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THINKSTOCK

NSTA Reports
National Science Teachers Association

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Engaging Students in the STEM Lab

Schools nationwide are adding STEM (science, technology, engineering, and math) Labs, spaces where students can apply science and math concepts. "We have two dedicated 'STEM Labs' spaces," shared by two grade-level groups, K–4 and 5–8, says Jessica Boualavong, K–4 STEM teacher at Town School for Boys, an independent school in San Francisco. "For our STEM program, we integrate engineering projects and skills into traditionally science-based units," she notes.

"One STEM lab is designed for heavy-duty prototyping and experimenting, [with] tool chests and large sinks for easy access and management of supplies and cleanup," she explains. "It's essential to have a very well-defined, student-accessible supply area for prototyping across subject areas."

The second STEM lab "is a forum space with three projectors for...presentations, [where] students can show off their projects or participate in a videoconference," she explains. This space has a smaller Maker Corner where students can do "open-ended tinkering and practice with tools and supplies," she relates.

At Franklin Avenue Middle School in Franklin Lakes, New Jersey, STEM Education Teacher Eileen Antonison teaches a 45-day STEM Lab cycle class. "I developed and wrote the curriculum for my [grades 6–8] integrated STEM courses that are aligned to the full-year core science classes…I collaborate with the science teachers to make sure we're supporting [one another]" and not assigning duplicate projects, she relates.

BILL GILMORE

In the STEM Lab at Englewood Middle School in Englewood, Colorado, eighth graders discuss plans for building a quadcopter drone of their own design. Students in the Englewood school district research the careers associated with each of their STEM Lab projects.

For example, seventh graders study life science in their science classes and "bioengineering—life science and environmental engineering," in STEM Lab, she notes. In science, they study photosynthesis; in STEM Lab, they build, use, and collect data from photobioreactors, systems that use light to grow algae using only the photosynthetic mode of cultivation.

Some schools are adding STEAM (science, technology, engineering, arts, and math) Labs. "[W]e built brand-new [ones] in all five of our elementary school[s]," says Tara Kristoff, director of curriculum at Cook County School District 104 in Summit, Illinois, a K–8 school district with high percentages of English language learners and students living in poverty. STEAM classrooms "are state of the art with writable wall[s], windows, and furniture...[T]he furniture is movable to encourage collaboration and discussion," she explains.

The curriculum delves "deeply into *Next Generation Science Standards* (*NGSS*) science and engineering instruction and assessment," she asserts. For example, first graders learn in science class that waves make sound through a material.

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STEM Lab, from page 1

In STEAM Lab, they create their own drums using different materials and see which sounds they make, and draw the type of sound waves that match their drum's sound. "Students see the connection of science to everything else in the world," Kristoff contends.

General education teachers and STEAM teachers co-teach the class. "Many K–5 teachers in our district who [don't] feel confident teaching science are becoming confident with the help and support of" STEAM teachers, who have been trained "in the pedagogy shift of *NGSS* and truly embody the three dimensions in their teaching," she maintains.

In group projects, students practice teamwork, compromise, and conflict resolution—"the skills to be the best STEM employee possible," she asserts. "Most importantly, we have [groups] who have been historically [considered disinterested] in STEM thinking about [future STEM] careers."

Focus on Careers

In the Powhatan County Public Schools district in Powhatan, Virginia, every school has a full-time STEM lead teacher, and "we have two full-time STEM coaches for our K–5 [STEM Lab] program" because "we believe by building interest early, our students will not only have a better understanding of the types of work people in STEM career fields do, but also they will be more likely to pursue STEM electives" and STEM careers, says Libbey Kitten, K–12 science/STEM curriculum specialist.

The program's design was based on recommendations from a steering committee of parents, teachers, engineers, and representatives from local businesses. "We're a small, semi-rural district with limited resources, but we have discovered that if you build it, and you have the support of your community, the money will come," she relates.

