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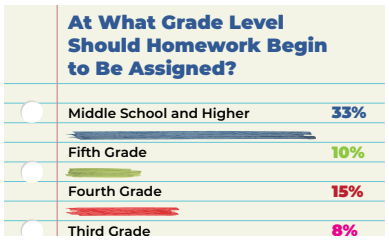


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# NSTA Reports

National Science Teachers Association

GEORGIA LITTLETON.

**Putting STEM Into Earth Day**
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## CONTENTS



# Building STEM Knowledge in a Breakerspace

A breakerspace—a makerspace workstation where students can disassemble toys, electronics, and appliances—engages students "in the 'how does this work,' 'what makes things work,' 'I wonder,' and tinkering phases of investigating the world around them. In the age of touch screens, cell phones, headphones, etc., it is important to stress engaging with others and the world around them and to foster [students'] curiosity," says Cynthia Crockett, science education specialist at the Harvard-Smithsonian Center for Astrophysics in Cambridge, Massachusetts. "This is not a new phenomenon—the 'take-apart table' [dates back to] the 90's—but…[it] has seen a resurgence [recently] with the advent of makerspaces."

JANET SWEAT

*Janet Sweat's middle school students in Lake City, Florida, disassembled broken toys to create cars, some that would run with remote controls and others without them.*

Crockett emphasizes that "no smashing or wanton destruction [is] permitted; that defeats the very purpose." Instead, teachers should encourage students to "explore and move toward understanding the workings," which happens when students study objects "to figure out how to 'get inside,' see how it is put together…'undo' it, then…[re-examine it]." Students can further their learning by reassembling the item, she adds.

When Janet Sweat of Lake City, Florida, taught middle school, her students "would take apart broken toys to create cars that run. We would repurpose motors and create circuits…A broken PlayStation became a car with a pop-up top and headlights," she recalls. "The students were extremely creative."

Sweat had students sketch their creations beforehand. "The art piece was necessary [to show] what will the thing look like? What is the energy source? How will the circuit be designed?"

Afterward, the students "remembered those circuits and did well on tests," she asserts.

Lucas Carr, technology teacher at Sullivan North High School in Kingsport, Tennessee, says his breakerspace "is a large part of my classroom...I have had students run through labs [in which] we took older/inoperable computers apart; students have brought in old electronic toys to repurpose parts; and we also compete in robotics competitions, which have involved many disassemblies of completed robots. In all, I believe these activities offer increased student motivation, and an opportunity for educators to present the knowledge and skills that students need to work with 21st-century concepts and equipment."

Carr has a closet designated for storage of items to be dismantled. "One of the biggest challenges is having enough space so you can keep a good supply and give students a range [of items] to choose from," he reports.

While Carr's students are most focused on electronics, he suggests teachers who want to establish a breakerspace "start with what you're most familiar with." Some teachers and students might be more comfortable

See Breakerspaces, pg 4

COMMENTARY: **Louie Lopez**

# Government Partnerships Support Science Education

By Louie Lopez

*Louie Lopez*

The United States Army recognizes the need for student engagement in science, technology, engineering, and mathematics (STEM) education for the future development of technologies by scientists, technologists, engineers, and mathematicians. To that end, the U.S. Army has a portfolio of STEM education initiatives for K–16 called the Army Educational Outreach Program (AEOP). According to Matthew Willis, director for the Army Laboratory Management within the Office of the Deputy Assistant Secretary of the Army for Research and Technology, "[By] leveraging the Army's valuable assets, our world-class scientists and engineers, and the research facilities that they work in, AEOP offers our nation's youth and teachers a collaborative, cohesive portfolio of opportunities that effectively engage future workforce generations in meaningful, real-world STEM experiences, competitions, and paid internships."

Through the AEOP cooperative agreement award, the Army partners with a consortium including academia, industry, and not-for-profit organizations, with mutual goals of broadening U.S. STEM literacy and empowering students and teachers through mentor-centered experiences.

The AEOP opportunities encompass three areas: enrichment activities for K–12 students and teachers, student apprenticeships (high school through undergraduate), and student competitions (grades 6–12). The STEM enrichment activities include summer programs at U.S. Army research sites for teachers and students in grades 5–16 to learn from scientists and engineers at those facilities: Research Experiences for STEM Educators and Teachers (RESET) and Gains in the Education of Mathematics and Science (GEMS). Apprenticeships include real-world research for high school students and undergraduates at Army Research sites or universities, where students work alongside practicing scientists and engineers. AEOP competitions include the Junior Solar Sprint (JSS) (grades 5–8), eCYBERMISSION (grades 6–9), and Junior Science and Humanities Symposium (JSHS) (grades 9–12). The competitions can be incorporated in the classroom or worked on outside the school, with support from U.S. Army scientists and engineers.

What can government partnerships do for students and teachers in science education? AEOP and NSTA's partnership has mutually aligned missions in empowering students and teachers with unique learning experiences. Participants in various programs have offered some insight into the impact of a few of these programs.

As a new STEM enrichment opportunity for teachers, RESET provides participants with summer research experiences at Army Laboratories alongside scientists and engineers at those facilities. One RESET participant noted, "I was so very overwhelmed by the projects individuals did in the summer and in awe of the science. I am delighted that AEOP offers this course to educators and am deeply appreciative to [Tennessee] Tech[nological University] for partnering in this endeavor."

GEMS summer programs for students in grades 5–12 are held at participating Army Research Laboratories. Students work alongside scientists, engineers, college students (Near Peer Mentors or NPMs), and teachers who share a passion for STEM, letting them experience doing research as part of a scientific community.

"As a college student who participated in the GEMS program in high school, I found that the program was extremely beneficial in gaining experience in the lab setting, as well as getting exposed to scientific terminology and concepts before learning about them in school. As a [NPM] this year, I found this job to be [not only] extremely rewarding and enjoyable, but also a fantastic learning experience as an educator," says a GEMS NPM who participated in 2016.

eCYBERMISSION is a web-based STEM competition for students in grades 6–9. Student teams work together to ask questions (for science) or define problems (for engineering), then construct explanations or design solutions based on identified problems in their community. A team advisor oversees students' work. One team advisor wrote this:

"The eCYBERMISSION program has changed the way I teach. It is an amazing experience for students, and I have all my students [in grades] 6–9 participate. Some teams are more serious than others, but all gain valuable experience in *real science*. The networking for the students with real researchers is one of the most important aspects, as is the students' freedom to pick their own projects and interests. It doesn't matter whether the teams place in the competition (although the kids all hope for the best!); they learn such an incredible amount of information from this competition."

Students also comment positively about their experiences. "eCYBERMISSION improves participants' social skills and encourages them to embrace science, technology, engineering, and mathematics on a much larger scale than before," contends a seventh-grade student who participated in 2017.

Parents are also impressed with eCYBERMISSION. A parent of a sixth grader who participated in 2017 says, "We have listened to these boys working on the phone all afternoon. They sound like little adults working! If nothing else happens, they have learned so much about working together, solving problems, overcoming obstacles, and lots more! "

Last year alone, 31,172 students and 2,568 teachers from 3,398 K–12 schools participated in the AEOP initiatives. Additionally, 288 college students received apprenticeships at universities across the United States. For more information on these programs, visit *www.usaeop.com.* ●

*Louie Lopez is chief of STEM Education and Outreach and AEOP Cooperative Agreement at the U.S. Army Research, Development, and Engineering Command at Aberdeen Proving Ground, Maryland.*

NSTA Reports

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Breakerspaces, from pg 1

working with "dolls and stuffed toys, or old lawnmowers," he notes.

"Our Makers' Lab has always had a take-apart space, as well as our Tinkering carts and spaces…Our largest item was a washing machine disassembled by kindergartners," says Matt Pearson, director of the Makers' Lab at Marin Country Day School in Corte Madera, California. Before students work with "CRT [cathode ray tube] TVs and microwaves, which are high-voltage," Pearson says he removes "the dangerous pieces" from microwaves and ensures the capacitors in electronics are discharged.

"I'm most interested in electromechanical items like pulleys, gears, motors, and switches because students learn a lot more" from them, he contends. "My most sought-after take-apart is the VCR [videocassette recorder]" because of "the many simple machines and electromechanical parts it contains. Students gaining an understanding of simple machines directly connects to the *NGSS* [*Next Generation Science Standards*] engineering standards in grades 3–5. An understanding of transferring or transforming energy is most easily taught with simple machines doing a task. VCRs have many."

To initiate a project, students "have to formulate a pitch, why they want to do it, and argue it, like in the real world," says Pearson. "They have to do research…I give them a budget for carrying out the project," he relates.

"You have to foreshadow the take-apart, so I do it myself first," Pearson advises. Students have to demonstrate the safe use of tools before using them.

Tinkering, he says, "serves as the creative and innovative connection between Making and STEAM [science, technology, engineering, arts, and math]. A STEAM education environment includes creative, stimulating, and inspiring classrooms where creativity is used to problem-solve interesting and culturally relevant challenges. I suggest that Making is the gateway to such a classroom, with Tinkering serving as the means to acquire new knowledge and skills and explore how to recombine the traditional in innovative ways."

Anthony Perry, invention education coordinator for the Lemelson-MIT Program—which encourages students to invent and develop hands-on STEM skills—has facilitated summer camps in which elementary and middle school students learned engineering design by disassembling electronics. Students entering the camps typically "had zero experience working in a group. [They learned] you can't do it alone; you depend on your teammates," he asserts.

The camps also helped students develop persistence, he says. "Things aren't going to work right away. You have to change course, ask a peer, or try something else."

Perry had students keep engineering notebooks. "For each step, they would sketch it out and make observations," he recalls. The notebooks also "made it clear that smashing something is not the way to learn about [electronic circuits and systems]."

## Suggestions for Safety

"Like with any type of demolition work, safety preparation is critical," asserts Ken Roy, NSTA's chief science safety compliance consultant. He cites "the need to be aware of personal protective equipment requirements and appropriate use [e.g. eye (safety glasses or goggles) and hand protection (work gloves)]; the need to work [safely] with hand tools; and the need to assess hazards and determine risks of materials/equipment to be worked with."

Above all, students must be trained "on all of these safety issues noted and [successfully assessed before doing]... breakerspace activities. Teachers [must] make sure [to have] continuous and direct adult supervision of students...under 'duty or standard of care' legal requirements...to ensure that behavioral expectations are being followed and to be prepared for the unexpected safety issues."

