exploration for Educators Organization (GEEO), these programs enable teachers to study abroad at a discounted rate. Programs are available in 21 locations worldwide, including Armenia and Georgia; Bali and Lombok; the Balkans; Bangkok to Hanoi; Bhutan; China; Costa Rica; Eastern Europe; The Galapagos Islands; Greece; Iceland; India/Nepal; Ireland; Italy; Morocco; Multi-Stan; Myanmar (Burma); Peru and the Peruvian Amazon; Southern Africa; and Vietnam/Cambodia. Participants can earn graduate and professional development credit.

GEEO travel programs are open to K–12 and university educators, administrators, and retired educators. Apply by **June 1;** see *www.geeo.org*.

Advanced Placement Summer Institutes H

These institutes are open to those teaching an Advanced Placement (AP) course for the first time, those with limited experience with AP courses, or teachers who are adapting or revising an existing course. Sessions will provide instruction on methodology, curriculum, assignments, exams, and teaching strategies in the AP classroom.

Two institutes will take place at Fitchburg State University in Massachusetts: one on July 10–14 and the other on July 17–21. On-campus housing and graduate credits and professional development points are available. Apply by **June 19** at *http://goo.gl/Y7pseu*.

SEE Turtles Belize Wildlife Research Expedition A

On this five-day (June 24–July 1) trip, participants conduct research on hawksbill turtles, dolphins, and manatees, and explore reefs and marine protected areas. Participants will also go cave diving and rainforest hiking and visit Tikal National Park in Guatemala. Proceeds from the trip will save at least 100 hatchlings per participant. Register at *http://goo.gl/dvfAuF*. ●

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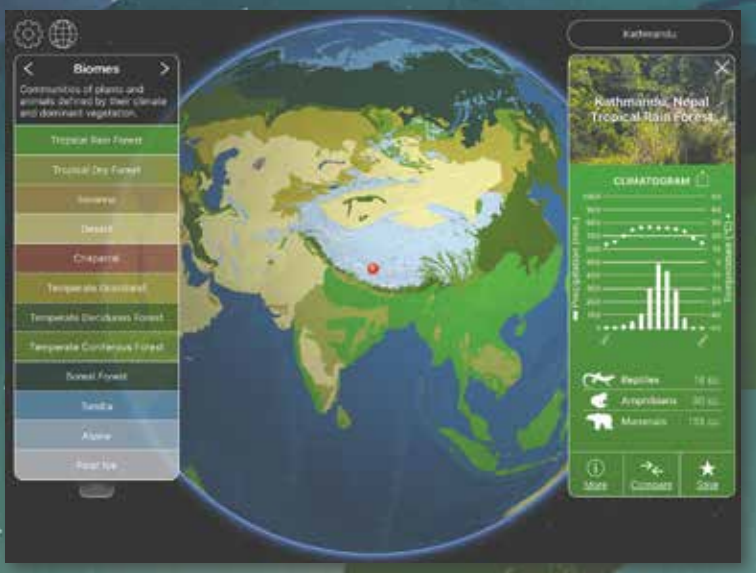

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MS. MENTOR, **Advice Column**

Strategies for Holiday Breaks, Lab Debriefings, and Incorporating Writing and Nonfiction Books

I finished a unit in middle school science two days ahead of our winter holiday break. We went on to the next unit, but my students didn't seem focused, and I think I'll have to review or repeat the activities. My colleagues advised that next time I should do holiday-themed activities, but this is my first year, and I need suggestions.

— L., California

The days before a long break can be challenging. Some students may leave early for the break, and as you noticed, others mentally leave in anticipation. I agree that jumping in to a new unit may be frustrating. But time is too valuable to spend on a study hall, a busywork activity, or an unrelated video (and students get bored with these, too).

I like ideas that recognize the season, but add a science focus. For example, I noticed that my middle schoolers assumed that all evergreens were "pine" trees, so before our winter break, we used references to identify a variety of specimens donated by a local nursery, and looked for patterns to identify characteristics for naming them (e.g., pine needles are in packages; spruces are sharp). And the lab smelled wonderful!

Other science/seasonal ideas

- The art and physics of snowflakes;
- Reason for the seasons;
- Winter storm patterns;
- The heart—up close and personal;
- The truth about bats;
- Bones of the skeletal system;
- Science of movement (skiing, skating, surfing, basketball, dance); and
- The science of cooking (but don't eat in the lab).

These "extra" days are also good for vocabulary games, discussions of current events, design contests (e.g, paper airplanes, towers, egg drops), organizing notebooks, or review activities.

My ninth-grade students enjoy doing labs. But afterward, most do not participate in the debriefing. How can I improve this?

—A., Washington

You could try an alternative to teacher-led discussions. Here's one that worked with my students.