STEM Lab teachers in Colorado's Englewood School District are certified "through the Colorado Department of Education as CTE [Career and Technical Education] STEM teachers," says Bill Gilmore, the district's STEM coordinator and STEM coach. "We have STEM Labs in…our high schools, our middle school, and one elementary school. We hope to [expand to all elementary schools] and our preschool by fall 2017."

STEM Labs "are stand-alone… classes at the middle school and high school level, and specials at the elementary level…We want these spaces to be places where students can be creative, collaborate, think outside of the traditional boxes, and fail in an environment where failure is expected and part of the process," he maintains. "We have three STEM pathways for K–12, based on Colorado's economy: computer science; natural resources and energy; and engineering, robotics, and advanced manufacturing. In the STEM Lab, students are free to come up with ideas and apply them through a pathway, following the design process," he explains. Students "explore careers related to their projects and connect their projects to their core classes."

Providing Enrichment

Crocker High School in Crocker, Missouri, offers STEM Labs as enrichment, says science teacher Marteen Nolan. "Enrichment activities have proven to be strong incentives for our students," she asserts. Students need "at least a C average and no Fs, 95% attendance,...and no written disciplines" to participate, she explains. Students in level two, Thinking Labs, which involve high-level STEM activities, must have a B average and 100% attendance.

Students in Thinking Labs can program robots, use a 3D printer "for agricultural structure creation," or join ExMASS (Exploration of the Moon and Asteroids by Secondary Students), an independent research project with a NASA mentor scientist, says Nolan.

STEM enrichment time gives other teachers time to help struggling students, explains Nolan. "This works well in a smaller school like ours…in a rural, high-poverty community..., [and] we're seeing trends in the right direction so far in all subjects that are tested." ●

COMMENTARY: **Erica Green**

Block Building Fosters a Child's Scientific Mind

By Erica Green

Erica Green

Spend any length of time with young children, and you will quickly discover that they are natural scientists and engineers. At the playground, park, beach, or sandbox, you will find children planning out and constructing a multitude of creations. Take the beach, for example. A favorite activity for children is to dig in the sand, making channels and culverts, adding water and watching it flow, shifting and changing walls and hills, building tunnels and digging out mudslides.

Now transfer these natural skills to the block area in an early childhood classroom. The scientific and engineering practices within block building are varied and numerous. Not only do blocks foster social connections and develop group skills, they also encourage engineering habits, reinforce cause and effect, develop inquiry skills, and introduce properties of physical science.

As children build with blocks, they often do so with other peers, either developing a plan in advance or constructing one as they go. The most popular ideas include castles, cities, tunnels, roads, houses, and bridges. Often, as children place blocks on towers, they will discover the property of cause and effect. As they put blocks on top of one another, testing out theories of size and weight, they discover that buildings crash down when too much weight or too big of a block is stacked in relation to what is underneath.

While some children recognize this concept more easily than others, a quick conversation can bring attention to this design flaw, and point out how to modify the plan to make the building stable. Children who have experience with blocks will bring up the necessity of a larger base as a way to anchor a design and keep it steady. When this experience is shared with the rest of the group, new learning takes place as peers educate one another through science and engineering.

Along with cause and effect, many properties of physical science can be found in the act of building with blocks. These properties include force and center of gravity, tension, design, stability, practice, characteristics of materials, and spatial awareness. Although the children are playing as they build, their brains are making connections about what will work and what won't.

If they plan to build a tunnel, they are thinking about what a tunnel looks like and what is needed to make that tunnel. If the plan includes rolling cars underneath, then the tunnel needs to be constructed in relation to the size of the cars. As the children use arch-shaped blocks as they go, they make decisions: Putting an arch between two other blocks helps to create the compression that will keep the arch in place. Making a tunnel with no gaps in the ceiling or enough room to move around existing structures to play involves spatial awareness.

Building with large wood blocks varies greatly from small wood blocks, as it does from cardboard or foam. Based on what material is used, the property characteristics will change the design, center of gravity, stability, and tension of a structure.