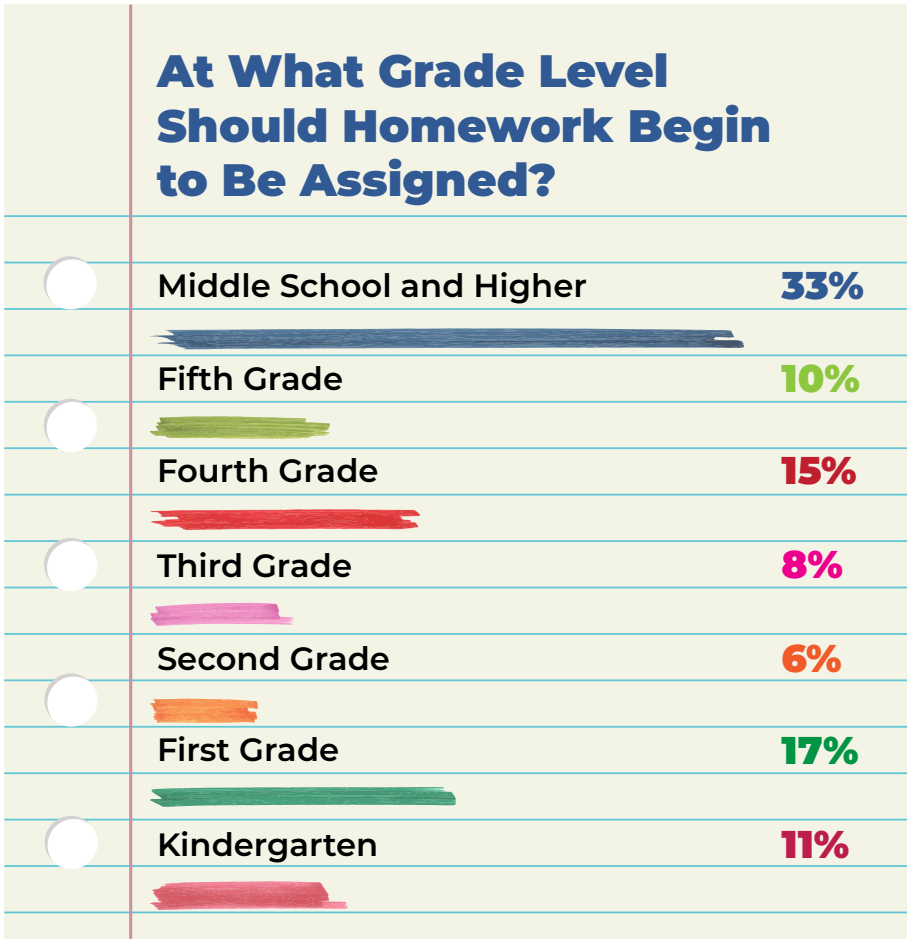
For a complete list of safety procedures for breakerspaces, see Roy's safety blog at *https://goo.gl/MB72dE*. ●

# Educators Evaluate Homework

*NSTA Reports* recently asked science educators to share their thoughts on homework in an informal anonymous poll. Eighty-three percent reported assigning homework, a slight decline from the 90% who reported assigning it in a similar *Reports* poll in 2013. Most educators assigned less than 30 minutes of homework a day (48% assigned less than 15 minutes, and 41% assigned 15–30 minutes). As in the 2013 poll, 33% said homework should begin in middle school and higher grade levels, although more respondents in the current poll said it should begin in kindergarten (6.7% in 2013 compared to 11%).

Forty-one percent said they collect and grade homework, while 43% said they check "for completeness only," and 11% only review homework in class. More than three-quarters include homework as a percentage of the final grade: 45% reported homework counts for 10–25% of the grade, 39% said less than 10%, and 16% said more than 25%.

Nearly two-thirds (65%) reported technology has changed the type of homework they assign.




**Here's what teachers are saying about the impact of technology on homework assignments:**

I can assign homework via Google Classroom; students are able to submit questions and get help from me after hours.—*Educator, Middle School, Minnesota*

I don't assign as many reading assignments from the textbook because there is plenty of good reading information on the internet. I also have changed the type of projects they submit.—*Educator, High School, Colorado*

I love using simulations [so] that kids can experience things outside of our classroom reach, like Hubble Deep Field Academy.—*Educator, Middle School, New York*

Technology has changed homework in that all of my students don't have phones or internet access at home, and it is inequitable to assign technology-based homework due to these constraints.—*Educator, High School, New York*

I can now assign online activities with confidence that all my students have access to the internet at home.—*Educator, High School, California*

Most material that I would have assigned as homework in the past is now available online. Students are expected to complete tasks in class in the time provided. Homework only occurs when students choose not to work or have been absent.—*Educator, Middle School, California*

I am more likely to give "current events"–style homework [in which] they are given a choice of articles to read or YouTube videos to watch, and then [asked] to write a reaction on [them].—*Educator, Middle School, Institution of Higher Learning, Michigan*

Technology has the power to allow students to have all the resources they need to learn outside of the classroom as well as in the classroom; however, technology has also squelched many of our students' curiosity, ambition, and desire to learn and better our world.—*Educator, Middle School, New Hampshire*

More investigative; research deeper than filling-in-blanks–thinking and problem solving as well as interacting with family

and community; project- and service-based homework with documentation such as video, pictures, recorded interviews, etc.—*Educator, High School, Institution of Higher Learning, Georgia*

Occasional lessons are flipped. Practice quizzes can give immediate feedback to students. Video sources can be incorporated.—*Educator, High School, Wyoming*

[Technology] allows for a better flipped model. Students now mostly watch videos so we can jump into discussion and hands-on activities.—*Educator, Middle School, New Hampshire*

I give less written homework, more reviewing or studying. The math teacher has flipped her class so the kids watch videos each night—[and] they do not like it.—*Educator, Middle School, Massachusetts*

Students can self-correct work for immediate feedback. Students have multiple ways to access homework. —*Educator, High School, Ohio*

**Homework's Optimum Role**

To practice concepts and chemistry calculations taught in class. To reveal weaknesses and misconceptions. —*Educator, High School, Indiana*

Formative evaluation allowing students to make and learn from errors. —*Educator, High School, California*

It should support what students learn in class and be used only as needed. It should not just be a routine, and should involve students' choice and a limited time commitment.—*Educator, Institution of Higher Learning, California*

Homework used to be how students practiced skills learned in the classroom...Since things have changed and we no longer assign additional practice outside of the classroom, the amount of in-depth practice students can get to work toward mastery has been drastically cut. The standards have increased in rigor and complexity, but what we are able to do and cover has decreased. There is not the support in the home for homework to be useful anymore.—*Educator, Middle School, New Hampshire*

If brain-based research is correct that it takes a minimum of seven times to learn a particular concept, then homework should be used as one of the learning periods.—*Educator, Middle School, Indiana* ●



## Quotable

***An essential aspect of creativity is not being afraid to fail.***

—Edwin Land, U.S. scientist and inventor (1909–1991)

# Putting STEM Into Earth Day

Teachers are integrating science, technology, engineering, and math (STEM) into activities marking Earth Day, on April 22, to make them more relevant and meaningful for students for more than just one day. Georgia Littleton, science teacher at Booneville Elementary School in Booneville, Arkansas, starts by having students read *A River Ran Wild* by Lynne Cherry. "This book is about the Nashua River in the northeastern part of the United States…As the Nashua Indians arrived, they only took what they needed from the land, but as white men came, they abused the land. The story follows the river from being a clean beautiful stream until it becomes so polluted that it is no longer able to sustain life," Littleton explains.

As her students read the book, Littleton gives some of them slips of paper describing pollutants, such as motor oil; students simulate the motor oil pollution by adding syrup to a "river" (container of water) that has a fish (a sponge) in it. "This continues until our river is polluted just as the Nashua River was, and our poor little sponge fish is no longer healthy. The next day, we begin building our water filtration systems to purify the water," she relates.

In this engineering activity, students research which items—such as rocks, sand, cheesecloth, and coffee filters—make the best filters. They test the total dissolved solids in the water, then modify as needed. "I usually let the students redo their filtration system two or three times," Littleton notes.

During the activity, Littleton's students discuss "third-world countries that do not have access to clean water and the different ways they purify their water. The students enjoy this activity, and it's a wonderful introduction to water purification," she observes.

Jennifer Stover, science instructional coach at Lufkin Middle School (LMS) in Lufkin, Texas, sponsors the after-school LMS Eco-Club, whose members, she explains, "have done STEAM [science, technology, engineering, arts, and math] projects with our local zoo. We have made [Dale] Chihuly–inspired recycled art projects that the Ellen Trout Zoo [in Lufkin] puts on display for Earth Day." (Chihuly, an American glass sculptor, creates large–scale, blown-glass sculptures for installations and environmental artwork.)

"Our club [staffs] a booth that day to demonstrate the many projects that we complete throughout the year that promote sustainable environmental practices, as well as the simple joy of having fun in the outdoors," says Stover.

For their sculptures, Eco-Club members recycled more than 1,000 plastic bottles, which they colored and cut into spirals (with Stover's supervision to ensure safety). They used the engineering design process to determine how to attach the cut bottles to one another. After they completed several trials, including trying to use string to connect the bottles, "I bought chicken wire, which they could shape to hold the bottles together," Stover reports.

The students also conducted several trials to decide whether the structure should be flat or curved ("curved worked," says Stover), and chose to put holiday lights in the middle of the huge, cone-shaped chandelier.

Creating the chandelier "took a long time," Stover observes. "We spent months [on it because] we worked on it for 45 minutes at a time, and a lot of things came up that we didn't anticipate, such as [the time] we had to take it apart and start over with new materials. We weren't simply following directions," she asserts.

"Sometimes we had to pause and discuss how we talk to one another, how to value everyone's ideas, and the ways to make [the project] work. [The club was] a safe place to fail and try again, and try new ideas," she contends.

Club members displayed the chandelier at the zoo on Earth Day. "It showed the importance of recycling," Stover maintains. "We talked about where the bottles would have ended up if we hadn't used them."