Instead of you asking questions, assign one team of students to present their results to the class in a panel format. Before the activity, choose one team to present. You could assign members' roles, ensuring participation: Person 1—Introduce the team and present the question, problem, or hypothesis. Person 2—Summarize the procedure. Person 3—Provide a display and description of the data, observations, or results, incorporating classroom technology. Person 1 (again)—Relate the results to the question or hypothesis. Person 4—Note any questions the team had and how the investigation could or should be done differently, and take questions from the audience.

Give the team time at the end of the activity or at the beginning of the next class to prepare. Rotate roles so the students are doing different components of the report the next time they present.

At first, you may have to model how to summarize and how to make an effective presentation (my students enjoyed it when I modeled an ineffective one, too). You also may have to model how to contribute as a respectful audience member and suggest types of questions and discussion prompts: Compare their results to yours. How are they similar? Different? And as an audience member, you get to ask questions, too.

THINKSTOCK

This may take more time, but students also will have the opportunity to be presenters.

I'm looking for ideas to incorporate writing into my general biology classes. I've tried term papers, but many of my students struggled, and it took a lot of class time. Any ideas for other writing assignments?

—V., Ohio

Writing in science has alternatives to traditional term papers or reports. It might be beneficial for students to experience how communicating information is an everyday science practice (as described in the *Next Generation Science Standards*).

A museum herpetologist told a group of teachers that although his research focused on snakes in their environments, a good portion of his time was spent writing: notes, memos, observations, summaries, reports, journal articles, blog entries, and letters. So if you have students write lab reports, make journal entries, summarize their learning, contribute to a class blog, take their own notes, or respond to open-ended items on an assessment, you're already helping students with the focused type of writing used in science and engineering.

You can't assume that students have the writing skills they need (especially for a term paper or formal report). You can teach students about writing, but the best way to develop skills is to have them write through planned and purposeful activities in class. Modeling is essential. Show students what effective science writing looks like (incorporating both words and graphics). Show them examples of ineffective writing, and ask them to clarify it. Do a "think-aloud" as you write along with the students. Show them the value of text structures such as bulleted or numbered lists, headings, or tables.

When students display or share their writing in the classroom or with the community through a web page or other publications, having an authentic audience adds another dimension of relevancy.

I am a new elementary librarian, and I want to prioritize science nonfiction. I need suggestions to help teachers who often do not have time to collect books from the library. I also need ideas for books to purchase.

— J., New York

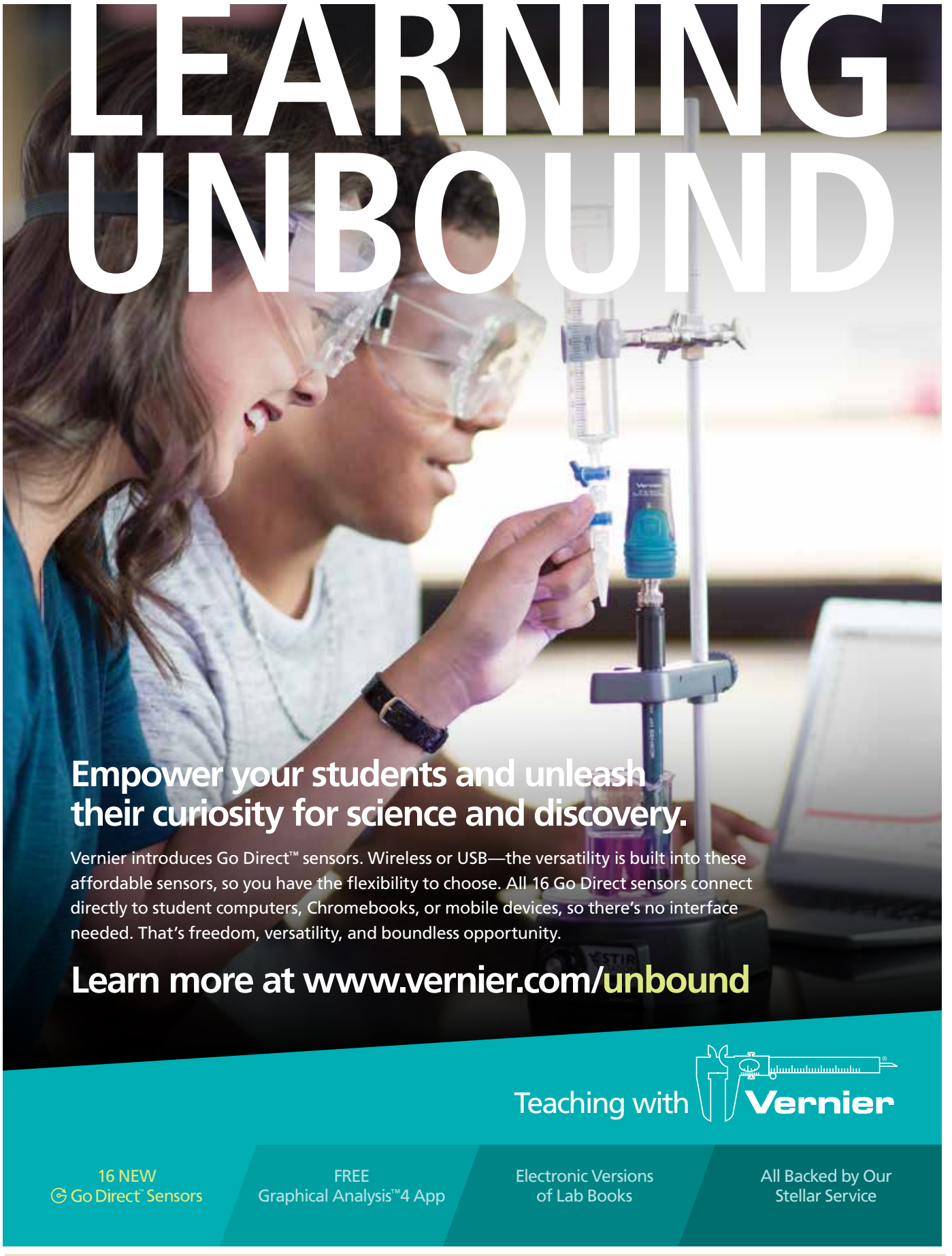
I spoke with a librarian colleague, who did what you are considering. She suggested asking teachers for a schedule of topics they work on throughout the year. She had a large plastic tub for each classroom in which she put corresponding books covering a range of reading levels. For each unit, the classroom received a new set of supplementary books. She often had older students or parent volunteers prepare the boxes.