As children become involved in building, they are also strengthening their inquiry skills. As they create and design, questions are asked about what they are doing. Builders may ask these questions of one another or of themselves as a way of clarifying ideas and concepts. They observe their structure: *Will it fall? Will it stay up? What will happen if I put this block over here to build a ramp?* These types of questions, while simple to some, signify quite a bit of thought and planning is involved.

Other inquiry skills play a part in building with blocks. Children plan their design together, predict what is going to happen, explore different building strategies, investigate methods of construction, and discuss the results. As science and engineering are connected, a group can be taught how to build with blocks in an architecturally sound way. Any curriculum can incorporate this important material; studying the places we live, whether rural or urban, or local businesses, such as a market or a fire station, can provide the chance for rich discussions in the block area.

Blocks are an integral part of any early childhood classroom. Not only do they create opportunities for peer interactions and social connections, but they also play a great role in fostering the scientific and engineering frames of mind of young children. ●

Erica Green received her master's degree from Bank Street College, and has been an educator of young children for more than 17 years. She is passionate about inquiry science and engineering design, having fully incorporated both into her kindergarten classroom. She has presented sessions on these topics at the National Association for the Education of Young Children's national conference and most recently, the NSTA STEM Forum and Expo. She can be e-mailed at egreen@fwsu.org.

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Science + Movement = Increased Learning

"I believe all students benefit from movement during science lessons because it promotes full participation, active engagement, and retention of new ideas. I notice an improvement in building connections between concepts and recall when students are moving," maintains Ann Kennedy, fourth-grade teacher at Robert Crown School in Wauconda, Illinois. "Throughout all of our science topics, I find ways to get students moving and thinking on their feet!"

Kennedy says she regularly incorporates movement into her science lessons "to engage students with disciplinary core ideas." Her students "often act out concepts (such as particle movement in a solid, liquid, or gas). We use physical cues or gestures to build connections with academic vocabulary," she explains, adding, "I frequently have students use movement to act out academic vocabulary. This activates memory about the meaning of a new term or concept."

When she added movement to a lesson about positive and negative charges, for example, she says she "noticed that students had a better understanding. We used hand-claps to show how opposite charges attract and like charges repel. By saying 'negative, negative' or 'positive, positive,' students would separate their hands, and with 'positive, negative,' students clapped their hands. The repetition of this activity reinforced the concept while generating enthusiasm. In fact, students requested that we review this particular topic because they were excited to show what they learned using the movement activity!"

In lessons about the Periodic Table, Kennedy uses movement "to help students identify and understand the organization of the elements. Each student will be assigned an element and will record the symbol, name, and atomic number from the Periodic Table on an index card. The student will then 'represent' that element as I guide the class through a movement activity," she relates.

"For instance, students with an element that is a non-metal may be asked

JACKSON BRASWELL

Students in Trudi Spencer's physical education lab at Sonora Middle School in Springdale, Arkansas, read and study while using fitness equipment.

to stand. All of the elements in the second period may be asked to march in place, and so on. Through this lesson, students actively participate in using the Periodic Table to locate elements while developing an understanding of how the elements are classified," she contends.

"Since we all learn differently, I feel that movement is another tool to support a variety of learning needs," she observes. "Along with using visuals, language arts connections, and technology, movement adds another dimension, to the benefit of all. Some students, such as English Language Learners, may especially benefit."

Though Kennedy allows that "adding movement can be a challenge when time is limited," she believes "using even three minutes of movement during a lesson can provide the stimulus for a deeper understanding." She also encourages science teachers to work with their students' physical education (PE) teacher: "I think many crosscutting concepts could be modeled in large spaces by using the gym or playground. Coordinating with the students' [PE] teacher could provide a great extension to a lesson to further reinforce core ideas."

Action Based Learning

Trudi Spencer, PE/Health Department Head at Sonora Middle School in Springdale, Arkansas, would agree with Kennedy. "I work with our science teachers, and we review content that they are learning in class," she reports. "I check with the math and science teachers to see what the students need."