Valarie Broadhead, science teacher at Aliso Viejo Middle School in Aliso Viejo, California, serves on her school's Earth Week team, which is using Earth Day Network's 2018 Earth Day theme (see *https://goo.gl/B1M6oU*) and holding an Earth Day Teach-In (see Earth Day Network's Teach-In resource at the website *https://goo.gl/z8ku8S*). "Our theme is 'Reducing Your Plastic Footprint.' In my lesson, students use Google My Maps to identify different areas of the ocean that have been identified as having problems [with plastic pollution]. They insert photos and links and write about the type of problem, [and] contributing factors," Broadhead explains. To further incorporate technology, students can present the information using infographics.

GEORGIA LITTLETON.

*Georgia Littleton, science teacher at Booneville Elementary School in Booneville, Arkansas, has students build water filtration systems as part of her Earth Day activity.*

"We're in the suburbs, but we have a creek bed nearby [from which] students can take water samples and test them. In an undeveloped area nearby, students can test soil samples for pollution [by measuring] pH and moisture, the soil composition," she relates.

During engineering activities, "students are able to design a device to help reduce plastic pollution," says Broadhead. Students practice designing models and "can improve their creativity and ability to design," she points out.

"We're incorporating [*Next Generation Science Standards*] because we want students to understand why reducing their plastic footprint is more than just [reusing and reducing the use of] plastics [while minimizing expenses]," she adds. In addition, Earth Week guest speakers "can get students interested in STEM careers," says Broadhead.

For Earth Day, Rebecca Newburn, science and math teacher at Hall Middle School in Larkspur, California, has created Drawdown: Climate Action Now Unit for her sixth graders. "We'll be using the book *Project Drawdown: The Most Comprehensive Plan Ever Proposed to Reverse Global Warming,* edited by Paul Hawken (*www.drawdown.org*). The book has 100 solutions to reverse global warming, and we'll look at how we can use math to analyze this data to engineer a path to reversing global warming," she explains. "Two of the top solutions to reversing global warming are reducing food waste and eating a plant-rich diet. These are things students can [do to] make a difference."

In addition, "we do an [invasive weed] broom-pulling activity on the hills near our school to restore native habitat and prevent fires. We then watch an inspiring environmental documentary at a local theater," which also will show "engineered solution videos about eliminating food waste" created by the students, Newburn relates.

Newburn's seventh graders use the Litterati app (*www.litterati.org*) "to obtain data on discarded single-use plastic containers, which snacks and school lunches are often packed in. [Students] design and implement school-wide programs and analyze the impact of their solutions," she relates.

"The culmination of the Climate Action Now project will be the students presenting a resolution to the Board of Education to take action on climate change," she reports. "This resolution was inspired by Schools for Climate Action (*https://goo.gl/g3zySk*), a group that encourages local school boards to take climate action."●

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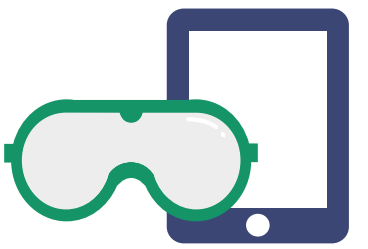

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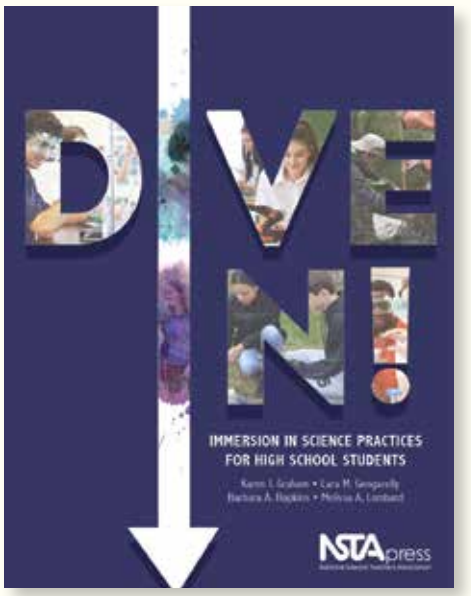
I plan to introduce my students not only to scientific concepts, but to a truly STEM perspective on life - and I know NSTA press can help me do just that!

—NSTA Press reader Sierra D.

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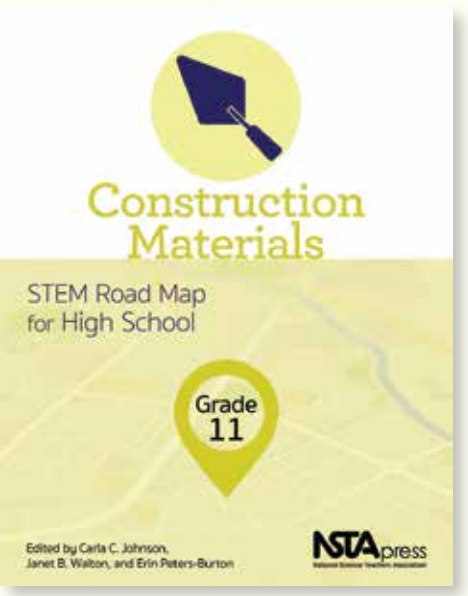


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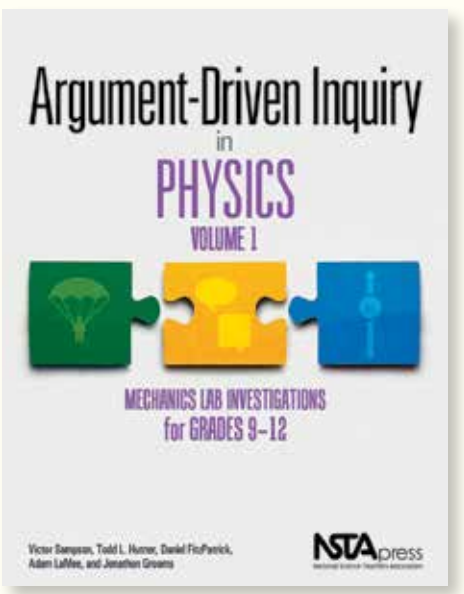


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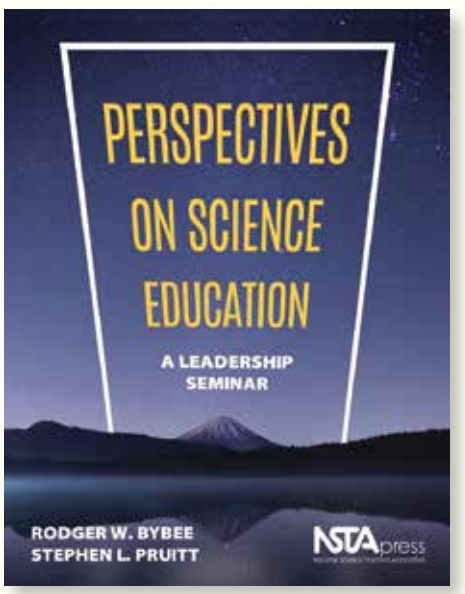


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NSTA National Science Teachers Association

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## Freebies for Science Teachers

**Chemists Celebrate Earth Week.** K12 The American Chemical Society (ACS) offers resources to help K–12 teachers celebrate Earth Week, taking place April 22–28. *Celebrating Chemistry,* a booklet available in English and Spanish, features articles and hands-on activities for grades 4–6 focused on the theme "Dive In to Marine Chemistry." In addition, *The ABC's of Ocean Acidification,* a video developed by and starring chemistry students from the ACS Student Chapter at Gordon College in Wenham, Massachusetts, explains this key topic in marine chemistry and would be useful for middle and high school science teachers studying oceans or introducing acids and bases. Find these resources and more at *www.acs.org/ccew.*

**On the Use of Mathematics in Undergraduate Chemistry Instruction.** HE Check out the papers and discussion threads from last fall's ACS/*Journal of Chemical Education* Division of Chemistry Education five-week, online conference on the use of mathematics in teaching chemistry at the college level. Eight approximately 5,000-word papers were presented during the conference, covering topics such as Estimation—An Empowering Tool for Students; Strengthening Math Fluency Through Calculator-Free Chemistry; Building Student Confidence With Chemistry Computation; The Chem-Math Project; and Addressing Math Deficits With Cognitive Science. Read the papers' abstracts and download materials of interest at *https://goo.gl/RWDqX3*.

**Students Discover.** M Access this website for high-quality curriculum for middle level science teachers worldwide. The curriculum modules were created in partnership between scientists and educators to support student participation in a broad range of citizen science projects, from measuring fossilized shark teeth to observing bird nests on school grounds. The interdisciplinary, project-based modules support the *Next Generation Science Standards* (*NGSS*) and the *Common Core* learning standards and feature lesson plans, handouts, rubrics, extension materials, and opportunities to contribute to authentic science research. Visit *http://studentsdiscover.org.*

GENERAL WESC

***A Perfect Day for an Albatross* Educator's Guide.** E Introduce students in grades 1–3 to the unique habits and habitats of the largest seabird in the Northern Pacific, the Laysan Albatross. Produced by the Cornell Lab of Ornithology's BirdSleuth program—and based on the book *A Perfect Day for an Albatross* (Loebel-Fried 2017)—the guide presents discussion questions and interdisciplinary, standard-based activities that teach students about albatross nests, behaviors (e.g., preening, dancing, bobbing, soaring, clopping), wingspan, and the impact of plastics and other trash on albatross chicks. An accompanying website offers background information and digital content to complement the guide's activities, including images of bird nests and video footage of albatross behaviors. See *www.birdsleuth.org/perfectday.*

**HHMI BioInteractive, in Español.** H HE Howard Hughes Medical Institute has launched a Spanish version of its award-winning website BioInteractive, which offers multimedia resources for high school and undergraduate biology, anatomy and physiology, Earth science, and environmental science educators. The site at *https://goo.gl/vf2UXD* presents more than 70 Spanish-language resources, including short documentary films, 3-D animations, clickable interactives, and hands-on activities exploring topics such as the biology of skin color, genetic changes associated with an adult's ability to digest lactase, and a large-scale ecological restoration project in Mozambique's Gorongosa National Park. Educators can search for resources by science category (Evolution, Ecology, Chemistry of Life, Diversity of Organisms, Genetics, Earth and Environment, Biology of Organisms, Biology of Cells, and Scientific Processes) or by material type (animations, classroom materials, data points, films, instructor resources, interactive media, and videos).