To find appropriate titles for all grade levels, I have used the NSTA website. The Best STEM Books K–12 (*https://goo.gl/f0aIH0*) and Outstanding Science Trade Books for Students K–12 (*https://goo.gl/FDFfvm*) contain book selections compiled by NSTA in association with the Children's Book Council. The titles are listed by year and include an annotated description of each book. These titles are in NSTA Recommends (*www.nsta.org/recommends*), a broader, searchable list with reviews of books and other media. The reviews are written by science educators and can be searched by format (e.g., print, kits, DVDs), keywords (e.g., weather, machines, insects), and grade level (K through college). The lists can be exported as Excel spreadsheets. NSTA Recommends also has monthly updates in the NSTA journals.

School Library Journal also has a list of recommended Science and Nature Books for Kids (*https://goo.gl/Egxe3U*).

Some teachers might be willing to help you select the books or suggest topics, perhaps during a faculty meeting or workshop on science and reading.

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



Quotable

The goal of education is the advancement of knowledge and the dissemination of truth.

—John F. Kennedy, U.S. president (1917–1963)

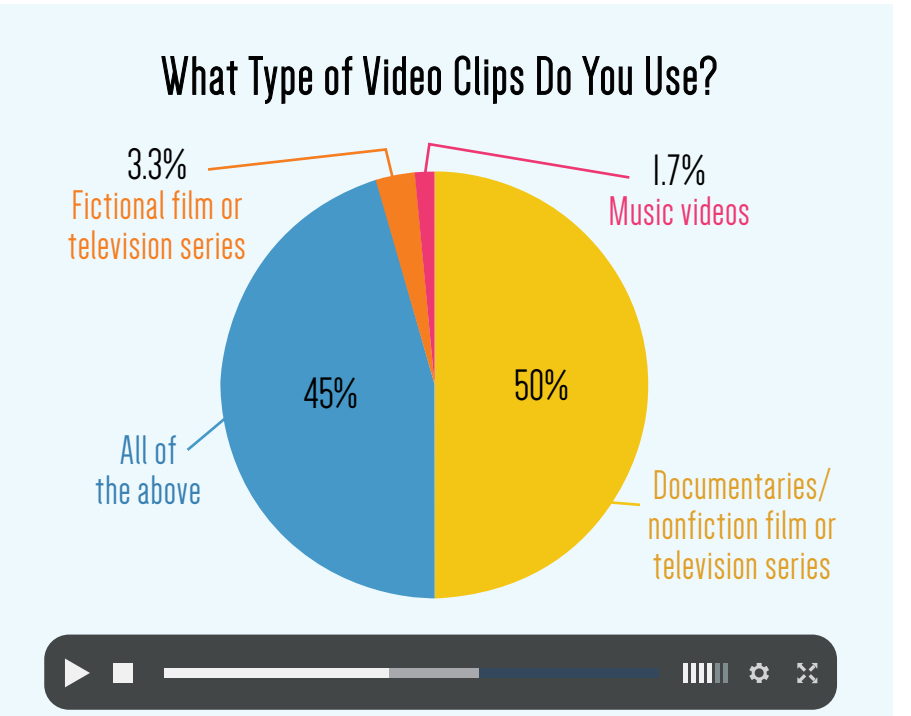
Science Educators See Value in Video Clips

More than 93% of educators responding to a recent *NSTA Reports* informal poll said they use video clips from popular media in their classrooms. Half said they use clips from documentaries or nonfiction films or television series, 3.3% use fictional films or television series, and 1.7% use clips taken from music videos. Forty-five percent said they use all three. The clips were used most often to illustrate a concept (86.7%) and as discussion starters (73.3%). [Multiple responses were allowed for this question].