Spencer has received training in Action Based Learning (ABL), a program of kinesthetic teaching strategies for teaching specific academic concepts (see *http://abllab.com*). She points out that "85% of people are kinesthetic learners. It's hard [for them] to just sit and listen to the teacher." And with many of Sonora's students living in poverty and "far behind in their classes, I wanted to make [learning] more creative and fun for [them] and improve their knowledge and health," she asserts. Data showing ABL's success convinced her school's teachers and instructional facilitators that it was worth a try, she observes.

In her lab, Spencer has 22 stations with treadmills, elliptical machines, recumbent bicycles, and other fitness equipment that has been modified to hold books and other written materials. The equipment, developed by Kidsfit (*www.youthfit.com*) for use with ABL, allows students to read and study "a small passage of text, science or social studies vocabulary words and articles, math problems," and other content, she explains, adding that classroom teachers often give her the vocabulary words at the beginning of a unit so students can become familiar with them in advance.

Having movement "brain breaks" before learning new material "makes the brain ready to learn," she contends, and "the movement helps them remember it." As students use the equipment, "I help them review what they've been learning" by asking them to reflect on what they have learned and discuss the projects they're working on, she explains.

In one of her success stories, three weeks after starting ABL, a student known for misbehaving and having trouble keeping up with his peers has now "caught up in class and has no discipline problems. He can do what he is assigned to do," she reports.

"ABL isn't really new. Sometimes we forget about what worked before. Running and playing is how they become better students," she maintains.

Gaming and STEM

Sandy Slade—creator of Skillastics®, a fitness and learning program—says the demand for PE teachers to integrate academics and physical activity is increasing. She developed STEM Skillastics (*https://goo.gl/NQlzoV*) for grades 3–6 because "it's important to get students interested in [science, technology, engineering, and math]. STEM takes time [to teach and learn], so integrating STEM and movement can spark kids' interest" early on, she contends.

In STEM Skillastics, student teams do physical activities such as toe-taps, leg swings, and heelwalking that coordinate with cards featuring general STEM knowledge questions for them to answer. Questions include What is the largest planet in our solar system? (science); Which state-of-the-art computer technology trains pilots? (technology); What type of bridge is San Francisco's Golden Gate Bridge? (engineering); and Which of the following figures doesn't have four sides? (math).

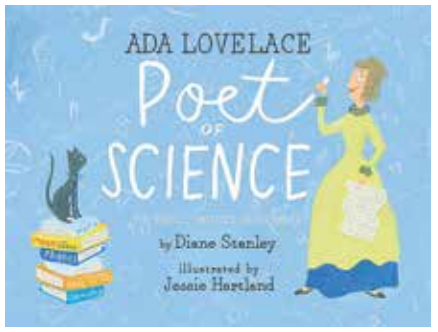
Slade says she researched the questions and had experts—including teachers around the country—review them. "I looked at the *Next Generation Science Standards* and tried to complement them," she explains. The game aligns with national PE standards and after-school Healthy Eating and Physical Activity Guidelines.

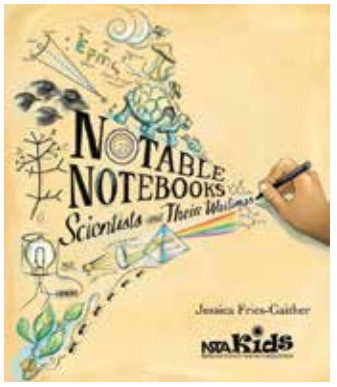
She emphasizes that "in a positive, non-competitive environment, students of all abilities can enjoy STEM Skillastics, not just the athletic students." On the student teams, "every child has the opportunity to be the team leader, and the teams work independently of one another." Because of this, the game has become "very popular with 21st-century learning organizations," she contends.

STEM teachers are using the game as "a brain-break in class," and it is used widely in after-school programs, Slade reports. It can be played in "a variety of environments," including outdoors, she notes.