**Native Knowledge 360°.** K12 This initiative from the Smithsonian's National Museum of the American Indian offers online lessons and other materials based on accurate Native American history and designed to meet national and state curricula standards. The interdisciplinary resources span elementary, middle, and high school levels and address topics in science, mathematics, history, social studies, geography, and art education. Notable resources include Q'eswachaka: A Living Legacy of Inka Engineering (middle

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Freebies, from pg G1

level), a poster and classroom activity that uses the Great Inka Road system as a basis to explore the engineering aspects of a suspension bridge. Living Maya Time offers information (and practice activities) for middle level students on how to tell time using shadows, as well as online math games to learn to multiply Maya-style, using beans, sticks, and shells. Why Do the Foods We Eat Matter?, a digital lesson for high school students, explores how Native nations of the Pacific Northwest protect and sustain salmon, water, and homelands. Find these resources and more at *https://goo.gl/AkeXhY.*

DE:BENUTZER:HPH

**Challenge-Based Learning (CBL)/ Big Picture Learning (BPL) Engineering Units.** M H Teachers in the Cincinnati Engineering Enhanced Mathematics and Science (CEEMS) program at the University of Cincinnati developed and implemented more than 200 CBL/BPL engineering units for secondary science and math (grades 6–12). The units address various disciplines (biology, chemistry, physics, Earth science, physical science) and are formatted to include the Big Idea, Essential Questions, a Challenge, and a Hook. Unit titles include Rocket Forces and Design, Natural Antacids, Cell Phone Drop, To Make a Better Project, Zip Line Physics, and Harvest Helpers. Find the units at *https://goo.gl/ziG3xu;* click on "Search Instructional Units" for a grid-style overview of every unit, including title, grade level/subject, and key descriptors.

**The STEM Career Connectory.** H A new Facebook group allows high school teens to connect with science, technology, engineering, and math (STEM) professionals and STEM majors to get the resources, mentorship, and information they need to succeed in a STEM career. Created by Ashley Pereira, a STEM educator and entrepreneur dedicated to inspiring the next generation of STEM leaders, the moderated group brings together STEM-oriented individuals for conversation and advice on many STEM topics. Join the group and check out Pereira's I Love My Career in STEM video series, which presents candid video profiles of young STEM professionals working in diverse fields such as astrophysics, pharmacy science, mechatronics engineering, Earth science, and education. See the website *https://goo.gl/6QrkMS.*

**theuniverseandmore.com.** H How do you get high school students to learn, practice, and understand physics concepts? Play educational games at *http://theuniverseandmore.com!* Created by New Jersey educator and game designer Matt Blackman, the site's games incorporate built-in scaffolding and positive reinforcement and address topics such as circuitry, graphical representations in physics (Graphing Challenge, Action Graphing), wave behavior (Wavemaker), and polarity (Polarity Shift). The games can be used both in and out of the classroom as collaborative activities or as homework assignments. In addition, the site has worksheets and a Physics Video Vault, which offers attention-getting videos that engage students in physics concepts (e.g., World Record Men's Pole Vault, Analyzing a Head-On Collision, Fighter Jet Sonic Boom, and Magnetic Field Produced by a Current).

**Life Science Lessons from University of Rochester.** H HE The university's Life Sciences Learning Center has developed more than 60 lessons for high school and undergraduate levels. The lessons were created with funding from the National Institutes of Health and have been rigorously field tested with teachers and students nationwide. The lessons explore topics in neuroscience, cancer biology, biology of drug abuse and addiction, environmental health, kidney function and health, nanoparticles, and other fields, and they include student handouts, teacher guides, and PowerPoint presentations. Download the lessons at the website *https://goo.gl/aqSSqm* (e-mail registration is required).

**Text Engineering as a Classroom Strategy.** K12 The *NGSS* have sparked instructional shifts in classrooms, and students are now exploring "core ideas" of engineering in their science classes (e.g., ETS1.A, define a problem; ETS1.B, develop possible solutions; ETS1.C, optimize the design). Interestingly, these core ideas can also be applied in writing to help students learn to communicate more effectively in nonfiction text and help teachers meet literacy-building expectations of the *Common Core.* Teaching students how to plan nonfiction texts, analyze audience needs, and iteratively revise their drafts as scientists do as part of the engineering design process rather than as literary theory—a concept developed through The Technical Literacy Project—can be an effective method for both students and teachers.

For a quick but revealing tour of Text Engineering Explained as a classroom strategy, see the summary at *https://goo.gl/FzqaVm.* The summary is part of the project's *Technical Writing in Science Class: The Handbook,* available at *https://goo.gl/sSXJ2u.*

LAURIE HEWITT/USFWS

***Green Schoolyards: A Growing Movement Supporting Health, Education, and Connection With Nature.*** K12 Published by the Healthy Schools Campaign and targeted for K–12 audiences, the report presents the lessons learned from successful green schoolyard programs across the country. Educators will find research-supported information and case studies informed by a rich dialogue taking place at the national and local levels about how to help children, families, schools, communities, and our environment thrive, as well as tangible steps communities can take to develop their own green schoolyards. Access the report at *https://goo.gl/3c377x.*

**LEGO's Monarch Mission Lessons.** K12 This curriculum was developed to empower K–12 students to create habitats for monarch butterflies on their school grounds or in their local community. Developed by the National Wildlife Federation and LEGO Community Fund U.S., the curriculum supports the *NGSS* and has versions for four grade bands (K–2, 3–5, 6–8, and 9–12). The curriculum's lessons and activities are multifaceted, emphasizing project-based learning, Green STEM (i.e., using the natural world as the lens through which to integrate STEM), and interdisciplinary instruction.

Selected activities include creating a monarch life cycle wheel (grades K–2), building and observing a small-scale ecosystem (grades 3–5), investigating soil and water health as part of the establishment of a Monarch Recovery Garden (grades 6–8), and using technological applications to show simulations of how proposed solutions will improve habitat and increase the number of migrating monarch sightings (grades 9–12). Learn more and access the curriculum at *https://goo.gl/DT1sdc.*

**Overcoming the Challenges of Teaching Science in Elementary School.** E Teaching Channel blogger Jennifer Munoz is an elementary STEAM (science, technology, engineering, art, and mathematics) and science specialist who has resources for teaching science well and managing time efficiently. Munoz has grouped the resources under three headings: Teachers Helping Teachers, Teachers Helping Themselves, and Communities Helping Teachers. In addition to sharing about her own experiences in the elementary classroom, she suggests resources like Six Steps to Successful Co-Teaching, *NGSS*-related materials, and tools for communicating with parents. See the website at *https://goo.gl/c6qgPN.* ●

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# News Bits

- **An Alabama school district is the first to have all its schools STEM-certified. K12**

Winfield City Schools in Winfield, Alabama, is the world's first district to achieve total science, technology, engineering, and math (STEM) certification through AdvancEd, a nonprofit accreditation agency. To become STEM-certified, a school has to demonstrate that it uses STEM strategies across classes and throughout the school. Winfield received national recognition for its success, with Senator Larry Stutts (R-Sheffield) commending the district on the state Senate floor.

Alabama AdvancEd Director Andrew Harrison said Winfield's success can be attributed to multiple changes, such as teachers now facilitating hands-on, student-directed learning. "The kids really are in charge of their learning," Harrison said. "When students are engaged, the battle is won." In addition, Winfield created partnerships with area businesses and industry and expanded its technology initiative.

To obtain certification, AdvancEd doesn't require specialized training or the purchase of any particular curriculum or professional development program. The only cost for certification is for hosting a review team on-site. The process has no set timeline, as schools begin at different stages, Harrison notes. Read more at *https://goo.gl/bFkwYe.*

- **Florida Atlantic University's (FAU) Brain Institute received $780,000 from Stiles-Nicholson Foundation to foster STEM career paths in middle and high school students. M H HE**

Students in Palm Beach County, Florida, will benefit from the four-year Advancing STEM: Community Engagement Through Neuroscience Discovery (ASCEND) program. Nicole L. Baganz, FAU Brain Institute's director of community engagement and programming, said ASCEND aims to spark awareness of and interest in neuroscience discovery. The program strives "to ensure that our nation has a well-trained, scientifically literate workforce, one that will allow the United States to remain at the forefront of neuroscience discovery," she said.

Undergraduate, graduate, and postdoctoral neuroscience trainees will visit classrooms and labs and perform hands-on virtual reality demonstrations. Trainees will also create web- and app-implemented neuroscience content and podcasts offering the latest findings in brain research at an age-appropriate level. In a key element of the program, ASCEND attempts to establish long-term relationships between middle level and high school students and neuroscientists to increase the likelihood youths will remain engaged in pursuing STEM careers. Read more at *https://goo.gl/dRWBYS.*

- **Stanford researchers find children see words and faces differently than adults do. E M**

According to a February 23, 2018, report published in *Nature Communications,* adults can comprehend a word best by viewing it straight on, but children have to look slightly up and to the left. When viewing faces, children have to look slightly up and to the right.

Researchers invited 26 children (ages 5–12) and 26 young adults (ages 22–28) into the lab and performed two types of scans on their brains to explore how visual processing develops over time in the brain. Jesse Gomez, a graduate student in the Stanford Neurosciences Interdepartmental PhD Program and the study's lead author, said researchers found differences between vision circuits on the brain's left and right sides. In children, both sides respond fairly similarly to words and faces. In young adults, the left side is more responsive to words, while the right is more responsive to faces, especially when words and faces are in the center of vision.

The results may help researchers better understand disorders associated with processing words (e.g., dyslexia) or faces (e.g., autism). Read more at *https://goo.gl/C4fMrZ.* ●



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# What's New

FROM U.S. GOVERNMENT SOURCES

## U.S. Fish and Wildlife Service (FWS)

**Fish and Aquatic Conservation Resources K12**

Dedicated to developing the next generation of conservationists, the U.S. FWS Fish and Aquatic Conservation (FAC) program is all about fish, other aquatic species, and their habitats. FAC field stations, located throughout the United States, provide outdoor education areas and field-study opportunities, host festivals and events, introduce newcomers to recreational fishing and other outdoor skills, and develop tools for teaching today's conservation ethic. The FAC website offers environmental education resources for several audiences, including K–12 educators, parents, and students. The resources at *https://goo.gl/hJWbnN* include fact sheets for all users, lessons on fish migration for K–12 teachers and parents, and coloring pages and activities for K–12 students.

