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NSTA Reports
National Science Teachers Association

TAMMY BRAVO

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Building Electric Cars Enhances STEM Learning

Students around the country are learning science, technology, engineering, and math (STEM) by designing, building, and racing electric cars. Mario Molina, eighth-grade science teacher at Dr. Juliet V. Garcia Middle School in Brownsville, Texas, co-coached (with a seventh-grade math teacher) a team of 3 seventh graders and 10 eighth graders who built a single-seat electric-powered racecar and competed in the University of Texas Rio Grande Valley HESTEC (Hispanic Engineering, Science, and Technology Week) GreenPowerUSA South Texas Electric Car Competition, held at the Brownsville South Padre Island International Airport on April 6–7 (see *www.greenpowerusa.net*). They competed to see which car could drive the farthest in 90 minutes with one set of batteries. "It was a good opportunity for students to look at a vehicle and see the components from start to end, and work on a project in a group setting," Molina contends.

Brownsville Independent School District paid for 10 car kits from GreenpowerUSA for its 10 middle schools. The kits cost about $5,000 each and consisted of "a body, a motor, and batteries," says Molina. "The students had to design the outside body panels, choose their own design and colors... The skeleton of the car had two pieces and had to be put together with the motor and wiring," he explains. The kits arrived in February 2018, giving the students two months to build them before the race.

PHOTO COURTESY OF UTRGV—DAVID PIKE

Brownsville (Texas) Independent School District's top three Middle School Division cars that competed in the University of Texas Rio Grande Valley (UTRGV) HESTEC (Hispanic Engineering, Science, and Technology Week) GreenPowerUSA South Texas Electric Car Competition included the second-place winning car from Garcia Middle School (center car).

As they built the car's interior, Molina says students learned about engineering and electrical work, as well as using hand tools and safety equipment, reading a blueprint, and "problem solving—why is the car making this noise?" Students designed the car's exterior "on their own as homework, and they brought their ideas to school. There was a lot of homework with this project," he reports.

Though the district funded the car kits, tools, and teacher training ($6,500 per school), the students had to find additional donors. Garcia's teachers donated three sets of driving suits and gloves for the drivers, and a local business donated a sheet of corrugated plastic for the car's body, says Molina. The students collected $800 in donations.

Molina's team placed second in the race's Middle School Division. It also had High School and College divisions, and "it was very impressive when the students got to see the high school and college students' cars and what advanced things they did with their cars," which further inspired them, Molina observes.

Though Jack Rosenthal's high school students at Lennox Mathematics, Science, and Technology Academy

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INSPIRE PROBLEM SOLVERS WITH PURPOSEFUL STEM PROJECTS PG 3

Electric Cars, from pg 1

(LMSTA) in Inglewood, California, weren't able to build a working car, they learned a lot by trying. Rosenthal—who was an EnCorps STEM Teacher Fellow (*https://encorps.org*) at LMSTA and is now an engineering instructor at St. John Bosco High School in Bellflower, California—and science teacher Jose Rivas spent a year building a safe electric car with LMSTA students for the 2015 Shell Eco-Marathon, held in Detroit, Michigan.

"I had [four high school] students working on the battery system and control portions of the car [for] a college competition. [LMSTA] was invited to participate because they had built an electric boat and received praise for it," Rosenthal relates. Though the competition allowed students to build various types of cars, Rosenthal says his students chose to build an electric car "due to the growth of electric cars. They're in vogue, and a hot topic because the autonomous car industry is shifting to less air polluting/safer cars."

Building a safe electric car from scratch as specified in the contest rules proved challenging and costly. "The financial issues and [limited] availability of advanced technologies such as battery safety equipment/systems to meet competition rules cost us the trip to Detroit," Rosenthal explains.

"The purpose of the competition was to get students to brainstorm, research, and build an electric car from specifications only and make it work safely," he maintains. His students benefitted from their effort because "they understood what it takes to build a safe battery and associated control system and to work with other teams doing different parts of the car…They got an understanding of how many people are needed to build an electric car and the many steps [involved]."

Starting Small

Because of the time and money needed to build a life-size electric car, some teachers opt to build small electric cars instead. "Our seventh-grade science teachers collaborate with our Tech Lab teacher on a recycled car project. Kids design and build their car with plastic bottles, bottle caps, 9-volt batteries, small motors with propellers, and anything they can think of to attach a battery to the car and motor," says Eric Diefenderfer, seventh-grade science teacher at Boardman Glenwood Junior High School in Boardman, Ohio.

"Students learn about lab safety and proper use of tools and power equipment (glue gun, utility knives, drills, drill press, awl)," Diefenderfer reports. "This student-led lab allows them to problem-solve as they work through the scientific methods/inquiry skills while making connections to the engineering design process," he observes. "[T]his was a great way to introduce STEM and 21st-century learning concepts while still connecting to science standards. Some people think STEM is a separate subject, but this project shows how it is integrated."

"I run an after-school competition called Junior Solar Sprint (learn more at *https://goo.gl/zwzunn*) in which students build an electric car out of any material that has to carry an empty soda can…The cars run on a solar panel if it is sunny; if not, a battery pack," says Gavin Kearns, grades 7–8 science teacher at Paul Elementary School in Wakefield, New Hampshire. He gives students the motors and solar panels, but students are free to choose the rest of the materials for their cars, which allows them to be creative, he contends.

One challenge students face is "with an electric car, they really have to pay attention to the weight and structure of the car. It needs to perform a lot of functions, but can't be over-built," Kearns points out. "It needs to be very precise in how gears mesh; the axles have to be perfectly parallel so that the gears mesh [properly]."

At the competition, students can win awards for innovation and style, craftsmanship, technical merit of the solar panel and powertrain, and technical merit for weight, traction, drag, and guidance. "Some cars might have an interesting design, but might not win the race. They'll get an award for their design," reports Kearns. ●

COMMENTARY: **Laura Arndt**

Inspire Problem Solvers With Purposeful STEM Projects

By Laura Arndt

Laura Arndt

When science, technology, engineering, and mathematics (STEM) first entered the academic mainstream, it promised integrated, deeper learning rooted in real-world experience. Classrooms became filled with the latest STEM gadgets, tools, and technology. The engineering design process took center stage as students engaged in more hands-on experiences. This movement renewed enthusiasm among students, teachers, and administrators and initiated a new wave of community programming.

Now, however, many STEM educators are finding that the novelty is fading and with it the enthusiasm for STEM learning. Transforming an activity that is materials-based into a real-world project that sparks curiosity in the learner is challenging. Yet this is the educational strength offered by the engineering design process and the *Next Generation Science Standards* (*NGSS*). Without pedagogical support, STEM educators may continue to introduce learners to new technologies as the latest fad instead of as the next fundamental tool for addressing actual problems.

In the flurry to incorporate STEM, many educators overlooked its core strength: using technology and the engineering design process to address the real-world problems and issues meaningful to the learner's culture, community, or interests. When we incorporate these elements into dynamic, project-based STEM lessons, we not only deepen relevance, but we also create opportunities for 21st-century skill application and cross-curricular connections.

Grounding STEM Projects

In an authentic STEM project, content and lesson design are grounded in a problem or issue that the learner cares about, offering real-world impact to learning content and designing solutions.

In one Colorado classroom, for example, students used a 3-D printer to make Braille books for sight-impaired students. In two Massachusetts and Colorado middle schools, students have used their printers to design prosthetic limbs for war veterans in their community. These students were directly connected to the outcome of their engineering design efforts.

Where to Start

Three essential pieces unite to create an authentic, relevant STEM project: a problem, the content, and the solution. The primary curricular goal starts the creative process as the first piece. The other two pieces support the goal to create a project with an impactful purpose.

Start with content: A Georgia eighth-grade class wanted to apply their understanding of electricity by helping to solve a local problem, re-routing a transmission line across a lake. They collaborated with the professional engineers working on the problem. The students researched and offered input on the engineers' proposed solution to build structurally sound, aesthetically pleasing towers that would support power lines spanning the water. The students built relationships with role models in electrical and structural engineering careers, explored community issues, and applied their required learning about electricity to help solve a real-world problem.

Start with the problem: Students in Arkansas noticed an ecological dead zone in the Gulf of Mexico near the Mississippi River delta. They wanted to determine why the water lacked enough oxygen to support life and to report their findings to decision makers. How would they monitor and collect data about the water? The solution they chose was to build a data-collecting drone to fly over the targeted area. Achieving this required students to learn about and apply content concepts (e.g., water quality, chemical composition, watersheds, agricultural practices) to understand and address the problem, design the solution, and present findings to decision makers.

Start with the solution: A Colorado school district created a sustainability program highlighting ideas that schools could implement to address school-relevant problems. Schools choose a goal—gardens, lunchroom composting, school-wide recycling, or electrical use and cost reduction—to integrate into their students' learning experience. Then they match the academic content needed, and students apply their learning to create a solution.

These real-world STEM experiences provide clear purpose and inspiration for learning academic content to understand and solve problems students care about. In turn, students gain confidence in using critical-thinking and problem-solving skills beyond the classroom and throughout their lifetimes. Sara Cooper, science education specialist at the Nebraska Department of Education, explained the essence of purposeful STEM: "As we think about the world we are preparing students for, we know they are going to be solving problems we don't even know exist. The only way to prepare them for the future is to facilitate their learning by engaging them in solving problems that we are faced with in our schools and our communities today."

Have you considered what purposeful relevant STEM experience would inspire and empower your students? ●

Laura Arndt is the founding director and relevant STEM creator of Global Green STEM. She taught high school science and K–5 science-GreenSTEM for 16 years, and has consulted with schools, school districts, museums, zoos, state parks, forest service, and nature-wildlife agencies to train educators, develop education programs, write curriculum, and align curricula to standards. Contact Arndt at lauraarndt@globalgreenstem.com,

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Bringing Seismic Data to the Classroom

As David Curry, Earth science teacher at Holland Middle School in Holland, Pennsylvania, displayed a feed from his classroom's AS-1 seismograph to teachers attending the Middle Level Share-a-Thon at NSTA's National Conference in Atlanta in March, something unusual happened. "I [was showing] teachers how to access seismic data in their classrooms," Curry recalls. "You could see the shaking on the seismograph's feed from my classroom. I could see what my students were doing while the sub[stitute teacher] was there: They were jumping around next to the seismograph. I knew it wasn't a real quake, just my students demonstrating for the sub," he relates.

Curry obtained his seismograph from Incorporated Research Institutions for Seismology (IRIS), a National Science Foundation–funded consortium of U.S. universities that enables and supports seismological research. He learned about IRIS when he attended a session IRIS presented at the 2008 NSTA National Conference in Boston, Massachusetts. After the conference, Curry applied for and was one of 24 teachers IRIS chose to receive a seismograph, free training, and tech support as part of the organization's Seismographs in Schools program.

Because the device is in his classroom, Curry and his eighth graders "look at the seismograph every day. It shows the last 24 to 36 hours' worth of data," he explains. Another eighth-grade science teacher at the school has a live feed from the seismograph in his classroom, Curry notes, and "everyone in our building is able to see the data from the seismograph."

His seismograph has provided data from major earthquakes worldwide, sometimes before news websites report them. "It's not uncommon with these devices. They can circle the globe before the event [occurs] and provide information very quickly. We pick up all kinds of things, [such as] rain, wind, snow, and hurricanes," he notes. "It's like having a weather station in your classroom,…[and] it creates a lot of interesting inquiry among students."

Holland Middle School is part of IRIS's worldwide network of stations, which means its seismograph data can be compared with that of others in the network. "It's a way to get students connected with real scientists and industry," Curry observes. "It makes the teaching of Earth science better when students can look at data from seismographs versus from a textbook…Live data in the classroom keeps students hooked."