Slade observes that "being an athlete, I was more interested in going outside and playing. This type of learning would have been much more interesting to me. My motivation is to spark that interest in STEM in athletic kids who may also have a STEM skill." ●

2017 Outstanding Science Trade Books Include Engineering, Design

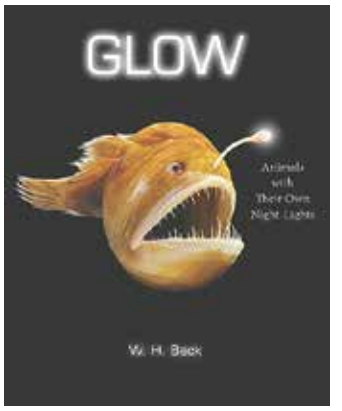




The 2017 list of Outstanding Science Trade Books (OSTB) includes more than 50 books found to help children build literacy skills while learning science content, chosen by a book review panel composed of educators selected by NSTA in cooperation with the Children's Book Council. This year's list includes books that address engineering and the design process, as well as science. Topics include the Moon, Ada Lovelace, insects, disease, and ecology. Download the list and lists from prior years at *https://goo.gl/0Zv0Mp*.

The 2017 OSTB are

- *About Marine Mammals*, by Catherine Sill, illustrated by John Sill
- *Ada Lovelace, Poet of Science*, by Diane Stanley, illustrated by Jessie Hartland
- *Ada's Ideas*, by Fiona Robinson



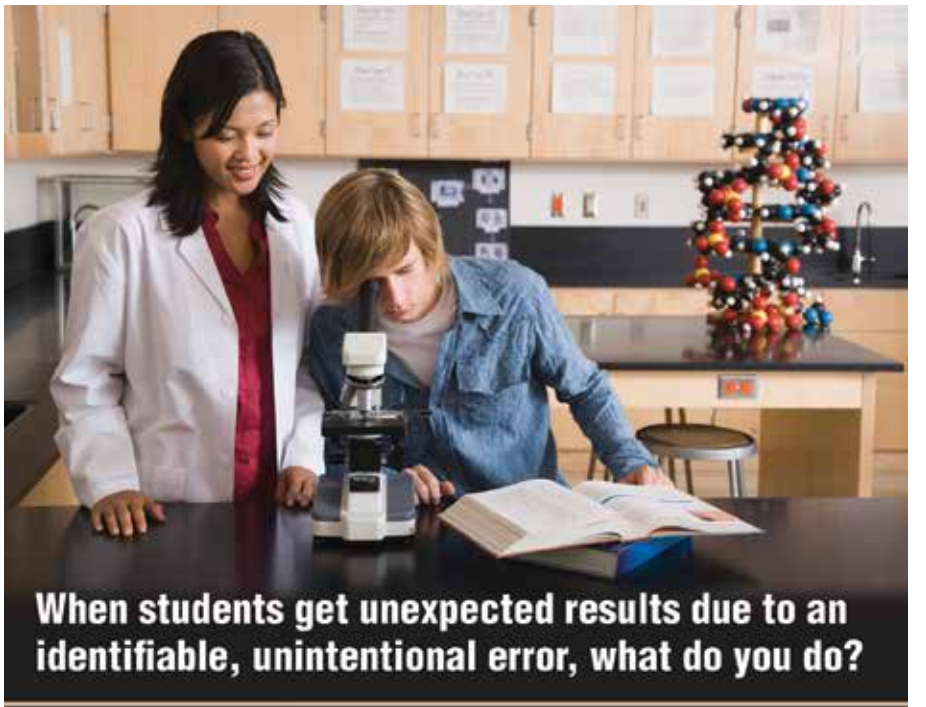
- *After A While Crocodile*, by Brady Barr and Jennifer Keats Curtis, illustrated by Susan Detwiler
- *Ancient Earth Journal*: *The Late Jurassic*, by Juan Carlos Alonso and Gregory S. Paul
- *Animals by the Numbers*, by Steve Jenkins
- *Because of an Acorn*, by Lola M. Schaefer and Adam Schaefer, illustrated by Frann Preston-Gannon
- *A Beetle Is Shy*, by Dianna Hutts Aston, illustrated by Sylvia Long
- *Best in Snow*, by April Pulley Sayre
- *Bubonic Panic*, by Gail Jarrow
- *Charles Darwin's Around the World Adventure*, by Jennifer Thermes
- *Chasing at the Surface*, by Sharon Mentyka
- *Circle,* by Jeannie Baker
- *Cleared for Takeoff,* by Rowland White
- *Day of the Dinosaurs*, by Steve Brusatte, illustrated by Daniel Chester
- *Every Breath We Take,* by Maya Ajmera and Dominique Browning
- *Feathered Dinosaurs*, by Brenda Z. Guiberson, illustrated by William Low
- *Florence Nightingale*, by Catherine Reef