## National Park Service (NPS)

**Live Bald Eagle Webcams A**

Students of all ages can enjoy a sneak peek at the breeding and nesting behavior of bald eagles living in the Channel Islands National Park in California. Both of the bald eagle nests visible on webcams have eggs in them this year. Made possible through a partnership with the NPS, Explore.org, and other groups, the webcam feeds enable students to watch live as eagle parents protect their eggs, feed the chicks, and raise them to fly out on their own. In addition, students can learn facts about eagles, read and participate in discussions about eagle sightings, and view a gallery of still images from the nest sites. Access both webcam feeds at *https://goo.gl/RVe4io*.

## U.S. Department of Energy (DOE)

**Women's History Month Illustrations M H**

Though Women's History Month (March 2018) is over, the DOE continues to promote the work of women in STEM all year long. For Women's History Month, the DOE featured online blogs and illustrated portraits highlighting the contributions of astronaut Mae Jemison, rocket scientist Annie Easley, physicist Chien-Shiung Wu, and astronaut Ellen Ochoa. The blogs briefly summarized each scientist's most notable achievements and offered five (mostly unknown) "fast facts" about each woman.

Educators can read the blogs and download poster-size (8.5" by 11") versions of the illustrated portraits at *https://goo.gl/5TWjzo*. Share the resources with middle and high school students to motivate and inspire the next generation of women in STEM pioneers.

**Smartphone Microscopes K12 HE**

Researchers from the DOE's Pacific Northwest National Laboratory (PNNL) have designed a 3-D–printable microscope for mobile devices—a smartphone microscope—using just pennies worth of plastic and glass materials. The technology, which combines an iPhone or tablet with a 3-D–printed clip and glass sphere to create the microscope, has a wide range of potential applications, from classrooms to scientists in the field. Best of all, the microscope's design specs are available for free, so anyone with access to a 3-D printer—including K–12 teachers and students—can make one in a matter of minutes for less than a dollar each.

Read an article about the technology, complete with files and instructions necessary to print your own microscope, at *https://goo.gl/TLVsKg*. Then fuel students' excitement about microscopes by watching a fun, fast-paced video—produced by PNNL and suitable for middle level audiences—that describes the importance of microscopy. View the video at the website *https://goo.gl/x43rLS*.

**The Bioenergy Workforce Development Curriculum M H**

Bioenergy is here to stay, and this curriculum produced by the DOE's Oak Ridge Institute for Science and Education in Tennessee helps middle and high school educators explore bioenergy topics in the classroom and prepare students for employment in the bioeconomy. The curriculum offers lessons and presentations from a three-day bioenergy technology research workshop, during which teacher-participants heard presentations from the Oak Ridge National Laboratory (ORNL) researchers, learned classroom content, and toured bioenergy sites of interest. Among the topics covered were alternative energies, bioenergy, solar technologies, mitigating harmful emissions, and computational and visualization resources.

The curriculum lessons are based on the work of ORNL researchers and include titles such as Density and Properties of Wood, Algae Shape and Sinking Rate, Catalysts and Reaction Rates, Ethanol Production, and Growing Algae. Access the lessons and other materials at *https://goo.gl/PggKGT*.

## National Oceanic and Atmospheric Administration (NOAA)

**Become a Young Meteorologist! E M**

Join Owlie and friends to embark on a "Severe Weather Preparedness Adventure!" Most appropriate for elementary and middle levels, this online game—produced as part of NOAA and the National Weather Service's Young Meteorologist Program—teaches students how to stay safe through weather hazards such as hurricanes, lightning, floods, tornadoes, and winter storms. Students who successfully complete all five challenges earn a Young Meteorologist certificate. Learn more and play the game at *https://goo.gl/QXnzz3*.

## U.S. Environmental Protection Agency (EPA)

**EPA Activity Book E**

Featuring fast facts, games, puzzles, and coloring pages, this activity book teaches K–5 students about the EPA's many roles in protecting our environment. The book presents information on environmental topics such as water supply, air quality, ecosystems, and land pollution and offers simple steps students can do themselves to contribute to environmental conservation efforts. Refer to *https://goo.gl/cZMcS9*.

## National Aeronautics and Space Administration (NASA)

***Our World: Sun's Position* E**

Help students in grades 3–5 learn more about how the Sun's position in the sky changes due to Earth's rotation, revolution, and tilt. Hosted by likable student scientist Aaliyah, this NASA eClips video turns to NASA experts Alex Young, a heliophysicist, and Nicki Viall, a research astrophysicist, to explain connections in kid-friendly language so students understand patterns within the Earth–Sun relationship (e.g., night and day, seasons). Visit *https://goo.gl/oDsYqq* to watch the video and find links to classroom activities that extend learning.

**Astronomy Clubs: Partner With NASA Space Place! E M**

Astronomy clubs across the United States are invited to partner with NASA Space Place to help spread the excitement of space and Earth science, as well as inform members about new technological advances in space

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science. Each month, club partners receive articles from NASA Space Place to publish in their newsletters. The articles, which are geared for upper-elementary students (grades 4–6), highlight NASA projects of interest to club members and include links to relevant explanations of astronomy concepts from the Space Place website.

Partner clubs can also request free materials from NASA Space Place, such as stickers and temporary tattoos, to share at club events. For information on how to participate, visit the website *https://goo.gl/g5MXfX*.

### CubeSat 101 K12 HE

Interested in starting a CubeSat program at your school and launching a small satellite? NASA's CubeSat Launch Initiative gives students, teachers, and faculty of all ages the opportunity to get hands-on, flight hardware development experience while designing, building, and operating small research satellites. The initiative is open to U.S. accredited educational organizations, K–college, as well as to other nonprofit organizations.

Interested educators can read the guide *CubeSat 101: Basic Concepts and Processes for First-Time CubeSat Developers* to learn how to get started. Six chapters (Introduction, Development Process Overview, Mission Models, Requirement Sources for Launch, Licensing Procedures, and Flight Certification Documentation) and appendices (e.g., List of Abbreviations, Glossary, Templates, Technical Reference Documents, and Notional Timeline of Events/Deliverables) address every step in the CubeSat process, from mission conception and development to the satellite's launch into orbit. Access the guide at *https://goo.gl/izxdaU*.

### Lunar Plant Growth Chamber Educator Guide H

An important part of future space exploration will be plant growth. NASA scientists are planning for astronauts to grow plants during long-duration missions, and the plants could be used to supplement meals. Because of the need for research into lunar plant growth, NASA and the International Technology and Engineering Educators Association created the Lunar Plant Growth Chamber Human Exploration Project Design Challenge. High school students participating in the challenge design, build, and evaluate lunar plant growth chambers while conducting research. Students follow the engineering design process and learn how to conduct a scientific experiment.

At *https://goo.gl/SJ5Mav*, teachers can access the challenge's educator guide, which explains how to conduct the Design, Build, and Evaluate Challenge, a 12- to 18-day unit, or the Design and Evaluate Challenge, which lasts from five to seven days. The guide includes pre- and post-tests, rubrics, handouts, resource sheets, worksheets, and links for further exploration.

Teachers can easily adapt this unit: After having her students read *The Martian*, one NSTA member tweaked this unit so students could create Martian Plant Growth Chambers.

## USA.gov

### Career Spotlight: Zookeepers E

Meet Kristen Clark and Juan Rodriguez, zookeepers at the National Zoo in Washington, D.C. In this video, targeted for grades K–5, students get an inside look at what zookeepers do, from animal care and feeding to training (for medical reasons) to check every part of an animal's body without touching it. In addition, the zookeepers offer advice for students who want to start working with animals, doing activities such as dog walking or pet sitting in the neighborhood. Watch the video or download a transcript of it at *https://goo.gl/naw5zv*. ●

# In Your Pocket

**Editor's Note**

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

## April 27–30

**Siemens STEM Day Possibility Grant Sweepstakes K12**

One school will win $10,000 so it can purchase the science, technology, engineering, and math (STEM) equipment, supplies, and technology it needs to update its lab. Full- or part-time K–12 teachers who are legal U.S. residents and provide direct instruction to students in the United States are eligible. Enter daily at *https://goo.gl/ez5dDA* until 5 p.m. Eastern Time on **April 27.**

**SeaWorld Environmental Excellence Awards K12**

These awards go to students, teachers, researchers, and others working at the grassroots level to protect the environment. The organization funds work in four areas: conservation education, species research, habitat protection, and animal rescue and rehabilitation. Most grants range between $10,000 and $25,000.

Apply at *http://goo.gl/kIgY7q* by **April 30** to receive funding during the last two quarters of the year.

**Patagonia Environmental Grants A**

These grants go to small, grassroots activist organizations aimed at preserving and protecting the environment. The company funds work that is action-oriented, builds public involvement and support, and protects local habitat. Grants of between $5,000 and $20,000 are available. Apply by **April 30** at *http://goo.gl/qQQizw.*

**Stepping Stone Grant for Grades K–5 E**

These grants support projects that are teacher-initiated and use an arts-infused approach to inquiry. 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 teachers of grades K–5 at Title I schools. Apply at *http://lilysarahgrace.org/grants* by **April 30.**

**The Lawrence Foundation Grants A**

These grants go to organizations that support education, the environment, human services, and other causes. Public schools, libraries, and nonprofit organizations may apply. Both program and operating grants are available. The average grant amount ranges from $1,000 to $5,000.

Apply by **April 30.** Learn more at *www.thelawrencefoundation.org/grants.*

**Voya Unsung Heroes Grants K12**

Each year, Voya Financial provides 100 grants of $2,000 to educators with innovative project ideas for their classrooms. Projects should be creative and innovative and positively influence students. At least one grant is awarded in each of the 50 states. The top three winners will receive additional prizes of $25,000 (first place), $10,000 (second place), and $5,000 (third place).

Full-time teachers, principals, paraprofessionals, and classified staff at accredited K–12 schools are eligible. Apply by **April 30** at *http://goo.gl/0RXngP.*

## May 1

**Spencer Foundation's Small Research Grants A**

These grants fund education research projects with budgets of $50,000 or less. Proposed projects should improve education generally and sometimes fall within these specified areas of inquiry: education and social opportunity; organizational learning; purposes and values of education; teaching, learning, and instructional resources; and the new civics. Most proposals, however, support the foundation's general mission, but not one of the specified inquiry areas; proposals in this category are called "field-initiated."