The majority of respondents (83.3%) said they usually use video clips with each unit, with the remainder saying they use them three to four times a year. Most (53.3%) found clips and ideas to use them through colleague recommendations, while 16.7% said their students were their primary source.

Several educators commented that they search out video clips themselves; others subscribe to science-based YouTube channels. One noted spending "countless hours of searching" as well as using "student suggestions [and] social media." Another said the best source was "my own creative genius."

In addition, 92% said they did not have to obtain administrator approval for the clips they used, and only 30.2% reported their schools had clear guidelines for using video clips in class.



Here's what science educators are saying about using video clips:

[I use them] as part of an assessment question, as an example for students to make their own clip.—*Educator, Middle School, Illinois*

I have low-level readers. Videos are a way to get them the [information]. —*Educator, Middle School, New Jersey*

It helps my students see concepts we might not be able to show in the classroom. Often after [watching a clip], they want to try things out or make variations; it makes some curious and gives others plans. When [students send] me a video, it's awesome: [N]ot only were they outside of class thinking, but they [also] made the connection between what they were seeing and class. It's nice to give them that ownership.—*Educator, High School, Maine*

I think it's important for them to see science in real life and especially the failures.—*Educator, Elementary, Georgia*

[Clips] can illustrate concepts, pique student interest, initiate discussion. —*Educator, Middle School, Ohio*

As a high school science teacher, my students are engaged when I show them clips from familiar [television series] and movies. I have showed scenes from *Apollo 13, The Big Bang Theory, Finding Nemo, Dora the Explorer,* and more! —*Educator, High School, Iowa*

[Video clips are] a supplement, not a substitute for hands-on experience. —*Educator, Institution of Higher Learning, California*

Another way to reach these 21st-century learners.—*Educator, Elementary, California*

Connections are effective.—*Educator, High School, Pennsylvania*

[It's] essential to reaching every student.—*Educator, Elementary, Texas*

[It's an] excellent way to add "test" to the lesson. Images/videos bring text to life and can make any concept real.—*Educator, Middle School, Illinois*

Extremely helpful for students to "get in the zone" after having had other various non-science classes or just after general life events.—*Educator, High School, Institution of Higher Learning, Tennessee*

Helpful to bring the world into the classroom.—*Educator, Elementary, Illinois*

Great for introducing units, delving into specific topics, or enhanc[ing] instruction.—*Educator, Middle School, Maryland*

I think they're powerful tools, especially for illustrating difficult abstract concepts for students.—*Educator, High School, New York*

Great way of engaging students. —*Educator, Middle School, California*

[A clip] can be a great tool, especially to introduce natural phenomena. —*Educator, Middle School, Vermont*

Great! Shows science in action in everyday life.—*Educator, High School, Wisconsin*

I find them very helpful.—*Educator, Middle School, California*

I think it's important to illustrate or re-state concepts.—*Educator, Middle School, Nebraska*

I think that this is a great way to enhance the learning experience. —*Educator, Middle School, High School, California*

I wish I knew how to get just a short clip of part of a movie. Besides YouTube, I'm not sure where else to look, and trying to set up a DVD or streaming film in just that one part is difficult. I do use some of the [Howard Hughes Medical Institute] short films, though.—*Educator, High School, Indiana*

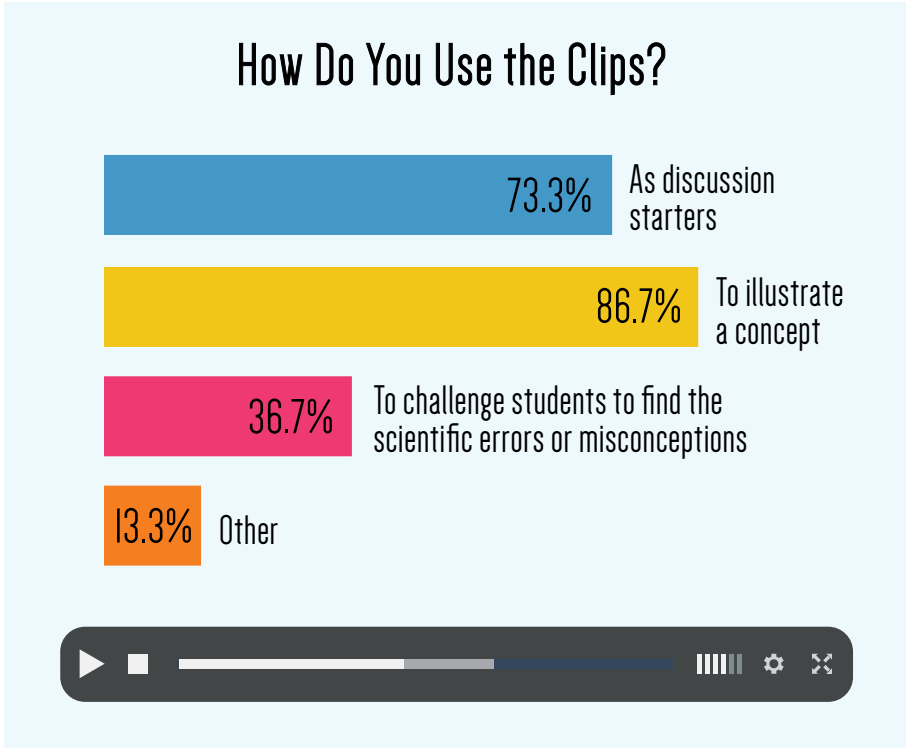
I think they are very useful.—*Educator, Middle School, New Jersey*