- *Flying Frogs and Walking Fish*, by Steve Jenkins and Robin Page
- *Giant Squid,* by Candace Fleming, illustrated by Eric Rohmann
- *A Global Warming Primer*, by Jeffrey Bennett
- *Glow*, by W. H. Beck
- *Good Trick, Walking Stick!* by Sheri M. Bestor, illustrated by Jonny Lambert
- *Great White Shark Scientist,* by Sy Montgomery and Keith Ellenbogen
- *Grow! Raise! Catch!* by Shelley Rotner
- *Hopping Ahead of Climate Change*, by Sneed B. Collard III
- *I, Humanity*, by Jeffrey Bennett
- *If You Are a Kaka, You Eat Doo Doo*, by Sara Martel, illustrated by Sara Lynn Cramb
- *Illuminature,* by Rachel Williams, illustrated by Carnovsky
- *Insects,* by Seymour Simon
- *Inside of a Dog,* by Alexandra Horowitz, illustrated by Sean Vidal Edgerton
- *Manatee Rescue,* by Nicola Davies, illustrated by Annabel Wright
- *Marie Curie for Kids*, by Amy M. O'Quinn
- *Milestones of Flight*, by Tim Grove
- *Natural World,* by Amanda Wood and Mike Jolley, illustrated by Owen Davey
- *Nefertiti, the Spidernaut*, by Darcy Pattison, illustrated by Valeria Tisnés
- *Next Time You See a Cloud*, by Emily Morgan, photos by Judd Patterson, Tom Uhlman, Steven David Johnson, and NASA
- *Notable Notebooks*, by Jessica Fries-Gaither, illustrated by Linda Olliver
- *Octopuses One to Ten*, by Ellen Jackson, illustrated by Robin Page
- *Our Food,* by Grace Lin and Ranida T. McKneally, illustrated by Grace Zong
- *Our Moon*, by Elaine Scott
- *Owls!* by Laurence Pringle, illustrated by Meryl Henderson
- *Peeking Under the City*, by Esther Porter, illustrated by Andrés Lozano
- *Platypus,* by Sue Whiting, illustrated by Mark Jackson
- *Poop Detectives*, by Ginger Wadsworth
- *Radioactive!* by Winifred Conkling
- *The Rock and Gem Book*, published by DK
- *The Secret Subway,* by Shana Corey, illustrated by Red Nose Studio
- *Solving the Puzzle Under the Sea*, by Robert Burleigh, illustrated by Raúl Colón
- *Squirrels Leap, Squirrels Sleep*, by April Pulley Sayre, illustrated by Steve Jenkins
- *Strange, Unusual, Gross & Cool Animals*, by Animal Planet and Charles Ghigna
- *Super Cool Tech,* published by DK
- *The Story of Seeds*, by Nancy Castaldo
- *Super Gear,* by Jennifer Swanson
- *Treecology,* by Monica Russo
- *Under Water, Under Earth*, by Aleksandra Mizielinska and Daniel Mizielinski
- *Whoosh!* by Chris Barton, illustrated by Don Tate ●

Teachable Moments From Unexpected Lab Results

Students getting unexpected lab results seems to be a universal challenge for science teachers, with 100% reporting their occurrence in a recent informal *NSTA Reports* poll. Measurement error was the most commonly cited cause (40%), while 13% said students omitting a step in the instructions led to errors.