To be eligible for these grants, the principal investigators (PIs) and co-PIs must have a doctorate degree or equivalent experience in an education research–related profession. Proposals are accepted from the United States and abroad, but must be written in English and propose a grant amount in U.S. dollars. Apply online by **May 1** at *https://goo.gl/96C7h6.*

**Presidential Awards for Excellence in Mathematics and Science Teaching E M**

This year, the White House will recognize outstanding K–6 science, math, and computer science teachers who serve as models for their colleagues, inspire their communities, and work to improve education in their field. More than 100 teachers in each of the 50 states; Washington, D.C.; Puerto Rico; the U.S. territories; and Department of Defense Education Activity schools will receive a certificate signed by the President; a paid trip for two to the awards ceremony in Washington, D.C.; and a $10,000 award from the National Science Foundation.

U.S. citizens or permanent residents with at least five years of teaching experience in K–12 schools are eligible. Applications are due by **May 1.** See *www.paemst.org.*

**BirdSleuth National Challenge K12**

Individual K–12 students, small groups, and entire classrooms can take part in this challenge by observing bird behaviors at their birdfeeders. Participants submit an interest form and get a coupon for free bird food. They then brainstorm a feeder behavior study, complete it, write up their findings, and submit them to the contest by **May 1.**

Finalists receive a poster, a $50 gift certificate for more bird food, and additional gifts from the Cornell Lab of Ornithology, which sponsors the contest. One grand-prize winner will also get a year's worth of bird food and a free membership in Project FeederWatch, a winter-long survey of birds that visit feeders at backyards, nature centers, community areas, and other locales in North America. FeederWatch data help scientists track broadscale movements of winter bird populations and long-term trends in bird distribution and abundance.

Enter the challenge at the website *www.birdsleuth.org/national-challenge.*

**The Edward N. Lorenz Teaching Excellence Award HE**

The American Meteorological Society presents this award to an outstanding teacher and mentor at the undergraduate, graduate, or postdoctoral level who has impacted his or her students. The society requires a nomination letter and three letters of support for the candidate, one of which must be written by a former student. Nominations remain active for three years.

Submit nominations by **May 1.** Consult *http://goo.gl/dPRuU4* for details.

**Outstanding Special Education Teacher Award K12**

The National Association of Special Education Teachers (NASET) presents this award to an educator who has demonstrated excellence in special

education. Candidates are judged on their teaching, professional activities, and service outside the classroom. Schools, district administrators, colleagues in the field, and parents of a child with a disability can nominate full-time special education teachers with at least two years of experience.

Honorees receive an award that bears the NASET seal, his or her name, and the name and date of the award. Submit your nominations online at *http://goo.gl/c83ueC* by **May 1.**

### The Leavey Awards K12 HE

These awards recognize elementary, junior high, high school, and college educators who teach students about entrepreneurship and the free enterprise system. One award of $15,000 and up to 20 awards of $7,500 are available.

Recipients must be U.S. citizens or permanent residents who are employed full-time at an accredited K–12 school, college, or university in the United States. Innovative projects that develop deep appreciation for and understanding of the private enterprise system are preferred. The program, course, or project must be currently operating or initiated during the previous academic year.

Submit nominations by **May 1** at *www.freedomsfoundation.org/Leavey.*

## May 3–10

### National Weather Association's Sol Hirsch Educational Grants K12

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

Teachers, program directors, school district supervisors, or other individuals or groups seeking to improve meteorology education for K–12 students are eligible. Apply by **May 3.** Refer to *http://goo.gl/cSQvin.*

### Dreyfus Foundation Educational Grants A

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

Applications must be postmarked by **May 10.** Learn more at the website *www.mvdreyfusfoundation.org.*

### National Green Week/Green in Action Award K12

Each year, the Green Education Foundation (GEF) encourages schools to highlight sustainability for one week in February, March, or April as part of its National Green Week initiative. The foundation provides five-day, standards-based lesson sets; activities; and readings, and holds contests focused on various green themes, such as the "Green Thumb Challenge," the "Green Building Program," or "I Ride Green." Schools can participate for the entire week, for just one day, or use just one lesson from the curriculum. Afterward, participants submit a survey and can nominate their programs or projects for a Green in Action Award of $250.

To participate in National Green Week 2018, teachers must become GEF members, choose a timeframe in which to participate, and select their green theme at the following website: *https://goo.gl/GE2Q6o.* Applications for the Green in Action Award are due by **May 10.**

## May 11–17

### Lowe's Community Partners Grants K12

These grants help build stronger communities by providing funds for nonprofits and municipalities with high-need projects, such as grounds improvements, technology upgrades, safety improvements, or building renovations and upgrades. Grants range from $2,001 to $100,000. To apply for a grant by **May 11,** visit the website *https://goo.gl/ze8uAx*

### AAPT High School Physics Photo Contest H

This American Association of Physics Teachers (AAPT) contest is open to high school physics students in two categories: natural photos and contrived photos. Natural photos capture everyday situations that demonstrate physics concepts. Contrived photos are those that are set up to demonstrate a specific concept or set of concepts. To enter, students write an essay explaining the physics demonstrated in their photos.

The top 50 photos in each category will be displayed at the AAPT Summer Meeting, and the top three entries win these prizes:

- First-place students in each category receive $100 and a certificate;
- Second place gets $75 and a certificate;
- Third place gets $50 and a certificate; and
- Teachers of the winning students get a certificate and a $100 gift card from Vernier Software and Technology.

Entries are free for AAPT members and $5 for non-members. Register online and submit the entry fee to upload your students' materials by **May 15.** See *http://goo.gl/CXsXKY* for details.

### Dollar General Literacy Foundation's Youth Literacy Grants K12

These grants go to schools, public libraries, and nonprofit organizations that help students who are reading below grade level or have trouble reading. Grants of up to $4,000 can be used to start or expand a literacy program, or purchase new technology, equipment, books, materials, or software to support literacy programs or initiatives.

Apply by **May 17** at the website *http://goo.gl/qIofdG.* ●



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# Summer Programs

**Editor's Note**

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

### Engaging Math and Science Students in Engineering Design H

The Knowles Teacher Initiative offers this professional development (PD) course to help teachers incorporate engineering design in the classroom and inspire their students to solve real-world problems. The yearlong program begins with a weeklong summer workshop to help teachers experience engineering firsthand and consult with peers, coaches, and professional engineers. Teachers then receive a year of online coaching to help them integrate engineering design in the classroom.

Summer workshops will take place in these locations:

- Oregon, Wisconsin—June 25–29;
- Denver, Colorado—July 11–15; and
- Philadelphia, Pennsylvania—July 20–24.

Teachers may earn optional graduate credits. Register online for the course at *http://goo.gl/ceVJzV.*

### Designing Instructional Tasks to Increase Student Engagement and Learning in Science H

This Knowles Teacher Initiative course supports teachers who want to increase the cognitive demand of their lessons and provide more opportunities for students to "talk science." Through a three-day introductory workshop, a one-day follow-up session, and support throughout the year, teachers become better acquainted with the disciplinary practices described in the *Common Core* and the *Next Generation Science Standards* (*NGSS*), as well as with the 5 Practices for Orchestrating Task-Based Discussions in Science framework. The end goal is for teachers to use what they learn to incorporate high cognitive-demand tasks and more scientific talk in the classroom.

The three-day workshop takes place June 26–28 in Moorestown, New Jersey, with follow-up dates throughout the year. To register, visit the website *http://goo.gl/9GtcY7.*

### Teaching Native Cases Summer Institute HE

This interdisciplinary institute focuses on using and teaching case studies about issues important to contemporary Native people and communities. The cases included—which cover a wide range of issues applicable to all subject areas—offer a way for educators to promote diversity while using a problem-based, place-based, and collaborative approach.

This institute will take place June 26–27 in Shelton, Washington; an optional one-day institute on Writing Cases is scheduled for June 28. Individuals and teams of teachers are encouraged to apply. For the registration form and details, visit *https://goo.gl/Z1cgSd.*

### Inquiry in Rain Forests A

Educators taking this Organization for Tropical Studies (OTS) field–based PD course observe organisms and ecosystems as scientists would, ask questions, formulate hypotheses, design experiments, collect and analyze data, and present results for peer review—all while exploring rain forests in the Caribbean and the La Selva field station. Based on their experience, participants then design creative projects for their students that align with the *NGSS.*

This year's program takes place July 7–20, with participants departing on July 21. Members of minority groups and teachers serving minority or underrepresented groups are encouraged to apply. Scholarships, graduate credits from the University of Washington, and 96 contact hours of continuing education/PD from OTS are available.

Apply online at the following website: *http://goo.gl/2PemNa.*

### CELF Institute in Education for Sustainability K12

The theme for this year's institute is "Leading School Change and Instructional Practices in Education for Sustainability." Teachers can choose from two strands. Those in the Leading School Change strand will develop change-making strategies, plan schoolwide initiatives, and learn to build stakeholder teams to help integrate sustainability into existing curricula and school practices.

Teachers in the Instructional Practices strand will use problem-, project-, and place-based learning strategies to create student-centered sustainability projects; connect *NGSS* with sustainability principles and practices; and learn to apply concepts such as systems thinking, interdependence, and community to their instructional practice.

This intensive institute takes place July 9–12 at Manhattanville College in Purchase, New York. Scholarships and discounts for school-sponsored teams are available, as are Continuing Teacher and Leader Education hours and graduate or inservice credits. Register online at *https://goo.gl/xZNeVF.*

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

Educators will gather at Maine's Hog Island July 15–20 to hear experienced instructors share their favorite approaches, methods, and activities for engaging children and adults with nature. Participants will explore an Atlantic puffin and tern colony on Eastern Egg Rock and hike the island's unspoiled spruce forest. They will also create inquiry-based lessons and experience both low- and high-tech teaching methods intended to excite and engage students. Workshops will include techniques in journaling, art, music, theater, and other disciplines.