Great ways to introduce and start units or lessons. I always use [ones that are] 10 min[utes] or less.—*Educator, Elementary, North Carolina*

I think using documentary clips [is] especially helpful when illustrating concepts for [English language learners].—*Educator, Middle School, Massachusetts*

I can usually find better, short YouTube clips to illustrate principles if I want a visual aid.—*Educator, High School, Virginia*

I think video clips are great at engaging students and giving them a different source for information. They can also help students broaden their understanding of where they can learn good science from.—*Educator, High School, Washington*



It helps to illustrate concepts. I teach chemistry and use video clips from various places.—*Educator, High School, New York*

It helps to keep the topic "real" for the students. How they might experience or be exposed to a concept in the "real world." Also, how [they can] determine/problem solve/analyze if it is "true" or not as it is depicted in the video clip. Good discussion starters. —*Educator, High School, Nebraska*

It helps to reinforce the concepts being discussed in the classroom.—*Educator, Middle School, Illinois*

It keeps the student's attention. —*Educator, Institution of Higher Learning, Illinois*

Works great in small doses.—*Educator, High School, Minnesota*

The clips often work as a hook to get students engaged in class.—*Educator, High School, South Carolina*

It makes sense to use them. They can sometimes explain things better than I can, and they're more interesting. —*Educator, Elementary, Illinois*

It's a helpful alternative to build student knowledge.—*Educator, Elementary, Ohio*

Love it. It's a great way to engage students and have them evaluate phenomena.—*Educator, High School, Michigan*

They can be more entertaining for the students. Often videos can demonstrate a concept better than a diagram in their book.—*Educator, Middle School, Indiana*

It is great to supplement a lesson and can help students visualize a complex concept.—*Educator, High School, California*

When done properly, it can be a valuable way to either introduce or reinforce a concept. Clips are also a good way to break up longer class periods.—*Educator, High School, Tennessee*

They can be very helpful, especially for visual/auditory learning styles. —*Educator, Elementary, New Mexico*

Video clips can be useful as long as context is provided before or after the clip is shown.—*Educator, Elementary, Missouri*

It has revolutionized my teaching. —*Educator, Middle School, Illinois*

It can be a good way to engage students. It varies source material. —*Educator, Middle School, Michigan*

It's a great way to illustrate a concept that is difficult to describe verbally in a lecture. I teach sixth grade in a rural community without a lot of science equipment.—*Educator, Middle School, Arizona* ●

Quotable

To live a creative life, we must lose our fear of being wrong.

—Joseph Chilton Pearce, U.S. author (1926–2016)

CALLING ALL MIDDLE SCHOOL EDUCATORS

Friday, March 31, 2017 | 10:15 AM–4:30 PM
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BLICK ON FLICKS

Revealing *Hidden Figures*

By Jacob Clark Blickenstaff, PhD

Before IBM built large mainframe computers that could do thousands of arithmetic operations per second, calculations for the U.S. space program were done by hand with a slide rule, an adding machine, and a pencil. Many of the "human computers," as they were dubbed, were women, and a significant number were African American women. The contributions of these women to the space program has long gone unnoticed in history and science classes. The new film *Hidden Figures* begins to change that by telling the story of Katherine Johnson, Dorothy Vaughn, and Mary Jackson and their work at NASA on the Mercury project to launch Alan Shepard into suborbital flight in the early 1960s.

The film is based on Margo Lee Shetterly's book of the same title, published in 2016. Shetterly, the daughter of an African American NASA researcher, grew up knowing families like those in the film. Science, math, computer science, and engineering teachers could all use this movie to inspire girls and students of color to work in fields where they continue to be underrepresented even today.