When the unexpected results are caused by an identifiable, unintentional error, 42.7% of science educators said they pool the class data and have an error analysis discussion. Thirty-two percent say they have the students use the collected data and note the error and its potential effects. When results are due to an intentional deviation from the lab directions, 67.6% say they ask students to explain why they didn't follow directions before taking other actions. Nine and a half percent say they create and teach a lesson on the choices that lead to flawed data. Only 2.7% said they either remove the students from the lab immediately or give them no credit for the lab.



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Here's what science educators say they do when students collect unexpected data that are not the result of an identifiable error:

There are simply results that deviate from the expected. (I had that happen in an experiment with Fast Plants, and it may have been [due to] the age of the seeds).—*Educator, Elementary, California*

We talk about what [might] have [gone] wrong and how to fix it. —*Educator, High School, Florida*

Explain that science isn't a cookbook; that mistakes happen: [G]lassware could have been dirty; [someone] didn't pay attention and used tap water instead of distilled water, etc.—*Educator, Institution of Higher Learning, Colorado*

It's science. Things happen, we try, we fail, we learn from mistakes.—*Educator, High School, Louisiana*

I tell them that science is not a perfect art form, and that in real life, in labs all over the world, the same thing happens. I also tell them that is why in real life, not a school lab, the experiment must be repeated many times to rule out "flukes."—*Educator, High School, Department of Defense Education Activity, Europe*

We discuss reasons for different results—errors in procedure or measurement, or true, if unexpected, data. I reinforce the learning goals (the scientific core idea *and* the scientific practices). Honesty is one of our school values, so students must report their own data, but may add in info[rmation] about other (more expected) results. —*Educator, Elementary, Washington, D.C.*

Use the moment to discuss why scientists repeat experiments.—*Educator, Middle School, Michigan*

We make a hypothesis list as a class on why the data deviated from our expectations.—*Educator, Informal Education, Idaho*

Try to figure out the cause of the incorrect data. A possible [teachable] moment. Possibly [a] demonstration that teachers aren't always right! —*Educator, High School, California*

I use it as a teachable moment to discuss that sometimes experimentation doesn't happen as planned. We discuss reasons why, such as human error and experimental design flaws.—*Educator, Elementary, Alabama*

We try to talk about random error, but the students often do not understand this concept.—*Educator, Middle School, Texas*

Ask students what they think could contribute to error: Why is our data not perfect? Where could things have gone wrong? Then [I] explain to [the] full class, using student answers, why the results were unexpected and what probably caused them. Even students who got good data can benefit from that discussion.—*Educator, High School, Wisconsin*

Teach critical thinking so that students realize that that teachers, lab books, texts, etc., aren't infallible.—*Educator, Middle School, Georgia*

Explain how we do not have all of the supplies we need and that we [are] doing our best.—*Educator, Elementary, Alberta, Canada*

Explain the importance [of] reading and *following* directions and measurements and how this could be fatal if they were working for someone in the pharmaceutical field.—*Educator, Middle School, Washington*

I tell the students what the results were supposed to have been, and we discuss what could have gone wrong. If there is time, we will try the experiment again.—*Educator, Elementary, Florida*

Ask the students to devise another, different experiment that would investigate the same issue, and run it, if time allows.—*Educator, High School, New York*

I follow up most labs by having students whiteboard results and holding a discussion. Usually this makes it clear to all groups what their results should look like.—*Educator, High School, Minnesota*

[We t]ry to identify error or limitations of experiment; discuss the importance of repeating experiments and having multiple trials to ensure reliable data.—*Educator, High School, Louisiana*

I usually tell the students that science is uncertain, but repeatable. I'm not worried about their unexpected data unless it happens in the same way again and again.—*Educator, High School, Indiana*

We discuss why the error happened, and how it changes our results. —*Educator, Elementary, Illinois*