Scholarships and continuing education credits from the University of Southern Maine are available, and spouses and friends also may attend. Learn more at *http://goo.gl/jkR45u.*

### Science Olympiad Summer Institute M H

This annual institute helps teachers, administrators, coaches, event supervisors, and tournament personnel and administrators at secondary schools (grades 6–12) stay up to date on all 46 Science Olympiad events. Participants attend sessions and meetings designed to improve any school's Science Olympiad program and meet state science benchmarks and standards. This year's institute will take place in Phoenix, Arizona, during July 16–20.

Two credit hours from the University of the Pacific are available, and participants can apply for Title 2 Teacher Quality program funds by contacting their school district's science curriculum administrator. For the registration form, visit *http://goo.gl/n9SWoA.*

### Earth Educators' Rendezvous A

Earth education teachers and graduate students at all levels, STEM education researchers, and administrators who want to improve their programs are invited to attend the 2018 Earth Educator's Rendezvous at the University of Kansas in Lawrence during July 16–20. Through a combination of workshops, plenary talks, panel discussions, and teaching demonstrations, participants will learn new teaching approaches, discover ways to get involved in research in the field, prepare for an academic career, and discuss various ways to address teaching and learning challenges.

Early bird registration ends on **May 1.** Register online at this website: *http://goo.gl/UQs3xX.* ●

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

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### Unity College

Unity College offers an online Master's in Professional Science (MS), providing the training and credentials to advance in your career path. Students choose from two concentrations: Sustainability Science and Sustainable Natural Resource Management. Teachers earn CEUs for undergraduate and graduate courses.

### NSTA Virtual Conferences

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

***http://learningcenter.nsta.org/onlinecourses***

National Science Teachers Association

ASK A MENTOR, **Advice Column**

# Advice on Motion, Inclusion, and More

I am currently a student teacher in an incredible third-grade classroom. I was thinking about doing a lesson on Forces and Motion. Are there any great strategies and tips for this subject?

*—J., Virginia*

Forces and Motion lends itself to fun science, technology, engineering, and mathematics (STEM) activities like balloon cars, wheeled cars, and so on.

Newton's laws of motion should be introduced using *simple* terms.

- **Newton's First Law:** *Things normally just sit there or stay moving in a straight line at the same speed! Changes in motion only happen if forces are involved.*
- **Newton's Second Law**: *The bigger the force, the faster the change in motion. The more massive things are, the more force needed to change motion.*

For example, a small car needs less force to start moving than a large truck. So small cars tend to have smaller engines than trucks. Small cars need less braking force to stop because they have a much smaller mass than a large truck.

- **Newton's Third Law**: *All forces come in equal pairs, in opposite directions*. This one is very poorly understood by many people! To jump in the air, your feet push *down* on the floor—(now switch the two nouns)—the floor pushes *up* on your feet. The floor is much more massive than you, so it doesn't move as much (see the Second Law)!

Have your students try to explain why their projects move the way they do! The key is to always link motion to *forces*.

For STEM activities, you can search NSTA's Learning Center, and feel free to check out my public collection at *https://goo.gl/EbZKsk*.

Do you have some suggestions for modifying a science experiment for students with physical disabilities that prevent them from participating?

*—A., Arkansas*

You can modify the experience in many ways for students with disabilities. Specific labs may have special modifications, but I suggest some general ideas:

- Team students with classmates for experiments. Developing collaborative team skills is important for everyone. Experiments usually have many steps. If physical disabilities prevent the student from, say, pouring liquids, he or she could still participate in brainstorming, identifying variables, reading meters, recording data, calling time intervals, and double-checking data and measurements. Perhaps the students could photograph or video-record experiments using their phones or tripod-mounted cameras for later observations or writing up lab reports. This record of the lab would be useful to the group and could perhaps be edited

into a video report by a student with language difficulties.

- Safety comes first! A person with limited mobility may have to take more precautions to ensure he or she can do the work properly or move away from danger quickly.
- Keep in mind that the object of an experiment is to answer a question by deriving meaningful, objective data in a controlled environment. The ability to use lab equipment is secondary, in my opinion. However, phone apps, infrared thermometers, or computer-based probes could be easier to use and read when measuring physical data.

**One of my biggest questions is how to get younger elementary students involved in science: Should I have them do more hands-on activities, participate in activities outdoors, or watch videos?**

*—F., Texas*

*Every kid starts out as a natural-born scientist, and then we beat it out of them. A few trickle through the system with their wonder and enthusiasm for science intact.*—Carl Sagan

We were all born with curiosity—a willingness to experiment and desire to figure out how the world works. Science should be the easiest subject to teach: We just need to let human nature take its course! I think adults do a good job of stopping young people from exploring and asking simple, but tough, questions. Doing hands-on activities that encourage manipulation and experimentation along with exploring the real world is when students really learn science. Have them make their *own* videos. You may be surprised at how involved they will get in their projects!

Teachers should provide opportunities to explore and inquire. Teach some basics like how to conduct a fair test; use observation, not conjecture; record data accurately; reach a conclusion based on evidence; and present data. In essence, teach children the nature of science—not just arbitrary facts. Let them see that science is an *active* pursuit of knowledge.

**What is the value of extended field trips? What factors should I consider when planning one?**

*– M., Florida*

I love field trips, and students often say that they are the highlights of school! Whether it is just a single day or lasts several days, going beyond the school environment gives students a chance to observe or experience new things much better than a video or book can. You also introduce them to enthusiastic professionals and role models.

I always made sure students didn't just walk around with hands in pockets during field trips. Decide the learning goals for the field trip and look for hands-on, authentic experiences. Most places will allow teachers to tour their facilities and check things out at no cost. Don't be afraid to ask for modifications: You are the customer, and you know what your students need! I always made sure that a field trip wasn't an isolated event by planning some preparatory and follow-up activities. Make sure any field trip fits your curriculum.

Several things must be considered on extended field trips: travel, time, and cost. Ask yourself: Can you do the same activities in your classroom for less time and cost? Can you borrow equipment or have outside people come to your class and run activities? Can you identify an alternate location and manage students yourself?

I also collected feedback from the students after a field trip. I would pass their comments on to whomever we visited or use the information to make changes myself.

Hope this helps!

*Check out more advice on diverse topics or ask a question of Gabe Kraljevic from Ask a Mentor at* www.nsta.org/mentor or e-mail mentor@nsta.org.

BLICK ON FLICKS

# A Wrinkle in Time

By Jacob Clark Blickenstaff

I have very fond memories of reading Madeleine L'Engle's *A Wrinkle in Time* when I was a kid. Though the novel was published in 1962, it felt totally current to me when I discovered it in the late 1970s. *A Wrinkle in Time* is the first book in a series that follows the Murray and O'Keefe families through adventures on other worlds and inside living cells. The title refers to the idea of traveling through space by "wrinkling" space-time, moving widespread points close together by folding space like a piece of paper.

This year is the centennial of L'Engle's birth, so it's a natural time for this movie adaptation to be released in theaters. Director Ava DuVernay is the first woman of color to have a budget of more than $100 million to make a film, and she chose to cast several African Americans in key roles. Meg Murry (played by Storm Reid) is a strong, smart, middle school student who could inspire girls to believe in themselves in the face of terrible challenges. I noticed several mother-daughter pairs at the screening I attended, so that message may connect with some folks.

I won't catalog differences between the book and film here, but fans of the novel should know they are substantial. Science teachers can use a number of connections to get students talking about geometry, waves, and sound.

Meg, her younger brother Charles Wallace (played by Derec McCabe), and Calvin O'Keefe (played by Levi Miller) search for Meg's father, who disappeared four years earlier while experimenting with teleportation. The children are helped by the three mystical "Mrs": Mrs. Whatsit (Reese Witherspoon), Mrs. Who (Mindy Kaling), and Mrs. Which (Oprah Winfrey). They travel from planet to planet by "tesseract" or "tesser," which is basically a kind of teleportation.

In geometry, a tesseract is a four-dimensional shape, also called a hypercube. Here is the connection to geometry: A point has no size, so it is zero-dimensional. A line has only length, so it is one-dimensional. A plane has length and width, so it is two-dimensional. Finally, a cube has length, width, and height, so it is three-dimensional. Each of the dimensions is perpendicular to the others.

Since we only experience three physical dimensions, it is hard to visualize a four-dimensional shape. The animation posted on YouTube by ediacura (*https://goo.gl/T8wUWU*) can be helpful to imagine how another dimension could be added to a cube. *A Wrinkle in Time*'s tesseract folds space-time, enabling people to move from one planet to another essentially instantly. In the film, understanding what

frequency to use appears essential to a successful "tesser."

Frequency is a wave property that describes how often the wave pattern repeats in a given time. Physicists generally use Hertz (Hz), or cycles per second, as the unit of frequency. (Human hearing detects sounds from about 60 Hz to 20,000 Hz, while visible light waves are oscillating at $10^{15}$ Hz.) When the movie begins, Meg's father shows her a Chladni plate, which is simply a sheet of metal with some sand or salt sprinkled over it. The plate is forced to vibrate by either rubbing it with a musicians bow, or with a variable speaker. When the frequency of vibration hits one of the resonant frequencies of the metal sheet, the salt forms a pattern: no salt where the plate is moving, lots of salt where the plate is still. A YouTube video by Brusspup (*https://goo.gl/OK21SL*) shows how the patterns change as the frequency is increased; the sound is quite loud, so you'll want to lower the volume.

Travel by tesser requires finding the right resonant frequency to "wrinkle" space-time. It's not unreasonable to propose that resonance causes a major effect. The 1940 collapse of Tacoma Narrows Bridge is one example of that power, as resonance-caused waves in the bridge became so large that the structure was torn apart. Wikipedia features a video of the collapse at *https://goo.gl/hRGafh*.

A memorable scene appears briefly in a trailer: In front of a row of identical suburban houses, about a dozen children bounce identical balls exactly in unison. The shot is very short in the trailer, but the scene in the movie is much longer. The loud pulse of the bouncing balls makes the kids, particularly Charles Wallace, very uncomfortable. Finally, in unison, mothers come out of the houses and call their children to come in for dinner, and the bouncing stops.