His main challenge with the seismograph is "it's an outside device that has to be connected with

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Carolina Carnalla-Martinez, manager of Mars Public Engagement for NASA's Jet Propulsion Laboratory, demonstrates a seismometer to children attending NASA's Mars InSight Mission Roadshow in Redding, California. The mission will study Marsquakes—meteorite impacts—to learn about the planet's interior.

the school network. It's hard to keep it networked at all times," as required by his school's internet security policy, he admits.

Seismic Data Resources

"It's fun to have [a seismograph] in class, but not all teachers want the responsibility," contends Tammy Bravo, seismologist and seismology outreach specialist at IRIS. "If you have one in your district and put screens in all the classrooms, everyone can see the data at the same time."

IRIS sells the instruments at cost as part of its Seismographs in Schools program, and "there are also opportunities for schools in some areas to apply for a free seismometer," she explains. (For information about educational seismometers, see this IRIS page: *https://goo.gl/Sc7pMJ*.)

"Often teachers just want to get seismic data in their classroom" without purchasing an instrument, Bravo maintains. "We have a variety of resources (at *https://goo.gl/ecWgwd*) designed to help bring seismic data into the classroom at whatever level students are at, from middle level to early undergraduate," for teachers with or without a seismograph, and "the resources can be adapted for elementary students," she reports.

For example, IRIS provides free software like jAmaSeis, a Java-based program that allows users to obtain and display seismic data in real-time from either a local instrument or from IRIS remote stations. Teachers "can use jAmaSeis with an old laptop; it just has to be internet-connected," Curry explains.

IRIS also offers Teachable Moments: presentations released following major earthquakes that contain interpreted U.S. Geological Survey (USGS) regional tectonic maps and summaries, computer animations, seismograms, photos, and other event-specific information. "Teachable Moments give teachers a chance to reinforce what students are learning with real-world examples," Bravo observes.

Barbara Ferri, seventh-grade science teacher at John Glenn Middle School in Bedford, Massachusetts, uses Teachable Moments in her classroom. "Students log earthquake data from the USGS recent earthquakes site [at *https://earthquake.usgs.gov*], including magnitude and depth, and I have them plot the earthquakes on a large Pacific-centric map that I drew on [a whiteboard]. I also use Teachable Moment [PowerPoints] that show cross-sections of plates, depths of earthquakes, and the magnitude of all of the quakes in an area for the last 10 or so years," she explains.

"It's a very powerful lesson: Students come to the realization themselves that there's a correlation between where earthquakes are occurring and where plate boundaries are located," Ferri maintains.

IRIS has a variety of lessons for teachers on its website. "Building a Seismograph (*https://goo.gl/V1tjfs*) engages students hands-on, using simple materials to build the important components of a seismometer. It allows them to really understand how a seismometer works," Bravo observes. Other useful teacher resources include animations of earthquake concepts, videos, fact sheets, posters, and interactives.

"Our website is always growing," Bravo notes. It will have more lessons and data over the next few years as IRIS partners with NASA on its InSight (Interior Exploration using Seismic Investigations, Geodesy, and Heat Transport) mission, which will study Marsquakes (meteorite impacts) to learn about the interior of Mars. Scheduled to launch as early as May 5, the InSight lander will place the first seismometers on Mars. (Learn more at *www.nasa.gov/insight*.)

"We want to engage students in this mission and get Mars data into classrooms. The seismometers will collect data for two years and distribute it" via the IRIS website, says Bravo. IRIS is developing a new curriculum to accompany the mission.

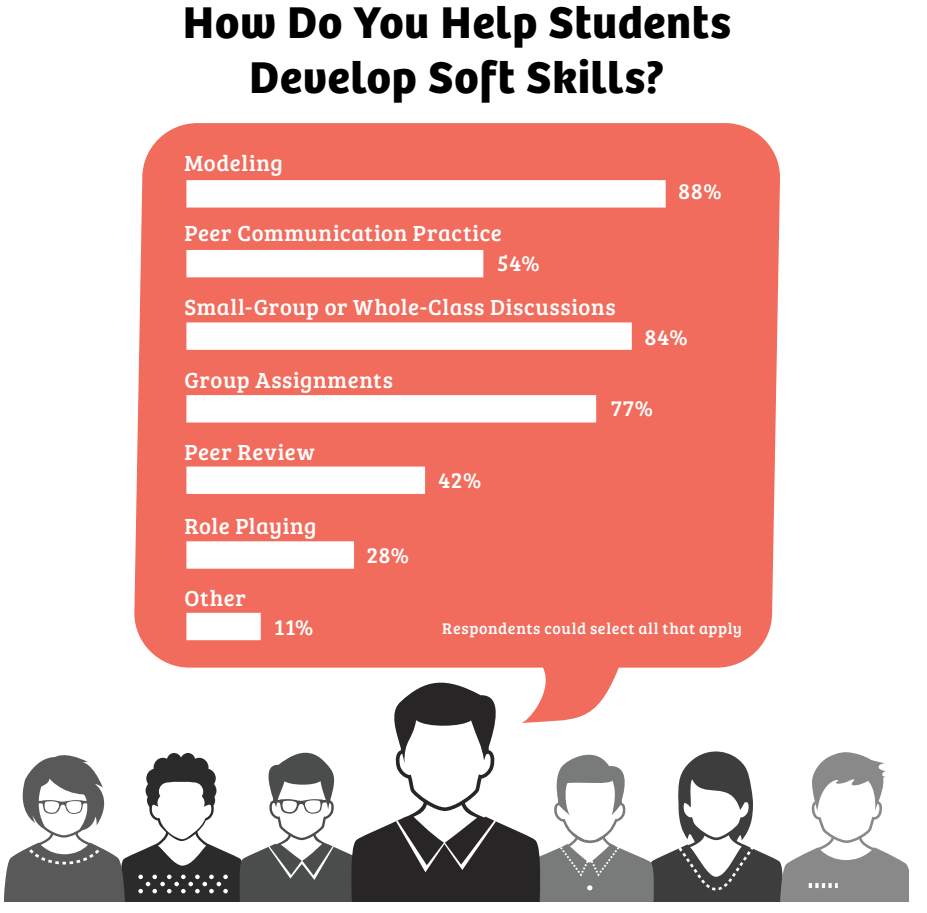
NSTA's National Conference on Science Education in St. Louis—taking place April 11–14, 2019—will coincide with when the first data will be available from the InSight seismometers, and "we plan to hold a session [in St. Louis] about protocols for getting the data into the classroom. Data from another planet will be exciting and really engaging for students," she asserts.●

Soft Skills Essential for Student Success

In a recent informal *NSTA Reports* poll, 95% of science teachers reported including instruction on soft skills in their lessons. Educators most frequently cited teamwork (91%) as a skill they address with students.* Problem solving (87%), critical thinking (84%), and communication (84%) were the other most popular answers. Other soft skills educators reported working on with their students include responsibility, independence, growth mindsets, evidence-supported arguments, mindfulness, organization, confidence, empathy, and public speaking. Most teachers said they employ modeling (88%), small-group or whole-class discussions (84%), and group assignments (77%) to help students develop their soft skills.*

A majority (71%) assign and rotate job duties during group labs or activities, creating opportunities for students to practice different skills. Fifty-six percent of participants reported explicitly including soft skills in grading rubrics. Educators reported using private (74%) and public praise (73%) to reinforce successful student collaborations, while 49% noted reinforcement is incorporated into the grade.*

[*Participants could select multiple responses to these questions.]



Here's what science educators are saying about the importance of developing soft skills in the science classroom:

Students need to develop soft skills to problem-solve and [for] group collaboration. High- performing students who do not know how to communicate and work together cannot successfully complete a task.—*Educator, High School, California*

Soft skills are 21st-century key competencies, and more important than science knowledge.—*Educator, Middle School, China*

It's too bad so many people "in charge" are stuck on test scores. Combine that with the proliferation of smartphones destroying kids' interpersonal skills, [and] a focus on soft skills is more important than ever.—*Educator, High School, West Virginia*

The more able you are to use soft skills, the more important you are than a robot or an algorithm.—*Educator, High School, Washington*

These skills are necessary for our global citizens. Our students have access to so much information; they must be able to work together to make sense of this information.—*Educator, High School, Maryland*

[It's a] no-brainer; I work in a collaborative team and graduated in a cohort. It is how we work with others. —*Educator, High School, Washington*

The soft skills are the absolute key to classroom management, student buy-in, and what helps them to build their confidence as well as [have an] open mind to college and career readiness. —*Educator, Middle School, Illinois*

These skills create a safer learning environment so students are able to express their needs. Soft skills make it so I am able to teach materials that might cause conflict by focusing on the ideas instead of the people.—*Educator, High School, Colorado*

Besides building skills for the future, these skills involve different ways of learning and help students to be successful now in class.—*Educator, Middle School, Massachusetts*

Probably the most important thing we teach—*Educator, Middle School, High School, New York*

I do not value it as one of the top 10 skills needed. Science is based on evidence and accuracy. The skills necessary to perform scientific experiments and run labs is mostly individual and requires a large dose of self-discipline and skepticism in order to maintain truthful, accurate results.—*Educator, Middle School, California*

It is extremely important. It gets left out, but we need to do something because people who don't have "soft skills" are difficult to work with. There is really not room for it in the curriculum for grading, but it helps with classroom management.—*Educator, Institution of Higher Learning, Maryland*

More important than the content, and needed in order to develop the best scientific process skills.—*Educator, Elementary, Middle School, High School, Alberta, Canada*

Teaching and practicing soft skills allows the management of the class to run smoother and allows us to behave and work like scientists.—*Educator, High School, California*

In order to develop scientists and thinkers, it is important that along with content, we teach them how to work with [one another]. Meaningful collaboration along with a purposeful reflection is critical to help them become innovative members of the society.—*Educator, Elementary, Arizona*

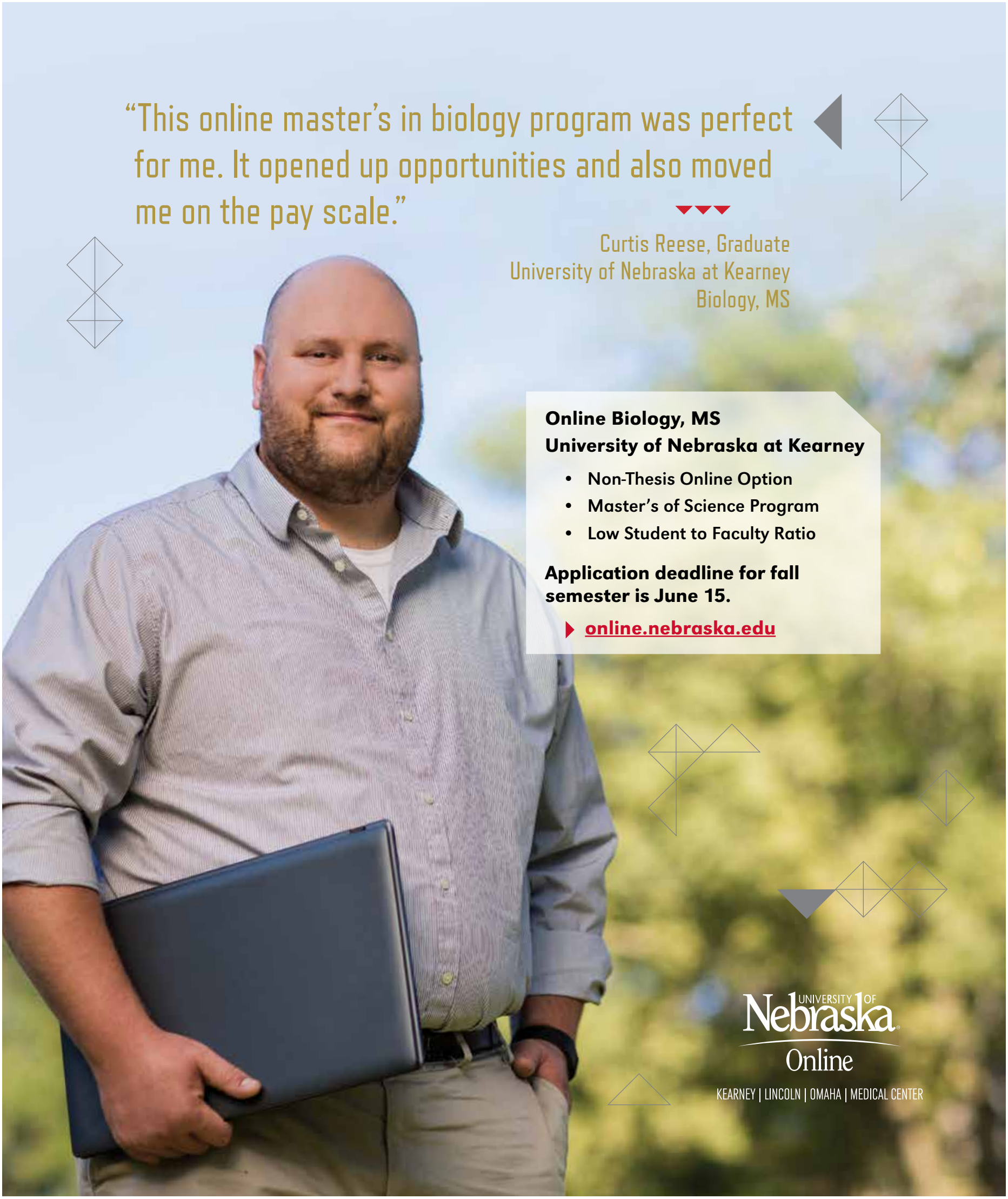
I think due to the collaborative nature of science, it is a good place to work on certain soft skills. I don't feel I have time to explicitly teach them to the whole class, but rather will talk with groups in the moment as issues occur.—*Educator, High School, New Jersey*