As *Hidden Figures* begins, Katherine Johnson (played by Taraji P. Henson) is working with a group of other African American women "computers" performing trajectory calculations to support the Mercury project. She is promoted to work with a group of white male engineers, but finds it difficult to get recognition for her work. Reports are published without her name, despite her significant contributions, because "Computers don't author reports." Only when Al Harrison (played by Kevin Costner) includes Johnson in high-level meetings are her abilities recognized.

Mary Jackson (played by Janelle Monae) also works as a computer, but aspires to become an engineer. Her dreams are delayed when she learns that she cannot take the college extension courses she needs because they are held at a segregated high school. She has to petition the local judge to continue her studies. Dorothy Vaughn (played by Octavia Spencer) is the informal supervisor of the African American computer group, but her repeated requests for a promotion to formalize the position are denied. Despite this, Vaughn assumes the task of learning to program a new IBM mainframe computer and teaches her group how to do so as well.

Hidden Figures depicts the contributions of African American women to the space program despite many obstacles. Johnson, Jackson, and Vaughn can

be powerful role models for girls and women of color interested in science, technology, engineering, and mathematics (STEM) careers. It is great to see STEM at the center of the story, and women of color at NASA being recognized.

New technologies are sometimes described as "disruptive" if they transform an industry dramatically in a short time. Robots have been a disruptive technology in the auto industry, and smartphones in many sectors. The IBM mainframe computer was a disruptive technology in the early 1960s. The electronic computer did away with the need for human computers, but Dorothy Vaughn saw that as an opportunity, not a disaster. Vaughn prepared her colleagues to work in the new paradigm by teaching them how to program the mainframe using punch cards and FORTRAN.

NASA

Katherine Johnson was one of the "human computers" whose calculations were vital to the United States' space exploration program.

Astronomy buffs will appreciate the brief appearance of James Webb in an early scene in the film. Webb was NASA's second administrator, and led the agency through the Mercury program and much of the Apollo program that took Neil Armstrong to the Moon. Webb's name is in the news again because the next space telescope, designed to dramatically surpass the Hubble Space Telescope, has been named after him. The James Webb Space Telescope is scheduled to launch in 2018.

One surprising error by a news announcer occurs when Sheppard's rocket is launched. The announcer says the rocket will reach "…an altitude of 116 miles per hour." Altitude is a measure of how high above the Earth the rocket travels. Miles per hour (mph) is a unit of speed, not distance, and the rocket reached a speed of more than 5,000 mph during the flight. I imagine that every physical science and physics teacher cringes on hearing that line, since correctly labeling numbers with units is a constant challenge for students in these classes.

STEM teachers can use *Hidden Figures* to bring attention to the real contributions of women of color to science and engineering, and inspire a greater diversity of students to pursue careers in STEM fields.

Hidden Figures *is rated PG for thematic elements and some language.* ●

Jacob Clark Blickenstaff is Director of K–12 Engagement at the Pacific Science Center in Seattle. Read more Blick at http://goo.gl/6CeBzq, *or e-mail him at* jclarkblickenstaff@pacsci.org.

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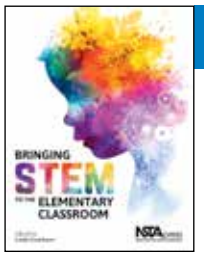
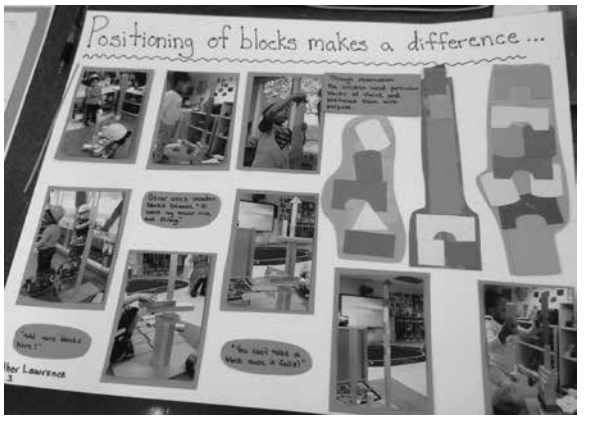


NSTA PRESS: *Bringing STEM to the Elementary Classroom*

Gimme an E!

Seven Strategies for Supporting the E in Young Children's STEM Learning

By Cynthia Hoisington and Jeff Winokur



A documentation panel makes children's ideas and thinking explicit.

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 Bringing STEM to the Elementary Classroom, *edited by Linda Froschauer, edited for publication here. To download the full text of this chapter, go to* http://goo.gl/2IERvi. *NSTA Press publications are available online through the NSTA Science Store at* www.nsta.org/store.