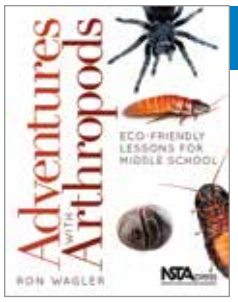
In *A Wrinkle in Time*, this scene has a definite creepy factor, but there would be a problem with doing this in reality. The problem is that it takes time for sound to travel from the bounce to our ears, a lot more time than it takes for the light to reach our eyes. You don't have to be very far from someone (50 meters is enough) to notice the bounce and the sound of the bounce getting out of synch. With all those kids at different distances away from you, if the bounces were simultaneous, the sounds wouldn't be.

TV programs and movies often "fix" this problem—even otherwise scientifically accurate series like *Mythbusters*. When they film something exploding from a safe distance, they usually re-synchronize the sound with the explosion. YouTube poster teterfilm has shared a video showing what the real delay is like at the website *https://goo.gl/PRK9ax*. While it looks odd to see a silent explosion, the dramatic pause is powerful, and is there for a real physics reason: Light is a lot faster than sound.

This new adaptation of a favorite young-adult science fiction story gives teachers the opportunity to discuss properties of sound and light, resonance, and geometry. ●

*Note:* A Wrinkle in Time *is rated PG for thematic elements and some peril.*

*Jacob Clark Blickenstaff is an independent science education consultant in Seattle, Washington. Read more Blick at* http://goo.gl/6CeBzq, *or e-mail him at* jclarkblickenstaff@outlook.com.




**NSTA PRESS:** *Adventures With Arthropods: Eco-Friendly Lessons for Middle School*

# Lessons Using Captive-Bred Tarantulas

**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* Adventures With Arthropods: Eco-Friendly Lessons for Middle School, *by Ron Wagler, edited for publication here. To download a larger sample, go to* https://goo.gl/SYCH9W. *NSTA Press publications are available online through the NSTA Science Store at* www.nsta.org/store.

Tarantulas can get students excited about animals, science, nature, and the study of Earth's ecosystems (Figure 8.1). As predators, they perform many essential ecological services that directly benefit the health of ecosystems. Students often have many misconceptions about spiders, so learning about them can teach students how important spiders are to global ecosystems. This knowledge can also change your students' beliefs about the importance of preserving Earth's ecosystems. A classroom tarantula, therefore, provides an excellent opportunity to integrate information about spiders and other arachnids (e.g., scorpions [order *Scorpiones*] and harvestmen [order *Opiliones*]) into many of the *Next Generation Science Standards* (*NGSS*) (*NGSS* Lead States 2013) ecosystem concepts. The lessons in Chapter 8 can be integrated into a middle school science unit with a focus on environmental science and ecology concepts that support the *NGSS*. Table 8.1 (pp. 90–94) shows how the lessons in Chapter 8 support the *NGSS*, the Nature of Science, and the *Common Core State Standards* (*CCSS*).

**Figure 8.1.** Captive-Bred Adult Female *Brachypelma boehmei* (Mexican Fire Leg Tarantula)

## Lesson 8.1. Tarantula Models

### Materials and Preparation

To prepare for this lesson, gather the following tools and materials:

*For the class*

- Toothpicks
- Pipe cleaners
- Modeling clay
- Fruit and candy
- Computer for students' online research
- Students' science notebooks

- Television for viewing movie segments

## Safety

- Remind students not to eat any food used in the lesson.
- Ensure that all modeling clay waste is picked up and disposed of properly when the lesson is finished. Dry clay dust can be a health hazard.
- Use caution when working with sharps (scissors, pipe cleaners, and so on).
- Wash hands with soap and water upon completing this lesson.

## Making Tarantula Models

Start by asking students what they know about tarantulas so you can determine whether their knowledge is scientifically accurate or based on misconceptions. It is common for people to have misconceptions about tarantulas (e.g., that they can jump very far and that their bites are deadly). Such misconceptions are one of the reasons people fear tarantulas. Gently address any misconceptions and let students know that although such misconceptions are common, they are untrue. Many students find a tarantula in the classroom exciting, but some students might be apprehensive at first. After I address my students' misconceptions, we engage in a simple but fun icebreaker lesson.

Introduce the classroom tarantula (and further address misconceptions) by allowing students to observe the tarantula. Then have students build an anatomically correct model of the tarantula (including the two body parts, the eyes, and the appendages) based on their observations. Have students do online research about common tarantula anatomical characteristics such as eye, leg, abdomen (*opisthosoma*), cephalothorax (*prosoma*), chelicerae, pedipalp, and spinneret. Have students answer the following questions in their science notebooks:

1. What are some common tarantula misconceptions students in your class have? Pick two of these common tarantula misconceptions and explain and refute them.
2. List four anatomical characteristics of the classroom tarantula and identify how those characteristics benefit the species. Write a brief story about what a typical day would be like for the tarantula if it did not have two of these anatomical characteristics.

Draw a diagram of your tarantula model and label its anatomy.

After students have built their models, have them compare the models with the classroom tarantula one more time to verify that their models are anatomically correct. *Do not allow students to eat their models*. Please dispose of the models and leftover materials promptly to avoid growth of mold. Have a classroom discussion with students about how the anatomical characteristics of the tarantula benefit the species. Assess students' tarantula models by using the rubric at the end of the chapter. Research shows that this simple, fun, and educational lesson decreases students' fear of tarantulas (Wagler and Wagler 2014). After the classroom discussion, show segments from movies such as *Arachnophobia* which demonstrate some misconceptions your students may have about tarantulas and spiders. (Please seek parental permission for any movie segment to be shown to students.)

You can extend this lesson by having a discussion with your students about the anatomical similarities and differences among arachnids. Ask students, "What are some animals that are closely related to tarantulas?" See whether students understand that all arachnids are related and share common anatomical characteristics because of their shared common ancestry. Now have students use Google Images to search for common arachnids (e.g., spider, tick, mite, and scorpion) and not-so-common ones (e.g., amblypygid, uropygid, opiliones, pseudoscorpion, and solpugid) and compare their anatomical similarities and differences.

Common arachnid anatomical characteristics for students to research online include leg, abdomen (opisthosoma), cephalothorax (prosoma), chelicerae, and pedipalp. Also allow students to perform internet searches for images of fossil arachnids. Use the word *fossil* and the name of any of the arachnids listed above. Compare the anatomical similarities and differences between these images of fossil arachnids and extant species, emphasizing the evolutionary concept of common ancestry. Also have students identify anatomical characteristics that differ between arachnid groups.

Have students answer the following questions in their science notebooks:

1. Identify and describe two types of living arachnids that are related through common ancestry. Draw a diagram of each and label their common anatomical characteristics.
2. Identify and describe two types of fossil arachnids that are related through common ancestry. Draw a diagram of each and label their common anatomical characteristics.
3. Write a paragraph describing the common anatomical characteristics of all arachnids. ●

# SAVE THE DATES

# 2018

## NSTA AREA CONFERENCES ON SCIENCE EDUCATION

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# Mark Your Calendar
## NSTA Dates to Remember

*(All dates are deadlines unless otherwise specified.)*

**April 1**—Share your best strategies for applying Newton's Third Law, constructing investigations into the factors affecting electric and magnetic forces, and more related to **"Motion and Stability: Forces and Interactions"** for the November/December 2018 issue of ***Science Scope*** by 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*.

**April 16**—Today's the final day to submit a proposal for the **2019 NSTA National Conference in St. Louis** (April 11–14). To submit a proposal, visit *www.nsta.org/conferenceproposals*.

**May 1**—***Science and Children*** (***S&C***), NSTA's peer-reviewed journal for elementary science education, is **accepting manuscripts** on the theme "**STE and M…Science, Technology, Engineering, AND Mathematics"** for the February 2019 issue. Share your expertise in blending the four STEM elements into learning experiences for your students. General-interest manuscripts may be submitted at any time. Read the call for papers at *https://goo.gl/UXBmlh*.

**June 1**—Submit your best strategies for teaching **"Motion and Stability: Forces and Interactions"** for the March 2019 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**—Submit your manuscript on successful **ocean** science lessons to ***Science Scope***, NSTA's middle level journal. The January 2019 issue will focus on the physical properties, weather, biodiversity, and more. General-interest manuscripts, as well as manuscripts focused on making, technology, practical research, and more, are accepted at any time. Read the call for papers at *https://goo.gl/l6bNbz*.

**July 1**—How do you teach your middle school students about **"Stability and Change"**? Share your best practices with your fellow educators in the February 2019 issue of *Science Scope*. General-interest manuscripts, as well as manuscripts focused on making, technology, practical research, and more, are accepted at any time. Read the call for papers at *https://goo.gl/l6bNbz*.

**August 1**—The March 2019 issue of ***Science Scope*** will explore how middle level educators are incorporating **"Performance Tasks and Test Prep."** Submit your manuscript on your experience designing, scaffolding, and organizing performance tasks, as well as how you prepare students for traditional tests. General-interest manuscripts, as well as manuscripts focused on making, technology, practical research, and more, are accepted at any time. Read the call for papers at *https://goo.gl/l6bNbz*.

**August 1**—Have you developed ways to modify how to use materials from kits to teach the *Next Generation Science Standards* (*NGSS*)? The April/May 2019 issue of ***S&C*** will focus on teachers **"Shifting From a Kit to *NGSS* Strategies":** Tell your story of modifying and refining lessons with fellow elementary educators! General-interest manuscripts may be submitted at any time. Read the call for papers at *https://goo.gl/UXBmlh*.

**September 1**—The focus will be on "**Biological Evolution: Unity and Diversity"** in the April/May 2019 issue of ***Science Scope.*** Manuscripts discussing how to help students understand evolution and correct misconceptions are being accepted for this issue. General-interest manuscripts, as well as manuscripts focused on making, technology, practical research, and more, are accepted at any time. Read the call for papers at *https://goo.gl/l6bNbz*.●



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# Highlights From 2018 National Conference on Science Education

Did you miss NSTA's National Conference on Science Education in Atlanta last month? Explore highlights from the conference online!

Check out the varied posts from NSTA members and staff who shared their experiences on the NSTA blog (*https://goo.gl/cKZTEt*) and the photo album on NSTA's Facebook page (if you spot yourself in a photo, tag yourself!). Archives of the electronic conference daily—which include links to NSTA TV coverage—are also online at *https://goo.gl/HtCWSq*. Don't forget to check out *#NSTA18* and *#onlyatNSTA* on Twitter. ●

JACOB SLATON

*Science teachers share and gather inspiration for their students and themselves at the NSTA National Conference in Atlanta.*