Soft skills are the most important thing in jobs today and in the future. It's important in all classrooms, but in the science classroom, it's particularly important because as children grow up, they need to be able to collaborate and communicate, especially if they become scientists or researchers. Sharing experiments and findings will help us find cures for disease and solve problems around the world.—*Educator, Elementary, North Carolina*

"Soft skills" are just as important as knowing the curriculum; with any job you can learn knowledge/what to do, but learning life skills like how to communicate effectively is much more difficult.—*Educator, High School, Michigan*

These are the skills that employers use to decide whom to hire for jobs. Technical skills can be taught to an industry standard.—*Educator, High School, Ohio*

Content knowledge can be gained and lost over time, but developing soft skills is like riding a bike: [Y]ou don't forget how to do it. Students have so much information at their fingertips, but it takes practice to work with others and to self-manage. The science classroom is the perfect place to develop soft skills because so much of what we do can incorporate these skills. Additionally, students learn better when they are collaborating and sharing their ideas with their peers.—*Educator, Middle School, Illinois* ●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MONEY 101

What Teachers Can Do About Health Care Costs

By Kelly Kenneally

In March, Gallup reported that more than half of Americans (55%) worry "a great deal" about the availability and affordability of health care, edging out crime, guns, and the budget deficit as top concerns (the poll surveyed adults living in the United States; see *https://goo.gl/Q6KoHA*). This marks the fifth consecutive year that health care has been either first or tied for first among issues of concern. In addition, research from the National Institute on Retirement Security finds that a whopping 88% of Americans believe that the rising cost of long-term care is a major factor in making retirement more difficult.

These high levels of worry can be attributed to several factors: Both employer-sponsored and individual health care benefits have become more uncertain and expensive; wages for most workers are stagnant while premiums and drug costs are rising; and Americans know they are living longer and must prepare for a retirement that may last for decades.

According to the Employee Benefits Research Institute (*https://goo.gl/2uWTL6*), a 65-year-old man needs $73,000 in savings and a 65-year-old woman needs $95,000 if they want to have a 50% chance of having enough savings just to cover health care premiums and median prescription drug expenses in retirement. If they want a 90% chance, the man needs $131,000 and the woman needs $147,000. Keep in mind that this figure doesn't include what is needed for other living expenses in retirement.

Yet many Americans are unprepared for these expenses because they haven't saved adequately or don't understand that Medicare won't cover all medical costs. The fact is that retirees are responsible for covering Medicare premiums, deductibles, and coinsurance, as well as routine dental, vision, and hearing care. And these costs can add up quickly. So where does one start?

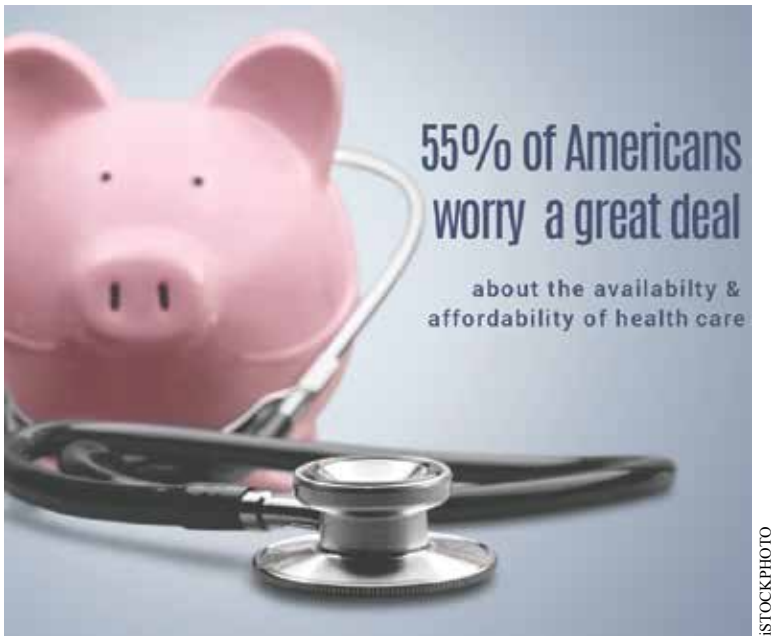
Know Your Health Care Insurance Coverage for Today and in Retirement.

Given these levels of worry and shifting health care laws, should education professionals worry about health care costs in their working and retirement years? This question has no simple answer except that all educators must understand and pay close attention to their unique situation. Full awareness will help you plan now for the near- and long-term, and perhaps even motivate educators to advocate for any needed changes to health care availability and costs.

There is good news for public school educators: All 50 states and most local governments provide health insurance coverage. However, the level of coverage, eligibility, and the portions paid by the employer and employee vary from state to state. Furthermore, data indicate that premium costs are rising at a time when most teacher wages are either stagnant or declining.

The recent teacher strikes capturing national attention aren't just about pay, but also about health insurance premiums. For example, following the West Virginia teacher strike, the governor agreed to delay increasing teacher health insurance premiums along with raising teacher pay by 5%.

Teachers in other states—including Arizona, Kentucky, and Oklahoma—also facing rising insurance costs are striking or threatening strikes. It's easy to understand their concerns: Ten years ago, teachers contributed about 35% toward the premium cost for a family plan, and now the typical contribution is about 38%. This can add up to more than $1,000 annually, according to data from the Bureau of Labor Statistics (*https://goo.gl/a92mXx*).



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And there is more good news for the public sector. The Center for State and Local Government Excellence reports that nearly every state and most local governments provide access to retiree health benefits, and in most cases, this coverage includes spouses and dependents. This employer-subsidized coverage typically serves as the primary health coverage until the retiree reaches age 65, when it becomes secondary to Medicare. The level of retiree health care benefits, and their associated costs, depends on multiple factors like eligibility requirements and benefit types.

For educators teaching at private schools, health care benefits vary from school to school just as benefits for other private sector employees do. As such, it is important to work closely with your employer to understand the health care benefits available while you are working and during retirement, and whether your spouse or partner and other dependents are eligible.

Understand Long-Term Care Insurance.

Long-term care (LTC) is another consideration when creating a health care budget. LTC refers to the assistance those with chronic illnesses, disabilities, or other conditions need over an extended period of time. AARP estimates once people reach age 65, 50% of them will require LTC at some point. The current average lifetime cost of LTC per person reached $172,000 in 2016 dollars according to a study of insurance claims, and these costs are growing.

Employer health coverage typically will not pay for daily extended care services, and Medicare usually covers a short stay in a nursing home. To help cover the potential LTC expenses, some people choose to purchase LTC insurance. Currently, about 7 million Americans have such insurance.

LTC policies offer varied coverage options and can help pay for the care you need, whether you are living at home or in an assisted living facility or nursing home. Some policies even will help pay costs to modify your home so you can remain in it safely. It is important to understand that these policies typically cost less if purchased when you are younger and in good health (although you will be paying

for a longer period of time). When you're older or have a health problem, you may not be able to get coverage, or it may be substantially more expensive. An easy-to-understand guide to what you should know about LTC insurance is available from AARP at *https://goo.gl/4PLnuZ*.

Now What?

What is the best advice for teachers? To do what teachers do best—study, ask questions, and stay abreast of new developments. Understanding your health care coverage for both your working and retirement years will help you plan and save. Investigate LTC sooner rather than later to help decide if investing in LTC insurance to defray out-of-pocket expenses when you're living on a fixed retirement income is appropriate.

Some sources of reliable, impartial research on health care benefits and costs include

- AARP *www.aarp.org*
- The Center for State and Local Government Excellence *https://goo.gl/u4TjZk*
- The Employee Benefits Research Institute *www.ebri.org*
- The National Association of State Retirement Administrators *https://goo.gl/qt2eQS*
- The National Conference of State Legislatures *https://goo.gl/1hpa2a*

Rising health care costs will continue to consume a larger portion of paychecks and retirement benefits for nearly all Americans, teachers included. In between lesson planning and grading papers, carve out time to engage with your employers' benefits staff and to focus on your health care costs. Your physical and financial health depend on it. ●

Kelly Kenneally has 25 years of public policy experience including serving in the White House, and she has worked for more than 10 years with retirement organizations to help improve retirement prospects for Americans. She has co-authored a biennial report on Americans' sentiments regarding retirement.

Quotable

It shouldn't matter how slowly some children learn, as long as we are encouraging them not to stop.

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

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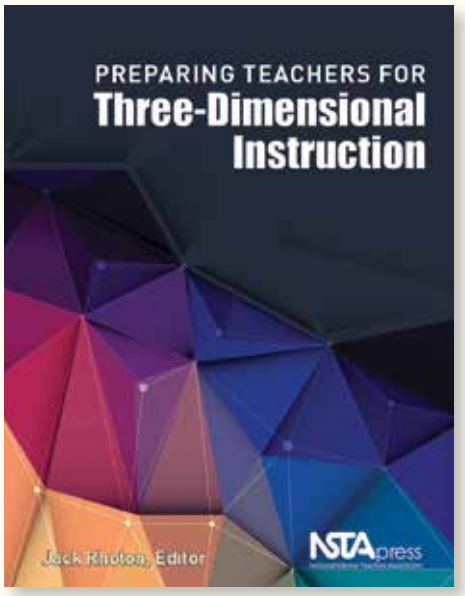
– Margaret W.