Integrate Opportunities for Language, Literacy, and Mathematics During Building Explorations

Science and engineering provide ideal contexts for language and literacy because communication is a critical aspect of both disciplines and because children are naturally motivated to communicate their observations, discoveries, and ideas. Building explorations addressed foundational skills in each of the four *Common Core State Standards* literacy strands: Language, Speaking and Listening, Writing, and Reading (NGAC and CCSSO 2010). Teachers facilitated 5- to 10-minute science talks using a small-group format, photos, and children's building representations to better support the participation of all children. Using productive prompts, teachers scaffolded children's ability to use language for asking questions, describing, making comparisons, and expressing conclusions. Teachers introduced and emphasized vocabulary words, including *build, blocks, structure*, and words that described the properties of the building materials. Teachers supported speaking and listening skills by encouraging children to focus on the topic, share their observations and ideas appropriately, and listen and respond to other children.

Teachers fostered foundational writing and reading skills as they helped children create, share, and interpret representations. They invited children to use emergent writing to record data and modeled conventional writing as they transcribed children's dictation about their buildings. When teachers talked with children about their building drawings and stories and read them fiction and nonfiction books about building, they supported children's development of pre-reading skills. Structures explorations enabled teachers to teach math concepts, language, and skills for a purpose. Teachers encouraged children to measure their towers using standard and nonstandard measurement tools. They supported children's learning about spatial relationships and patterns.

Collect Assessment Data Related to Building From a Variety of Sources

Assessment in science is a continuous process of uncovering children's knowledge and skills in relation to the core concepts and science and engineering practices. The best assessment probes are embedded in the curriculum and promote, as well as assess, conceptual learning and inquiry.

Cultivating Young Scientists (CYS) teachers collected assessment data in the context of children's building explorations and as they facilitated learning and inquiry during each phase of the Engage-Explore-Reflect cycle. During the Explore phase, for example, teachers closely observed and recorded children's building behaviors. They noted how the children approached and persisted at building, used materials, designed their structures, and played and talked with one another. They made copies of children's building representations and transcribed what children said about them. During Engage-Explore-Reflect conversations, teachers noted how individual children communicated observations, experiences, and ideas. They could individualize in the moment for children with a range of developmental levels, language skills, and social-emotional abilities by adding or removing materials, scaffolding language and vocabulary, or pairing students with a more knowledgeable peer, for example.

Reflect On, Document, and Use Data From Children's Building Explorations

When teachers reflect on and document data from children's explorations, they make children's thinking and learning visible. This process also serves to inform ongoing planning. CYS teachers collaboratively reflected on their building observations, photos, representations, and language samples. Each teacher created a documentation panel illustrating what the teacher viewed as the most prominent aspects of his or her own children's learning. Individual panels highlighted children's abilities to investigate the properties of materials and design and the materials' impact on stability, identify and recreate patterns in their structures, and collect data about structures using a variety of measurement tools. The panels also illustrated children's thinking and emerging theories about building. Additionally, panels highlighted the playful, imaginative, and social nature of young children's authentic science and engineering explorations.

This collaborative reflection revealed that many children were trying out and choosing different materials for different parts of their towers and developing tower-building strategies, such as creating a hard base to build on and placing blocks carefully with an eye to balance. Some children verbally shared their ideas about how to build tall towers, indicating their readiness to address a second design challenge. It also enabled teachers to identify children who would benefit from more explicit language supports, additional options for representing, and intentional grouping with peers during explorations and conversations. Teachers determined that some children would benefit from ongoing open explorations and individualized support for investigating, using, and observing different building materials.

Teachers used their panels as the basis for follow-up conversations with children, further drawing out children's building interests and their ideas about building strong and stable structures. In doing so, teachers obtained assessment information that informed their planning. They gained a deeper understanding of young children, how they think and learn, and the types of experiences and interactions that foster their learning in science and engineering.

Conclusion

Young children are curious and eager to engage in constructive and dramatic play—but they must be taught to take advantage of these predispositions to become more adept at thinking like scientists and engineers. Although preK performance expectations are not explicitly outlined in the *Next Generation Science Standards*, we have identified some of the ways in which young children's building experiences connect with and are foundational to developing specific practices, disciplinary core ideas, and crosscutting concepts. ●

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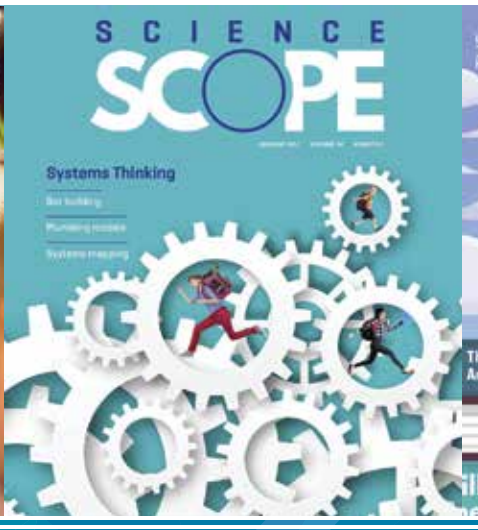

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(All dates are deadlines unless otherwise specified.)