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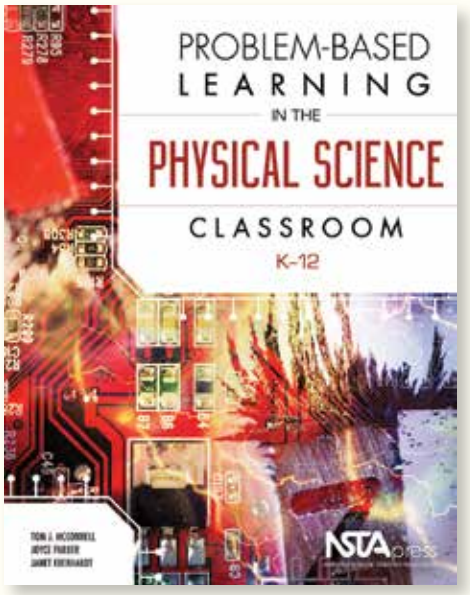
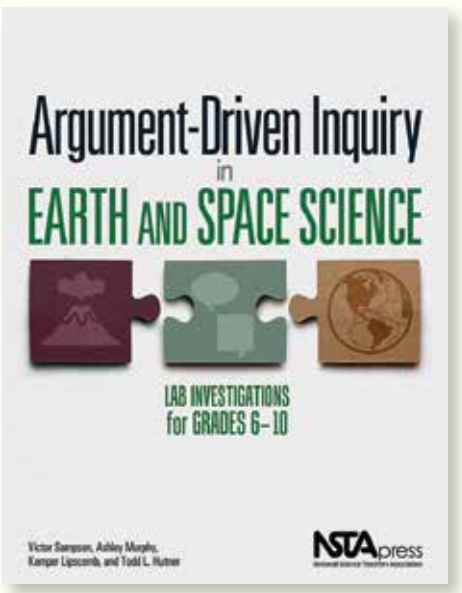


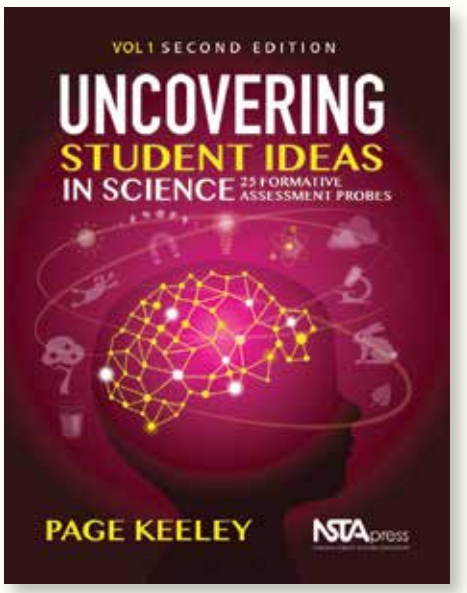
Grades 11

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



Grades 9–12

Book: Member Price: $38.36 | Nonmember Price: $47.95
E-book: Member Price: $28.77 | Nonmember Price: $35.96
Book/E-book Set: Member Price: $46.03 | Nonmember Price: $57.54



Grades K–12

Book: Member Price: $25.56 | Nonmember Price: $31.95
E-book: Member Price: $19.17 | Nonmember Price: $23.96
Book/E-book Set: Member Price: $30.67 | Nonmember Price: $38.34

To place an order or download a free chapter, visit

www.nsta.org/store

NSTA National Science Teachers Association

PULL-OUT SECTION

SCIENCE TEACHERS' GRAB BAG

Inside this Convenient Pull-Out Section you will find:

Freebies for Science Teachers

READI Project Curriculum Modules. M H The Reading, Evidence, and Argumentation in Disciplinary Instruction (READI) Project, a multi-institutional initiative headed by the University of Illinois at Chicago and funded by the Institute for Education Sciences, established partnerships to support disciplinary argumentation from multiple sources in middle and high school science and history/social studies classes. At *https://goo.gl/fAeFLZ,* educators can access integrative curriculum modules developed as part of the project.

For example, Life Sciences: The Spread of MRSA (versioned for grades six and nine) supports science students' close reading, modeling, explanation, and argumentation practices while building their knowledge of evolution, microbes, and antibiotic resistance. Similarly, the module Earth Science: How Are Humans Impacting Water? (for eighth grade) supports students' close reading, modeling, explanation, and argumentation practices in science while building knowledge of water resources and pollution. And Reading Science Modules (for grades six and nine) support students' close reading of science visuals and models while building knowledge about the conventions of scientific models and the criteria for evaluating them. Each module includes an interactive notebook with integrated texts, tasks, scaffolds, and routines, along with an annotated teacher guide.

Engineering Challenges in Physical Science Curriculum. M With National Science Foundation funding, the Harvard–Smithsonian Center for Astrophysics Science Education Department and middle and high school teachers developed an engineering challenge–based physical science curriculum for middle level students. The open-source, downloadable curriculum at *https://goo.gl/n11TvE* includes student workbooks and teacher's guides for six topics: Solar House, Windmills, Batteries, Electromagnets, Bridges, and Gravity Wheel. The activities require only low-cost, readily available materials and can be easily adapted for your classroom's needs.


LAITCHE

Kansas School Naturalist. M H Written by experts in the field, *Kansas School Naturalist* has published issues on insect and other arthropod themes, including millipedes and centipedes worldwide, the yucca moth, damselflies, dragonflies, tardigrades, springtails, and raising ants. Several issues have also been translated into Chinese and Spanish for use with English Language Learners. While some issue themes are specific to Kansas, most are of universal interest. Teachers can request back copies of any issue, including class sets. Learn more at *www.emporia.edu/ksn.*

Fire Safety Education Patch Program. E Developed by BIC corporation and the Girl Scouts of Connecticut for K–3 students, the Play Safe! Be Safe! Patch Program leader guide presents four kid-friendly lessons about fire safety: My Friend the Firefighter; Stop! Drop! and Roll!; Get Low and Go; and Safe for Play! Keep Away! The guide also has games, puzzles, and activities that reinforce lesson content, and Fire Safety Tips for Parents and Families. While the curriculum was written for Girl Scouts, the content is appropriate for all children and can be easily be adapted for classroom use. Access the guide at *https://goo.gl/TRtXQZ.*

Frankenstein200. M Arizona State University researchers and partners created an interactive story experience for middle level students to commemorate the 200th anniversary of the publication of Mary Shelley's novel *Frankenstein.* The game immerses students in an online story about what might happen if Victor Frankenstein's descendant, Tori, continued his work. The story takes place in real time over 30 days. Every three days, teachers (or parents) get an e-mail that something has happened. Participants then go online to the watch the story unfold and explore related science concepts through quizzes, puzzles, and games, as well as at-home activities that encourage students to investigate some of the questions from the game in the real world.

Though the online story isn't as creepy as the original *Frankenstein,* it raises many of the same questions about scientific ethics and responsibility and presents lessons about topics such as DNA, electricity, and artificial intelligence. Refer to *https://frankenstein200.org.*

Science in the Classroom. H HE The *Science* family of journals created a collection of freely available annotated research papers. The annotations—which include vocabulary, methods, descriptions of prior research, and explanations of major conclusions—can help educators, undergraduates, and advanced high school students dissect and understand the advanced

See Freebies, pg G2

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

Freebies, from pg G1

science in each paper. Each has an educator's guide outlining connections to science, technology, engineering, and math (STEM) learning frameworks and standards, along with suggested activities, discussion questions, and resources for further exploration. You can search for annotated papers by general topic (e.g., Anatomy, Biochemistry, Diseases and Disorders, Earth and Environmental Science, Genetics, Physics) or by category, such as Most Recent, Popular Papers, Papers With Activities, or Papers With Multimedia. A tutorial, How to Use This Resource, presents video walkthroughs to help users make the most of the features available. Visit *www.scienceintheclassroom.org*.

***NGSS* Classroom Science Assessment Examples.** K12 K–12 educators can use these *Next Generation Science Standards* (*NGSS*)–related resources to better understand what "three-dimensional" means for science instruction. The website presents links to assessments created by groups nationwide working on 3-D assessment, ideas for creating these types of tasks, and tools for working with students' misconceptions in assessment. Consult *https://goo.gl/oXYYGv*.

EDDIE MALONEY FROM NORTH LAS VEGAS, USA

The PictureSTEM Project. E Three instructional units for K–2 classrooms use an engineering challenge and picture books as supports for learning science, mathematics, engineering, computational thinking, and reading. Unit titles include Designing Paper Baskets (kindergarten), Designing Hamster Habitats (first grade), and Designing Toy Box organizers (second grade). Each unit includes specific book titles and the literacy strategies for each lesson, along with science, math, and computational thinking connections. See *http://picturestem.org*.

Cornell's Composting in Schools. K12 Learn the do's and don'ts of composting and more at this website produced by Cornell University's Waste Management Institute. Found at *https://goo.gl/vgfc83*, the site covers everything K–12 educators need to begin a school composting program, from a rationale for composting and solid waste lesson plans and labs for all levels to the nitty gritty science and engineering of composting. The site also has sections with Ideas for Student Research Projects, a Compost Quiz, and information about indoor and outdoor composting. Don't miss the section on Weird and Unusual Composting, which is filled with interesting-but-true composting stories sure to engage students, including Birds That Make Compost and What Better Way to Get Rid of Old Explosives?

Flap to the Future game. E M An immersive game from The Cornell Lab of Ornithology's Bird Academy, available on BrainPOP at the website *https://goo.gl/29LNBZ*, teaches upper-elementary and middle level students how birds evolved flight. Players start as dinosaurs and travel through adaptation stages as they evolve to modern birds and learn to fly. Supplementary classroom activities from Cornell Lab's BirdSleuth K–12 program (see *https://goo.gl/8wnkfo*) extend learning. In these activities, designed for grades 6–8, students identify and compare common characteristics of prehistoric and modern birds, learn about the advantages and disadvantages of certain adaptations, and apply new knowledge about adaptations to create a futuristic bird.

Crash Course. H HE These educational videos are for Advanced Placement high school students and adult learners (e.g., preservice educators) alike. Wittily hosted by brothers Hank (sciences) and John (history and literature) Green, the fast-paced video courses address science and humanities subjects, including Anatomy, Astronomy, Biology, Chemistry, Ecology, Physics, and U.S. and World History. Each video course has several lively video "chapters" (each about 10–15 minutes long) that entertain as they explain concepts central to the subject. Access the courses at *http://thecrashcourse.com*.

DG-505

Teach Ocean Science. M H This website features learning modules and ocean science curriculum for middle and high school students developed through partnerships between ocean research scientists and teachers. The Education Modules explore coastal science topics like Applications of Landsat Data, Dead Zones, Estuaries and Climate Change, Marine Bacteria, Seagrass, and Water Quality and GIS. The multimedia modules incorporate text, videos, illustrations, lessons, and "interactive Try-Its" on each topic and can also be used by teachers interested in refreshing their content knowledge.

The Ocean Science Curriculum has teacher- and scientist-vetted lesson plans structured around the Ocean Literacy Principles and Essential Concepts. Teachers can use the structure of the curriculum and lesson plans to teach a semester-long ocean science course, or teach lessons individually on specific concepts in biology, chemistry, environmental science, or other disciplines. Visit *www.teachoceanscience.net*.

University of Colorado (CU) Science Discovery Makerspace Resources. A Educators of all levels can learn about the Makerspace movement using the resources at *https://goo.gl/ZBiADA*. Compiled by the staff of CU's Boulder Science Discovery Program, this collection of resources from leading universities, educational organizations, and other groups presents news articles, videos, and web resources to support all aspects of makerspace learning. The vetted resources address everything from research on how makerspaces can impact education to how to build and run one in your learning environment. You'll also find a suggested shopping list for items typically used in makerspaces.

OK Go Sandbox. K12 An online resource for K–12 educators uses OK Go's music videos as starting points for integrated guided-inquiry challenges, enabling students to explore STEAM (STEM plus Arts) concepts. The website features music videos and resources to help teachers connect the joy and wonder of the videos to concepts such as sound and simple machines. The resources accompanying the video *The One Moment*, for example, include a Q&A with the band on the science and math involved in producing a video in which objects pop, crash, and crumble to the beat of the music. In a science challenge, Timing Is Everything, students explore gravity's impact on objects of different sizes and masses by dropping objects from a consistent height and recording their falls. See *www.okgosandbox.org*.

I-Engineering. M This project engages middle level students and teachers in designing and implementing sustainable solutions to energy engineering challenges that matter to their community. The concept of Engineering for Sustainable Communities (EfSC) expands what it means to be an engineer, requiring students and teachers to consider both the technical challenge of design and the social dimensions of problems and solutions. At *http://engineeriam.org*, teachers can learn about EfSC's core tenets and see examples of student-created projects using the approach.

In addition, the curriculum unit How Can I Make My Classroom More Sustainable presents lessons modeling the EfSC teaching/learning process. For example, students learn about circuitry and renewable energy as they design "Electric Art" and power it with green energy sources. Lesson plans, student activity sheets, student work samples, implementation tips, *NGSS* connections, and embedded assessments are included. ●

News Bits

- **In a Bayer and National 4-H Council survey, more than half of high school teachers reported feeling unqualified to teach agri-science, with 80% believing it is important, but only 22% teaching it.** H

Study results also revealed 48% of teachers believe less emphasis is placed on agri-science than there was 15 years ago. Most parents surveyed (86%) agreed encouraging the pursuit of agri-science careers was important, but only 70% thought their children would follow that career path.

Jennifer Sirangelo, president and CEO of National 4-H Council, said opportunities are needed to inspire students to pursue agri-science careers. "[R]eliable access to safe and affordable food is one of the most significant challenges of our time, with most experts predicting that by 2050, population demands from nearly 10 billion people will require a 60% increase in global food production," she points out.

In response, Bayer and the National 4-H Council have created STEM Matters. The program will reach 25,000 students in urban, rural, and suburban settings, providing curricula, scholarships, grants, and volunteers to local clubs. See *https://goo.gl/XMv1aj* to learn more.

- **A Microsoft study shows girls lose interest in science, technology, engineering, and math (STEM) as they age, but countermeasures can have positive effects. A similar trend was found in Draw-A-Scientist studies.** K12

For the report *Closing the STEM Gap,* Microsoft researchers surveyed more than 6,000 female students on their interests and perceptions of STEM and found that, among other areas, their interest in computer science specifically drops 27% between middle school and college. But researchers found several tactics can counter this decline: the presence of role models and mentors, exposure to real-world examples of STEM, hands-on experience through clubs/activities, and encouragement from parents and educators. Learn more at *https://goo.gl/r2vNf8*.

Another study, "The Development of Children's Gender-Science Stereotypes: A Meta-analysis of 5 Decades of U.S. Draw-A-Scientist Studies," from the March 2018 issue of *Child Development,* also showed drawings of female scientists are more prevalent among younger children. But despite women's increasing representation in science (and female scientists frequently appearing in mass media), as students age, they increasingly associate science with men, and their drawings reflect that. Encouragingly, in 78 studies of more than 20,000 children, U.S. children's drawings of scientists depicted female scientists more often in later decades. See *https://goo.gl/tNg8zX*.

- **In McKees Rocks, Pennsylvania, Montour Elementary School has opened the first LEGO-themed "Brick Makerspace."** E

The school has created the first science, technology, engineering, arts, and math lab in conjunction with Carnegie Mellon University. Its activities involve brick building, 3-D printing, car racing, stop-motion animation, and an interactive mixed reality system that lets students build and test structures. Montour's co-principal, Jason Burik, an accomplished LEGO artist, said, "We wanted to create a unique learning space that kids would love coming to…a room that would inspire students to become architects, engineers, designers, makers, and use problem-solving and critical-thinking skills," he said. Read more at *https://goo.gl/yCSWWg.*

In addition, researchers at University of Colorado, Boulder, published a study in *Geosphere* showing spatial skill scores were significantly higher among students who played with construction-based toys, such as LEGOs. Read more at *https://goo.gl/dRzqCS*. ●

What's New

FROM U.S. GOVERNMENT SOURCES

National Institutes of Health (NIH)

Electricity, Frankenstein, and the Spark of Life M

This lesson for students in grades 6–8 uses visual materials from Frankenstein: Penetrating the Secrets of Nature, an online exhibition produced by NIH's National Library of Medicine (NLM), to consider how Mary Shelley's science fiction novel, *Frankenstein,* reflects the increasing knowledge and hopes about electricity in her time. In Class One, students explore the references to electricity in the novel and in a 1931 film. In Class Two, students learn about Galvanism and Luigi Galvani—whose experiments and observations on electricity and muscle contractions ignited the work of many scientists in the late 18th century—through a play depicting fictitious encounters featuring Galvani and his contemporary Alessandro Volta.

The lesson plan includes learning outcomes, background information, vocabulary, student handouts, video clips, evaluations, extension activities, and standards correlations. See the website *https://goo.gl/Dux88a.*

Greenhouse Gases M

Learn about the role of greenhouse gases in climate change with resources from the NLM's Environmental Health Student Portal. The Greenhouse Gases web page (*https://goo.gl/XYwPYs*) provides basic information for middle level students about greenhouse gases and the human activities that increase them, links to news articles and websites with more information, explanatory videos, experiment ideas, and homework help. Classroom resources include an animated lecture on the greenhouse effect; fact sheets addressing frequently asked questions about climate change (e.g., What is the relationship between climate change and weather? Is the amount of snow and ice on Earth decreasing?); and Earth on Fire, a classroom activity from NASA in which students calculate and compare the amount of CO_2 released in the atmosphere from fossil-fuel burning and the actual increase of atmospheric CO_2.

National Oceanic and Atmospheric Administration (NOAA)

Discover Your World With NOAA: An Activity Book E M

This publication has more than 40 activities to help elementary and middle level students learn more about our planet and NOAA's role in exploring, understanding, and protecting Earth. Students can discover NOAA's many facets in the board game NOAA's Building Blocks, or create tools to explore the Earth with hands-on activities such as Make Your Own Astrolabe and Build Your Own Underwater Robot. Activities like Rip Currents, Be a Tree Ring Detective, and Wooly Magma provide basic content knowledge on common Earth science topics, while others like Endangered Species Origami, It All Runs Downhill, and What Are the Impacts of Shrinking Polar Ice Caps? help students deepen their understanding of current issues in conservation. Download the publication at *https://goo.gl/1GkL8E.*

Weather Science Fair M

SciJinks's Weather Science Fair web page at *https://goo.gl/XvGBnE* offers middle level students project ideas in several categories: those that test a hypothesis (e.g., How does the temperature change during the day? One possible hypothesis: The temperature is lowest at midnight and highest at high noon.); those that review what we already know (e.g., How are tornados formed and what causes them?); those that find relationships in data (e.g., Is weather related to illnesses?); and those involving engineering design (e.g., Design, build, and test an automatic recording weather device). The page also includes steps for how to do a science fair project.

Beat the Uncertainty: Planning Climate-Resilient Cities M H

This classroom simulation activity challenges teams of three or four middle or high school students to make smart decisions to increase a city's resilience to climate change. To play, teachers set up stations representing coastal cities vulnerable to climate change. Students at each station are that city's decision makers: citizens, policy makers, businesses, civil society, and researchers.

Using a Resilience Measure Checklist, which describes adaptation strategies and their costs, students must collectively decide how to spend their limited funds. Then students play a game to see how their group's choices fare when their city is subjected to various climate events, such as erosion, saltwater intrusion, heat wave, loss of fisheries, flooding, and storm surge. Visit *https://goo.gl/on5VnV.*

NOAA Office of Response and Restoration Website E

At this site, elementary teachers will find a collection of activities exploring the behaviors of oil and water and the effects of oil spills. The activities can be completed in class or at home and include titles like Oil Behavior and Beach Sediments, The Best Way to Clean Oil Off Bird Feathers, and What Happens to Oil on the Ocean's Surface? The site also features news articles and fact sheets from NOAA scientists that provide background information for teachers of all ages (e.g., What Happens in an Oil Spill?, How to Test for Toxicity, Five Key Questions NOAA Scientists Ask During Oil Spills, and Oil Spills at the Water's Edge). Visit *https://goo.gl/5hu1cP.*

National Aeronautics and Space Administration (NASA)

What's It Like Inside Jupiter? E M

Visit NASA's Space Place website at *https://goo.gl/cQhhB7* for a tour inside planet Jupiter! Targeted for elementary and middle level audiences and featuring NASA images, the page presents an overview of Jupiter, including discussions of temperature and pressure. Students can also play the game JunoQuest to learn how gas giants form and their role in the formation of our solar system. Younger students may enjoy making a cartoon-style Jupiter Mask from a printable template.

How Do We Weigh Planets? E M

For accurate, kid-friendly information on planets, see NASA Space Place's page at *https://goo.gl/D6xwf6,* How Do We Weigh Planets? Written for elementary and middle level audiences, the explanation covers topics such as How do scientists use gravitational pull as a scale?, Why do scientists usually discuss mass rather than weight?, and What is Earth's mass? A sidebar has links to material about other space questions, such as What is gravity? and Why are planets round?

Food for Thought: Eating in Space Educator Guide E M

This guide presents five *Next Generation Science Standards*–supported lesson plans for grades 5–8 that relate to food and nutrition. Through the lessons, students research the caloric content and nutritional value of space foods (Mars Needs Food!); construct and use calorimeters to measure the kilocalories (energy) contained in several food samples (Burning Question: Which Food to Take to Mars?); design and assemble a robot to perform a specific task using commercial robot kits or construct a simulated robot

using various scrap materials (Always Wash Your End Effectors); investigate adhesion, cohesion, contact angle, and capillary action in liquids (Now That's a Cup of Coffee); and create nutritional labels for cookies (If You Give an Astronaut a Cookie). Lesson plans include learning objectives, background information, materials lists, procedures, assessments, and student handouts. See *https://goo.gl/sAUAFw.*

A Day in the Life Aboard the ISS K12

Follow astronauts' daily routines on the International Space Station (ISS) in a series of videos. Crew members explain how to shower, wash their hair, eat, sleep, work, exercise, and have fun in a gravity-free environment. The clips are organized by category (e.g., Morning Routines, Working in Space). Share the videos with K–12 learners to generate interest in space science and excite students about space-related careers. Visit *https://goo.gl/aeuEKr.*

U.S. Department of Energy (DOE)

Energy Institute for Teachers' Lessons K12

The DOE's National Renewable Energy Laboratory (NREL) has resources for K–12 audiences to learn about renewable energy and energy efficiency technologies. Developed by NREL and participants in NREL's Energy Institute for Teachers, these resources include hands-on energy projects, activity books, and curriculum suggestions for teachers, students, and families. Topics addressed include biomass, solar energy, wind power, energy efficiency, and hydrogen and fuel cells.

Elementary students can enjoy the *Solar Energy Coloring Book* (grades K–2) and Experiments with Biomass (grades 4–6), 12 experiments exploring plant growth and the environment, byproducts of biomass, and energy contained in different types of biomass. For middle and high school students, the site offers a poster, "Making Fuel Cells from Hydrogen" (grades 6–8); a template for conducting a School Energy Audit (grades 8–12); and a guide to Renewable Energy Science Projects (grades 9–12). Consult the website *https://goo.gl/cGkHYP.*

School Energy Survey M H

Created by the DOE's Office of Energy Efficiency and Renewable Energy and the National Energy Education Development Project, The School Energy Survey provides students in grades 7–12 the background and framework to conduct a comprehensive energy survey of their school building. Students gather data as they analyze energy-consuming appliances and systems. Next, they identify energy-related issues and brainstorm solutions, then rate the costs and benefits associated with their proposed solutions and craft an action plan. At each step, graphic organizers and charts are provided to help students structure their plan.