March 30—The **2017 NSTA Los Angeles National Conference on Science Education** opens today! The conference features strands on *NGSS*: The Next Generation of Science Teaching; 2017: A STEM (science, technology, engineering, and math) Odyssey; Science and Literacy Reloaded; and Mission Possible: Equity for Universal Access. Andy Weir, author of the *New York Times* best seller *The Martian* and a lifelong space nerd, will deliver the keynote presentation. For more information or to register, go to *www.nsta.org/la*.

April 1—***Science and Children*** (*S&C*), NSTA's peer-reviewed journal for elementary science education, **is accepting manuscripts** on the theme **"Developing and Using Vocabulary in Context"** for the November issue. Share how you help students develop their vocabulary and connect science investigations to literacy. General-interest manuscripts may be submitted at any time. Read the call for papers at *https://goo.gl/UXBmlh*.

April 1—How have you used **informal learning** to enhance students' science learning? Share your ideas and methods with your fellow middle level science educators by submitting a manuscript today for the November issue of ***Science Scope***, NSTA's peer-reviewed journal for middle level science teachers! General-interest manuscripts, commentaries, and column submissions may be submitted at any time. Read the call for papers and access submission guidelines at *https://goo.gl/l6bNbz*.

April 15—Proposals for **sessions at the 2018 NSTA Atlanta National Conference on Science Education** are due now. The national conference will be held March 15–18, 2018. For more information on submitting a session proposal, visit *https://goo.gl/eTVbJK*.

May 1—Submit your manuscript today to help ***S&C*** explore how educators are **"Using the 5E in Alignment With the *Next Generation Science Standards*"** in its December issue. General-interest manuscripts may be submitted at any time. Read the call for papers at *https://goo.gl/UXBmlh*.

May 1—Forensic science can do more than solve crimes: It can engage your students! Share your best activities and practices for teaching **"Forensics: Solving Mysteries Through Science"** with your fellow high school teachers in the November issue of ***The Science Teacher*** (*TST*), NSTA's peer-reviewed high school–level journal. In addition, the journal accepts articles unrelated to a theme at any time. For more information on writing for *TST*, issue themes, and more, go to *https://goo.gl/u6JTM6*. For help with preparing a manuscript, see an annotated sample manuscript at *https://goo.gl/EwzlLG*.

May 1—Submit your best **modeling** methods to show cause and effect, address misconceptions, and more in a manuscript to ***Science Scope*** today for consideration for the December issue. General-interest manuscripts, commentaries, and column submissions may be submitted at any time. Read the call for papers and access submission guidelines at *https://goo.gl/l6bNbz*.

May 12—Register today for the **Sixth Annual STEM Forum & Expo**, hosted by NSTA, to be held July 12–14 at the Gaylord Palms Resort & Convention Center in Kissimmee, Florida. The forum will feature strands targeting early childhood and lower-elementary educators; upper-elementary, middle level, and high school educators; and administrators. The event will also feature a strand devoted to exploring successful partnerships among community, business/industry, and education members that enhanced STEM education for preK–16 learners. Earlybird registration for NSTA members costs just $180. For more information or to register, go to *https://goo.gl/dTLN6j*.

June 1—Share how you are **"Meeting the Needs of *All* Students With Physical Disabilities"** with your fellow elementary educators by submitting a manuscript today for the January 2018 issue of ***S&C***. General-interest manuscripts may be submitted at any time. Read the call for papers at *https://goo.gl/UXBmlh*.

June 1—Good **assessment strategies** are essential to effective instruction. ***Science Scope***'s January 2018 issue will feature educators' best assessment strategies—if you submit a manuscript today! General-interest manuscripts, commentaries, and column submissions may be submitted at any time. Read the call for papers and access submission guidelines at *https://goo.gl/l6bNbz*.

June 1—How are you **"Using New Tools to Support Science Learning in a Connected World"?** ***TST*** is accepting manuscripts for the December issue that explore the use of social media, online simulations, virtual learning communities, and cloud computing, as well as ways to improve critical thinking and digital and media literacy, and more. In addition, the journal accepts articles unrelated to a theme at any time. For more information on writing for *TST,* issue themes, and more, go to *https://goo.gl/u6JTM6*. For help preparing a manuscript, see an annotated sample manuscript at *https://goo.gl/EwzlLG*. ●

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New NSTA Ed Policy E-Mail List

NSTA launched a new e-mail list for members to share information, opinions, resources, and research on federal and state education policies that impact the science/STEM classroom. The list gives members an opportunity to discuss implications and implementation of federal policy issues such as the Every Student Succeeds Act, as well as funding for science, technology, engineering, and mathematics programs.

NSTA members can sign up to receive the Ed Policy e-mail list or one of NSTA's 18 other e-mail lists, covering everything from general science to pedagogy to the *Next Generation Science Standards,* at *https://goo.gl/4ciuER*. ●

Quotable

It's amazing what children can accomplish in the classroom when they don't know what they can't learn.

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

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