The survey experience also introduces students to careers in the energy management industry. The survey tasks closely parallel the work of engineers and other technicians in this growing field. A teacher's guide contains correlations to learning standards, and a student guide provides the science background information and the data forms and handouts needed for each activity. Refer to the website *https://goo.gl/jSH1DT.*

U.S. Environmental Protection Agency (EPA)

Learning About Acid Rain—A Teacher's Guide for Grades 6 Through 8 M

This guide features explanatory text, illustrations, experiments, activities, and games exploring acid rain, from the science of what it is and how it occurs to the need for regulatory and citizen action steps to address it. Nine experiments move sequentially from developing basic understandings of pH to examining the effects of acid rain in the environment. The guide includes a timeline of the History of the Acid Rain Program and a template for a certificate of achievement for participating in the Acid Rain Awareness Program. Consult *https://goo.gl/r1tcki.*

Another website, Understanding Acid Rain (*https://goo.gl/bbLFwJ*), has the online versions of the nine acid rain experiments in *Learning About Acid Rain—A Teacher's Guide for Grades 6 Through 8*. The experiments are presented sequentially, moving from developing students' basic understanding of pH and how to measure it to applying understandings to examine the effects of acid rain on plant growth, metals, and marble and limestone. The site offers practical tips for how to best measure pH, stay safe in the laboratory, and properly record scientific observations.

U.S. Geological Survey (USGS)

Water Shortage! M H

Use this survey from the USGS Water Science School to start a class discussion on how to address a hypothetical city's water demands. The survey asks middle and high school students to assume the role of city mayor and choose the best measures to solve a city's water crisis. Measures include enforcing mandatory restrictions on water use, finding a new water supply, raising the price of water, cutting back or stopping new developments, encouraging water conservation, or buying water from elsewhere. The survey presents positives and negatives of each measure, fueling discussions about why some measures would work and some wouldn't.

The activity gives students an opportunity to discuss real-world issues and practice the art of compromise. Access the survey at *https://goo.gl/xseFD9.*

U.S. Department of Agriculture (USDA)

Spring Food Fun Activity E

Excite elementary students about healthy eating with a simple activity that incorporates the USDA's MyPlate food groups: fruits, vegetables, protein foods, dairy, and grains. Students take a field trip to a local farmers market to gather healthy foods from each food group, then use the foods to design an edible spring or summer scene on a paper plate. Afterward, students can enjoy their tasty, healthy snack! The page includes links to fact sheets with information about each food group and photographs of sample scenes to inspire students' creative "juices." See *https://goo.gl/wJx2J8.*

Kids.gov

Career Spotlight: U.S. Marine Pilot M H

Meet Captain Pete Benning, a U.S. Marine Corps pilot who flies an Osprey, a tilt rotor aircraft that can function as both a plane and a helicopter. In this short video clip, students tour the aircraft and cockpit, learn what Benning likes most about his job and how he prepares for each mission, and get advice about what is needed to be a Marine pilot: discipline, hard work, and drive. Watch the video at the website *https://goo.gl/ZT9qms.*

Career Spotlight: Aerospace Engineer E M

In this video for elementary and middle levels, NASA engineer Acey discusses his job and building the James Webb Space Telescope (JWST). The video highlights similarities and differences between the JWST and its predecessor, the Hubble telescope, and presents interesting facts like what a "clean room" is and why it's important in building a telescope. Acey also shares advice for students interested in engineering.

Watch the video and access a transcript at *https://goo.gl/inyRxX*. The transcript includes a link to *Infrared: Beyond the Visible,* a video that explains infrared astronomy and the science behind the upcoming Webb Space Telescope in language middle level students can understand. ●

NSTA District Professional Learning Packages

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- Administrators
- Curriculum leaders
- Classroom teachers

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

—Educational Services District Leader

Ask Us About *NGSS* Training for Districts

- **Exploring the *NGSS*:** Give teachers a foundational understanding of the standards and shows them what three-dimensional instruction looks like in classrooms (modeled for each grade and discipline).
- ***NGSS* Administrator Institutes:** Help administrators design professional learning around science standards, assessing current capabilities of teachers, and setting goals for professional learning.
- **Train-the-Trainer Workshops:** Build your team of experts by giving them a powerful tool kit of resources and a solid understanding of the *NGSS*. This workshop uses the interactive e-book *Discover the NGSS: Primer and Unit Planner* to prepare participants to conduct comprehensive teacher training around the new standards.
- **Online Book Study and Discussion Forum:** This series of four web seminars combines asynchronous thought activities with discussions in private forums to give districts a flexible option for *NGSS* training.
- **Or let us tailor a program for your needs.**

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

NSTA National Science Teachers Association

In Your Pocket

Editor's Note

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

May 25–31

ASM's Living in a Material World Grants K12

The ASM Materials Education Foundation provides these grants to help K–12 teachers bring the world of materials science into their classrooms. Funds should help teachers raise student awareness of everyday materials. Twenty $500 grants are available.

Applicants can contact local ASM members to help them develop innovative projects. Apply by **May 25;** see *http://goo.gl/dYSGYa.*

SPIE Education Outreach Grants A

SPIE, the international society for optics and photonics—the science and application of light—provides these grants for optics- and photonics-related education outreach projects. Schools, youth clubs, universities, science centers, optics centers, industry associations, and optical societies are eligible for grants of up to $5,000. Projects are judged by their potential to impact students and increase optics and photonics awareness. Apply by **May 31;** consult *http://goo.gl/hbR8Ls.*

June 1

Entomological Society of America's President's Prizes K12

These awards go to teachers who use insects as educational tools. One K–6 and one grades 7–12 teacher will each receive $400 for their schools to purchase the materials they need to expand the use of insects in their curriculum. Both will also receive $400 to present a paper or poster on their use of insects in the classroom at a peer professional venue of their choosing, and free registration and $800 in travel expenses to help them attend the ESA Annual Meeting, at which they'll present their lesson.

Nominate yourself or a colleague for these awards by **June 1.** Learn more at *http://goo.gl/HEbcoq.*

NABT's Prof. Chan Two-Year College Award for the Engaged Teaching of Biology HE

This National Association of Biology Teachers (NABT) award goes to a two-year college faculty member who has successfully developed and demonstrated an innovative, hands-on approach to teaching biology and has shared his or her commitment with the wider community. The winner receives $500 worth of Vernier equipment, a complimentary one-year NABT membership, and $500 for travel to the NABT Professional Development Conference, at which he or she will receive a plaque. Nominate yourself or a colleague by **June 1** at *http://goo.gl/7AD6UK.*

Clif Bar Family Foundation Small Grants A

The foundation provides $7,000 grants to small and mid-sized groups working to strengthen our food system and communities, enhance public health, or safeguard our environment and natural resources. Those that protect Earth's bounty and beauty, reduce environmental health hazards, increase opportunities for outdoor activity, create a robust food system, or build stronger communities are encouraged to apply. Priority is given to those that demonstrate strong community ties and operate at the community level.

Applicants must take a short eligibility quiz before applying by **June 1.** Visit *http://goo.gl/guiG7V.*

Pets in the Classroom Teacher Grant Program P E M H:

These grants go to preK–9 teachers and school librarians who have a classroom pet or would like to introduce one in their classrooms. Funds can be used to buy small pets, pet food, pet environments, or pet supplies. Eight types of grants are available, including $50 sustaining grants to support current class pets and $75 and $125 rebate grants for the purchase of new birds or small pets and reptiles or fish, respectively.

Public and private school teachers and school librarians are eligible; apply by **June 1** at *www.petsintheclassroom.org.*

June 15–30

Mitsubishi Electric America Foundation's Grants for Youth With Disabilities A

The foundation funds innovative projects that help youth with disabilities develop the leadership and employment skills needed for success—particularly in science, technology, engineering, arts and design, and math (STEAM) fields. Grants range from $10,000 to $75,000. Preference is given to projects involving Mitsubishi Electric employee volunteers or their communities in Cypress, Garden Grove, and San Diego, California; Suwannee, Georgia; Vernon Hills, Illinois; Maysville, Kentucky; Cambridge, Massachusetts; Northville, Michigan; Mason, Ohio; Warrendale, Pennsylvania; Memphis, Tennessee; and Arlington, Virginia.

Take the eligibility quiz and submit proposals by **June 15.** Refer to the website *http://goo.gl/zxIhTS.*

NAGT Outstanding Teaching Assistant Awards HE

This National Association of Geoscience Teachers (NAGT) award honors 30 outstanding teaching assistants (TAs) in geoscience education. Winners receive a one-year NAGT membership, which includes subscriptions to the *Journal of Geoscience Education* and the *In The Trenches* quarterly magazine.

Both graduate and undergraduate TAs are eligible. Awardees must be nominated by the department chair or faculty member who coordinates TAs. Submit nominations by **June 15** at *http://goo.gl/Li3jKi.*

ASM's Kishor M. Kulkarni Distinguished High School Teacher Award H

ASM International, the professional society for materials scientists and engineers, presents this award to recognize a high school science teacher who has made a significant and sustained impact on precollege students. The honoree will receive a $2,000 cash grant and up to $500 in travel costs to attend the ASM Awards Dinner.

ASM members can nominate colleagues for these awards. Suggested candidates include past recipients of ASM Foundation K–12 Teacher Grants and graduates of the ASM Materials Teachers Camp. Submit nominations by **June 30** at *http://goo.gl/ZjC1WY.*

Year-Round

VWR Foundation Grants K12 HE

The foundation provides grants to K–12 school science, technology, engineering, and math programs that go beyond the textbook (and are not funded by government or tuition dollars); professional development programs for teachers; and science-related camps for students. Funds can be used to support the purchase of supplies and equipment for such programs or for student or teacher scholarships.

At the college and university level, funds can be used for programs—including scholarships, equipment, and products—that are science-related. Science-related institutions (e.g., science museums) can also apply for grants to help further science education.

Nonprofit programs that have been established for at least three years are eligible. Take the eligibility quiz at *https://goo.gl/qKCMnD.*

Applications are accepted throughout the year and reviewed on a quarterly basis. ●

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

Summer Programs

Editor's Note

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

Smithsonian Science Education Academies for Teachers (SSEATs) K12

These weeklong teacher professional development (PD) programs were created to bridge the gap between formal and informal science education. Each course combines science content and pedagogy with behind-the-scenes experiences at the Smithsonian and other research facilities in Washington, D.C.

Three SSEATs will be offered: Biodiversity (June 17–22); Energy's Innovations and Implications (July 8–13); and Earth's History and Global Change (July 29– August 3) Participants in each course will interact with scientists, curators, and museum educators and learn pedagogical techniques to deliver the content discussed in their classrooms.

K–12 teachers are encouraged to apply. Register online at the website *http://goo.gl/e7wENq* for the Biodiversity workshop by **May 25,** for Energy's Innovations and Implications by **June 22,** and for Earth's History and Global Change by **July 13.**

BioBuilder's Synthetic Biology Workshops H

The BioBuilder Educational Foundation offers three-day workshops to help biology teachers incorporate engineering in their classrooms, labs, or science clubs. Participants receive ready-to-teach lesson plans and 45 PD points. Workshops will take place at these locations:

- Rice University, Texas: June 5–7
- Rockefeller University, New York: July 10–12
- Penn State Hershey Medical Center, Pennsylvania: July 25–27
- Northwestern University, Illinois: July 31– August 2
- BioBuilder Learning Lab, Cambridge, Massachusetts: July 31–August 2
- Universidad Autonoma de Baja California, Tijuana, Mexico: August 6–8

A one-day advanced workshop will be held in Cambridge on August 3 for teachers who have used the BioBuilder curriculum before and want to incorporate DNA assembly techniques and research in their classrooms.

These workshops are intended for high school science, technology, engineering, and math (STEM) teachers, but anyone working in STEM education can apply. Preregistration is required, and scholarships are available. See *http://goo.gl/9nBkMj*.

Intro to Aquaponics Teacher Workshop E M

This workshop at the Herring Gut Learning Center in Port Clyde, Maine, introduces K–8 teachers to aquaponics, the cultivation of plants and aquatic animals in a recirculating environment. During two-and-a-half days (July 10–12), teachers will use the facility's small-scale greenhouse and hatchery and learn how to integrate aquaponics in the classroom through hands-on lessons and experiments. Teachers also receive curriculum materials and an aquaponics kit, which includes a tank, filter, pumps, planting materials, and a manual for their classroom.

Register by **May 31** at the website *http://goo.gl/R33ybR*.

Lawrence Livermore National Laboratory PD Workshops M H HE

The Teacher Research Academy at Lawrence Livermore National Laboratory (LLNL) in Livermore, California, offers programs for middle and high school teachers and community college faculty. Participants engage in a continuum of standards-based instruction, progressing from novice to mastery. Workshops support *Next Generation Science Standards* disciplinary core ideas and scientific and engineering practices. The following workshops will be offered:

- Teacher Research Internships: June 11–August 3;
- 3-D Print and Design: June 11–13 and June 18–22;
- Bioscience: June 13–15 and June 18–22;
- Fusion/Astrophysics: June 20–22 and June 25–29;
- Computational Modeling: July 9–13 and July 23–27; and
- Technical Writing: July 12–13

Continuing education credits and graduate credits from California State University, Chico, are available. Register online at *http://goo.gl/5m5Z4N* at least two weeks before the desired workshop's start date.

NASA GAVRT Summer Institute K12

This institute trains teachers to use the Goldstone Apple Valley Radio Telescope (GAVRT) with their students. Teachers observe phenomena with NASA Jet Propulsion Laboratory and international space scientists and work directly with professional radio astronomers. The institute will take place in three locations:

- Columbia Memorial Space Center (with tour), Downey, California, June 12–14;
- Udvar-Hazy Center, Chantilly, Virginia, June 25–26 and June 27–28; and
- Sydney, Australia, July 23–24.

For more details and to apply, contact *mc@lcer.org* or *kcole@lcer.org*. See also *http://gavrt.lewiscenter.org*.

The daVinci Project: Residential Workshops at UConn E M H

This weeklong series of hands-on workshops aims to help grades 5–12 science, math, and technology teachers expose their students to engineering. During July 9–13, teachers reside on the University of Connecticut campus in Storrs and focus on one of six specialization areas in engineering. They then develop curricula and exercises they can bring back to their classrooms to explore how chemistry, physics, biology, and math are used to solve challenging real-world problems.

Register online by **June 15** at the website *http://goo.gl/qWf6v7*.

Hamline University Rivers Institutes E M

These field-based PD opportunities are meant for teachers of grades 3–8 who want to engage students in STEM investigations at local watersheds. One institute will take place on the St. Croix River during June 25–27, and another on the Mississippi River, July 23–25. Participants receive experiential instruction, 21 continuing education units (CEUs), and additional classroom resources.

Full scholarships are provided to teachers, and graduate credits are available for a fee. Apply at the website *http://goo.gl/iBhANm*.

NASTAR Center's PD Programs K12

The National Aerospace Training and Research (NASTAR) Center's Teacher PD Program offers unique one-day programs. Teachers receive program curriculum, content knowledge, activities that include NASA and Federal Aviation Administration materials, and an actual flight experience in NASTAR's aviation and space training facility. These programs will be offered:

- Flight Physiology (July 9);
- 500 Years of Flight (July 10);
- Atmosphere and Weather (July 11);
- Rocket Science, Stage I (July 12 and July 26);
- Living and Working in Space (July 13 and July 24);
- The Magic of Flight (July 16);
- All About Newton (July 17 and July 25);
- K'NEX Energy, Motion, and Aeronautics (July 18);
- Rocket Science, Stage II (July 19);
- Exploring the Solar System (July 20 and July 27); and
- The Senses in Flight (July 23).

K–12 teachers who are physically able to participate in flight simulations may apply. All programs are free to teachers and will take place at NASTAR headquarters in Southampton, Pennsylvania. Participants receive 48 CEUs from the Pennsylvania Department of Education. Register online at the website *http://goo.gl/XEsjim*.●

The NSTA Learning Center

High quality interactive content for K–12 science teachers

Earn graduate credits and advanced degrees

Affordable and user-friendly

Moderated by world-renowned faculty

Gain knowledge specific to your area of instruction

American Museum of Natural History

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

California University of Pennsylvania

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

Montana State University – Bozeman

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

University of Nebraska

Four campuses, 100+ online programs including Biology, MS; Science for Educators Specialization, MAS; and Science/Math Education, MS Ed. Experience the same rigor, faculty, and support you expect from a leading university. Learn more: online.nebraska.edu

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

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7TH ANNUAL STEM

SCIENCE TECHNOLOGY ENGINEERING MATHEMATICS

Forum & Expo

HOSTED BY NSTA

Philadelphia, Pennsylvania

July 11–13, 2018

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

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

#STEMforum

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

Lower Elementary/Early Childhood

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

Upper Elementary

How do we ensure that our students develop a solid foundation in the STEM areas so that they are prepared to both work and live in the 21st century? The sessions in this strand showcase programs and instructional strategies that support STEM and have been successfully integrated into the elementary core curriculum.

Middle Level

A successful middle school STEM program allows students to create, innovate, communicate, collaborate, and iterate projects that are driven by their own interests. The sessions in this strand showcase learning environments where STEM subjects interconnect to serve as a vehicle for independent problem solving while also meeting rigorous content standards.

High School

As we prepare high school students to enter the workforce and college, students must not only understand but apply their understanding in the context of real-world problem solving. Nowhere is this more important than in STEM for grades 9–12. The sessions in this strand will highlight innovative, hands-on, student-centered approaches to STEM topics that cross subject boundaries.

Partnerships

Leveraging partnerships among community, business/industry, and education-focused entities can be key to preparing students and supporting teachers to meet the needs of a dynamic workforce that is constantly changing. The sessions in this strand highlight select preK–16 partnership initiatives that have been successfully implemented and have demonstrated positive outcomes.

Administrators

This is an incredibly exciting time in education as we shift to support the development of these skills in STEM and across the curriculum. The sessions in this strand will highlight how administrators can best support innovative, hands-on, student-centered approaches to STEM education.

For information and to register, visit www.nsta.org/stemforum

NSTA National Science Teachers Association

ASK A MENTOR, **Advice Column**

Inquiry, Class Discussion, Homework, and Motivation

What are some of the best ways to start and facilitate a class discussion about science topics?

—B., Arkansas

I have used many different ways to get science discussions going. I think the key is to either "wow" them or provide them with some structure to get the ball rolling.

If you have a really good demonstration or discrepant event (such as a skewer through a balloon or an ammonia fountain), the students will perk up and take notice. Have them work in groups to figure out how it worked, then have a full class discussion of the answers.

Start a new topic with a What I Know–Want to find out–Learned (KWL) chart. Have students fill in the K column and at least two items in the W column, then share their work with a partner. They can challenge their partner's knowledge or agree. They may even be able to answer their partner's questions. Anything they learn goes in the L column.

You can have students share their questions with the whole class. This launches the next phase of learning, when they get their answers.

Graphic organizers can spark discussions: A variety are available online. Students start on their own, then share. I found a few online and have them in a collection in the NSTA Learning Center (*https://goo.gl/yZNHNB*).

How beneficial and effective can inquiry-based learning be at the younger elementary school grades (K–2)? What are some ideas for incorporating this type of learning at this level?

—K., Wyoming

I would argue the only way to teach science to our youngest students is through inquiry! Humans were born with innate curiosity and a willingness to experiment. Why not tap into those innate characteristics and provide students the opportunity to observe, experiment, and reach conclusions on topics of their choice?

Make science hands-on, and judiciously guide students with questions. Have them record data in interesting ways that include counting, measuring, representing values with icons or pictures, and using *language*. Don't underestimate a child's ability to observe: When he was in kindergarten, my son asked me, "Why do sunrises look like rainbows?" I was about to answer that they don't, but then I looked out the window to observe…the full spectrum of colors! Watch for misconceptions that we tend to pick up very early in life. Teach your students observation skills and how to explain things using evidence.

Teach students the safe use of magnifying glasses, and have them go outside to look at grass, weeds, trees, insects, wood, metal, concrete, and so on. Create little exploration stations, and give students cameras to record what they observe, organize the photos, and explain. Don't have preconceived ideas of what you want from the stations; encourage out-of-the-box thinking. Don't be afraid that you might not have the answers for them.

Have fun!

A colleague and I were wondering what type of homework works best for our students? How do we hold them accountable?

— N., California

In general, you have to be flexible and adapt to your classes. Different courses, units, and students will create different conditions for homework to be useful. Topics like balancing equations, math/physics word problems, genetics crosses, and others that follow an algorithm require practice and repetition. Projects that require more time than you can afford in class also can be done at home. Give students time in class to familiarize themselves with a topic while you are there to provide support. This time is critical to ensure that the students understand what they are taking home and that you know where they are in their understanding.

THINKSTOCK

Varying your approach will keep students on their toes. You can sometimes just check for completion; at other times, collect and grade homework papers. I often asked students to pull out their homework and I just walked around, giving them a small mark for completion. I might even give them partial credit for partially completing homework!

Be mindful of some concerns with work completed outside of class: Students may copy from others; parents or siblings may "unteach" your lessons; and students may have little free time outside of school. To mitigate these concerns, I rarely gave daily homework and almost never asked for work to be done in one night. This reduced pressure to copy and allowed students to plan around after-school activities and time to ask me questions.

What are some science activities that I can plan for the next school year that will excite my students for the lessons to come?

— C., Arkansas

A host of demonstrations and hands-on activities can impress a class and start off the year with excitement! Try conducting quick science, technology, engineering, and mathematics (STEM) challenges using drinking straws and tape that get students motivated on the first day *and* teach teamwork. Divide the class into small teams to build something. For instance, each team can be responsible for one part of a tower that will be built in half an hour. In 30 minutes, stop and assemble all the pieces into a huge structure!

Discrepant events are also exciting and thought-provoking. Find ones that match your curriculum, but be sure to test them out before demonstrating them. Alternatively, provide groups of students with simple discrepant activities and have them try to explain them to the class. The *Brain-Powered Science: Teaching and Learning With Discrepant Events* series by Thomas O'Brien (published by NSTA Press) features a multitude of discrepant events.

Give teams several science brainteasers and demonstrations and tell them that if they can adequately explain them all, you will give their team an A for the entire course on the first day! Obviously make these too hard for that to happen, but the students will be excited, and they will argue with you about what the correct explanation is!

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

Science in the *Backyard Wilderness*

By Jacob Clark Blickenstaff

In March, I had the opportunity to attend an early screening of a new IMAX documentary, *Backyard Wilderness*, that is screening in science centers and other specialty IMAX theaters nationally. The film's central message encourages kids and adults to explore the natural world all around them just outside their door—and disconnect from electronic devices that keep them inside. When I had the opportunity to speak with her after a screening, Susan Todd, the writer, director, and a producer of the film, affirmed her goal for the film was to support outdoor exploration by every child.

Backyard Wilderness was filmed in Todd's neighborhood in New York State, in and around a home that overlooks a lake and woodlands. We see a family of four (the two children appear to be in high school) living their modern connected life with computers, televisions, tablets, and electronic games entertaining them and keeping them indoors, while a dramatic ecosystem storyline unfolds around them.

The daughter, Katie, begins to engage with the surroundings while working on a class assignment about local ecology. She then decides to study and report on the spotted salamanders she finds living in the vernal pools behind her house. A vernal pool is a seasonal body of water that is filled in the spring and dries up in the early summer. They make ideal breeding spaces for amphibians because fish can't live in temporary pools, and fish love to eat amphibian eggs. In addition, Katie notices insects, birds, and mammals large and small as the seasons bring changes to the vegetation around her home. Eventually, other family members take interest as well, and we see their activity transition from screen time to outdoor time.

When *Backyard Wilderness* is available at nearby theaters, middle school and upper-elementary teachers could use it to support lessons on ecosystems and seasonal changes, and to encourage students to look close to home for inspiration from nature.

Seasonal Variation

The storyline for *Backyard Wilderness* starts in the winter and runs through one year, so we see all four seasons in this part of northern New York. This region provides a great exemplar for seasonal changes, with a cold, snowy winter; cool, rainy spring; warm, moist summer; and cool, dry fall. Kids in the deep South, Southwest, and far western states don't experience what I dub the "*Sesame Street* seasons," the ones typically appearing in books. For example, I grew up in northern California with a Mediterranean climate, where vegetation is brown all summer long, not green, and winter is when the hills are covered with fresh green grass. It makes good sense to use the seasons of the northeast United States as the example, though, since that part of the country has the greatest population density.

The film's beautiful time-lapse sequences show seed growth in the spring, fall color change, and even the development of salamander eggs up close. Seasonal variation in sunlight and changes in star patterns are also depicted in wonderful animated sequences.

Coexisting

Another idea teachers can introduce after watching *Backyard Wilderness* is that not all animals are displaced by human activity. Some even adapt well to living alongside people, though we often think of them as pests. In the film we see several key examples.

Mice successfully nest in our homes and live off of our food. (In talking with Susan Todd, I learned just how challenging it is to film mice nesting and raising their young.) Raccoons are skilled at getting into our garbage cans to find scraps, and can live in attics. Deer are very content to dine on landscaping and make their way over fences and through yards across the country. Feral rabbits are becoming common in my neighborhood in Seattle, though they are not one of the examples in the movie.

Access

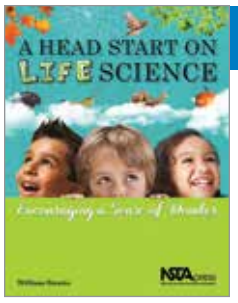
It's important to note that many students don't have the kind of open space in their backyards that we see in the film. Katie's suburban family is well-off, with no shortage of resources to support kids' learning. Folks who live in urban areas may only have public parks, which are usually heavily managed by people and where vernal pools would not be allowed to exist. Getting to open space by public transit can be really difficult for families without cars. It can then be up to teachers to provide outdoor experiences for their students, and so they need to find outdoor field-trip experiences. In the Seattle area, an amazing resource called Islandwood (*https://islandwood.org*) has overnight experiences for upper-elementary students on Bainbridge Island.

Resources

Teachers considering using *Backyard Wilderness* should explore the extensive collection of educator resource materials available at *https://goo.gl/GTSkZT*. The materials include substantial lessons to teach before and/or after seeing the film, and clear links to the *Next Generation Science Standards*. The materials were developed in collaboration with the California Academy of Sciences and include links to academy resources. For teachers seeking ways to integrate science notebooks into their classroom, the academy has developed a set of resources and guides.

Elementary and middle school teachers could use *Backyard Wilderness* to explore seasons or ecosystems, and to excite kids about studying the natural processes occuring all around them. ●

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: *A Head Start on Life Science: Encouraging a Sense of Wonder*

Animal Walk
With Angelica Gunderson

Lesson: Observing, describing, and counting animals

Learning Objectives: Children will go on a nature walk at a local park (or around the school grounds) to observe and count the types of animals that live there and to learn about animals' basic needs.

Materials: Chart paper, markers, data sheet and pencils or crayons to record observed animals; camera, binoculars

Safety: This lesson will involve being outside. As with all field trips, scout out the area before you take children there; make sure the area is safe and free from hazards. Be aware of children in your class who may have allergies, and plan accordingly. Be careful to stay away from poisonous plants. Also, be mindful of roots, obstructions, and other hazards along your path. It will be helpful to have additional adults to help supervise and interact with children.

Teacher Content Background: When asked to consider the animals in the area, children might first think of pets and other domesticated animals. However, your neighborhood—whether urban, suburban, or rural—is home to many different wild animals. An animal's ability to live in a particular place, whether in a city or in the wild, depends on its ability to meet a few basic needs: oxygen, water, food, and shelter. Oxygen is essential for nearly all animal life. Among other roles, oxygen is required at the cellular level to release energy from food (glucose). We most often think of oxygen as a component of air, but it is also dissolved in water. Water is vital to animal life for many, many reasons—which is not surprising, considering that an animal's body is 50% to 95% water. The roles of water include regulating body temperature, digestion, excretion, and the absorption and transportation of nutrients. Food provides sources of energy and nutrients for animal metabolism, growth, and movement. Most species of animals have adapted to use specific types of foods. These specific dietary needs help to determine appropriate habitats for different animals. Shelter provides animals with protection from the environment and from predators. To limit competition between species, most animals have specific needs for shelter. For example, different species of birds that nest in trees will make their nests from different materials and place their nests in different types of trees and at different locations within a tree. The availability of water and different types of food and shelter help to determine the specific animals that can be found in a given area, including neighborhood parks.

Science terms that may be helpful for teachers to know during this lesson include *observe, animal*, and *graph*.

Procedure

Note: For this lesson, focus on larger, more conspicuous animals such as lizards, squirrels, birds, butterflies, and

rabbits. If animals are hard to find, encourage children to search for clues (birds' nests, spider webs, gopher holes, etc.) that might indicate the different types of animals that live in the area.

Getting Started

Introduction: To begin this lesson, get children thinking about animals. Ask them, "What is an animal?" They may initially suggest examples of animals. Welcome these responses, but eventually direct the conversation toward the characteristics of animals, asking children questions such as "Is this table an animal? What about this plant; is it an animal? Why not?" During the discussion, children will point out that animals are living. Follow up on this, asking children for their ideas about what animals need to live. Expect a range of answers, and list each child's suggestions. Review the list with children and have them decide which two to four factors are most important. [*Note:* It's fine if they don't select air, food, water, and shelter as the most important needs. The goal is for young learners to understand that animals live in places that meet their basic needs. Throughout the *Investigating* portion of the lesson, ask children how each animal is able to meet its needs.]

Initial Explanation: Let children know that during their science lesson, they will be looking for animals. Ask children, "What are some of the animals that we might find in our neighborhood?" Record each animal using words and picture support. For each animal listed, ask children, "Where are some places in our neighborhood where we may be able to find this animal? Why would that animal live there?" Have children share their ideas and record these next to each animal, again using words and picture support.

Investigating

Observing: Take the children outside to the location of your planned walk. [*Note:* Be sure to have scouted out your walk ahead of time to identify specific places with lots of animals, as well as possible hazards to avoid.] At several places along your walk, have children sit and look and listen for animals. When an animal is located, ask children if they know the name of the animal, and if needed, tell children the name. Let children share what they know and notice about the animal. Then use questions that encourage children to make more detailed observations about both the appearance (e.g., "What colors does the [observed animal] have?" "What other animal does the [observed animal] look like?" "How is the [observed animal]'s body different from yours?") and the behavior (e.g., "Watch the way the [observed animal] walks; can you imitate the [observed animal]'s walk?" "Where do you think the [observed animal] sleeps? How does it make its home?" "What do you think the [observed animal] eats? How can you tell?") of the animal. Also ask the children about how the animal meets its most important needs. The children can use the binoculars to get a closer look and cameras to take pictures of the animals they see.

Recording Data: Give children data sheets with pictures and names of the different animals discussed during the Getting Started portion of the lesson. Be sure to leave space for children to add additional animals not discussed earlier. On their data sheets, children can record tally marks for each animal they see. Once children have observed and tallied the animals at one location, move to another; let children's interest guide you in determining the number of stops to make. ●

Editor's Note

NSTA Press publishes high-quality resources for science educators. This series features just a few of the books recently released. This excerpt is from A Head Start on Life Science: Encouraging a Sense of Wonder, *by William Straits, edited for publication here. To download the full text of this chapter, go to* https://goo.gl/3cKynq. *NSTA Press publications are available online through the NSTA Science Store at the website* www.nsta.org/store.

SAVE THE DATES

2018
NSTA AREA CONFERENCES ON SCIENCE EDUCATION

Elevating Science
Digging Deeper

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NOV. 15–17

Energize Science
Educate and Engage

CHARLOTTE, NC

NOV. 29–DEC. 1

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- Developing Persistence: The Power of Experience
- Advancing Three-Dimensional Classroom Culture
- Cultivating Constructive Partnerships

Science Education

- Monumental Challenge: STEM Equity, Diversity, and Advocacy via *NGSS*
- Freedom to Become Scientifically Literate
- Cultivating Curiosity in the Capital Region

Energize Science

- Illuminate Literacy Through Science
- Amp Up Science Instruction
- High-Voltage Science Strategies Beyond Standards

Learn more about the NSTA Area Conferences at
www.nsta.org/conferences

#NSTA18

NSTA National Science Teachers Association

(All dates are deadlines unless otherwise specified.)

June 1—Register today to lock in the advance registration rate for NSTA's **Seventh Annual STEM Forum & Expo,** July 11–13. The forum will be held in Philadelphia, Pennsylvania, and features strands targeting concerns specific to lower-elementary/early childhood, upper-elementary, middle level, and high school education, as well as administration and partnerships. Advance registration for members of NSTA, American Association of Chemistry Teachers, American Association of Physics Teachers, American Society for Engineering Education, International Technology and Engineering Educators Association, National Association of Biology Teachers, and National Council of Teachers of Mathematics costs $205. For more information or to register, visit *www.nsta.org/stemforum*.

June 1—Submit your best strategies for teaching **"Motion and Stability: Forces and Interactions"** for the March 2019 issue of ***Science and Children*** (***S&C***)**,** NSTA's peer-reviewed journal for elementary science education**.** 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— ***Science Scope's*** March 2019 issue 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 ***Science Scope's*** April/May 2019 issue**.** 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*.

September 1—Informative assessments can help clarify student understanding and guide instruction, but developing and implementing them can be challenging. Share your innovations with your fellow teachers by submitting a manuscript on **"Using Formative Assessment in Designing Lessons"** for ***S&C's*** July 2019 issue. General-interest manuscripts may be submitted at any time. Read the call for papers at *https://goo.gl/UXBmlh*.

November 1—Help your fellow middle level educators teach about agriculture by submitting a manuscript on the theme **"Farm to Table** (**Agriculture, Soil Chemistry, Botany, Animals**)**"** for the July 2019 issue of ***Science Scope.*** Possible topics include chemical components of soil, factors affecting erosion, plant growth investigations, and field trips. 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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Join NSTA's Journals Team!

NSTA's journals rely on insightful reviewers to evaluate manuscripts and help develop the articles published in each issue. *Science and Children* (*S&C*), NSTA's journal for elementary teachers, and *Science Scope*, for middle school teachers, are seeking manuscript reviewers with content expertise and classroom acumen to help guide authors as they refine their submissions into the inspiring content NSTA members expect.

NSTA's online manuscript submission and review system allows reviewers to select areas of interest (e.g., assessment, physical science, inquiry skills, and so on), and manuscripts are assigned accordingly. Being a member of the review panel is a great professional development experience: Not only do you get to preview the articles, but you also help create them! If you are interested in becoming a volunteer reviewer, e-mail *S&C* Field Editor Elizabeth Barrett-Zahn at *ebarrettzahn@nsta.org* or *Science Scope* Field Editor Patty McGinnis at *pattymcginnis1@gmail.com*. Be sure to include your curriculum vitae.

Science 101

S&C is also seeking an author for its Science 101 column. Science 101 offers "background boosters" for educators—both the science-phobic and the science-savvy, often tied to content from the issue's feature articles or overarching theme (see *https://goo.gl/UXBmlh* for examples of themes). Read past columns at *www.nsta.org/elementaryschool* (search the archives for "Science 101"). To apply for the columnist position, submit a list of at least six potential column topics and one sample column, along with your resume or curriculum vitae, to *s&c@nsta.org*. ●