Pooling data always allows for interesting conversations about results and possible mistakes along the way. —*Educator, Elementary, New York*

Usually there is enough data from the rest of the class that we can extrude the concept being studied from the group data. It is a great opportunity to show that more data makes

for a more convincing conclusion.—*Educator, High School, Ohio*

[We t]ry to figure out what happened. [We d]iscuss that this is part of the scientific process.—*Educator, Middle School, Texas*

Try to analyze with students possible causes of the unexpected results.—*Educator, Institution of Higher Learning, Oklahoma*

We talk about it as a large group. I ask the students if they can think about a variable unaccounted for, or if they can think of a reason for the anomaly. We then discuss why it is so important to collect large data sets in case anomalies occur.—*Educator, Elementary, Ohio*

[I h]ave them writ[e] about them in a report (conclusion: what happened, and why do you think this happened?).—*Administrator, Elementary, Middle School, High School, Washington, D.C.*

[I s]ay that's science, and have students work with the unexpected results for calculations/graphing/etc.—*Educator, High School, Michigan*

Sometimes we redo the lab or brainstorm factors that might skew results. We discuss the importance of a large data pool.—*Educator, Elementary, New York*

The data is what it is. They are to draw conclusions from the data they collected.—*Educator, High School, New York*

Pool the class data and hold an error analysis discussion as part of a teachable moment.—*Educator, High School, Maine*

Science is not always black and white. It is a teachable moment to address variables seen or unseen or unexpected results and how scientists deal with [them].—*Educator, High School, New York*

We work to figure out why and incorporate that into the lab write-up.—*Educator, High School, North Carolina*

If we can determine the cause, we keep the data and discuss findings, ideas for cause in conclusion; sometimes we repeat the investigation or portions of it.—*Educator, Elementary, Minnesota*

Ask students what had happened, what are the reasons for the phenomenon and other teachable moments. It is the process that [is] important; it is not always about the results. Error analysis is also an important part of real science processes.—*Educator, High School, California*●

Quotable

We do not learn from experience … we learn from reflecting on experience.

—John Dewey, American philopsoher, psychologist, and educator (1859–1952)

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Freebies for Science Teachers

Science Action Club. M This nationwide, after-school science, technology, engineering, and math learning program features games, projects, and hands-on activities that middle level students can use to investigate their local environment. The program also lets them use citizen science to document discoveries, share data, and design strategies to protect our planet. Teachers can watch videos of students participating in citizen science experiences and access sample activities from program units—such as Bugs in Your Schoolyard, Clouds in Your Schoolyard, and Birds in Your Schoolyard—at *https://goo.gl/YnUY0C.*

Practices Resources in Science and Math (PRISM). K12 This website is for teachers who want to learn more about engaging students in the Science and Engineering Practices as described in the *Next Generation Science Standards* (*NGSS*) and in the Mathematical Thinking Practices as described in the *Common Core State Standards* (*CCSS*). The site presents videos of students and teachers engaged in the Practices together, interviews with teachers about shifts in instruction, and frames for thinking about integrating the Practices into learning. This is not a "go-find-a-lesson" website, but an "explore-how-these-lessons-look" website designed to promote meaningful discussion among colleagues. Consult *www.practices-resource.com.*

PAUL STEIN FROM NEW JERSEY, USA

Hive Alive! Honey Bee Lessons. E: Targeted for fourth graders, but adaptable for learners of all ages, these five lessons and accompanying background materials from Sweet Virginia Foundation, a working apiary and farm in Virginia, introduce students and teachers to the wonders of the honey bee. Learn about the structure and function of the honey bee anatomy (Bee Bodies); what makes the inside of a honey bee hive fascinating (Everybody Has a Job!); the honey bee's roles in the community, ecosystem, and world (Tiny Bug, Huge Role); how honey bees manage their community (Swarm); and how honey is made and used (Honey). Access the lessons online at *www.sweetvirginia.org/hive-alive.*

Solar Eclipses 2017. M H The Astronomical Society of the Pacific (ASP) has collated resources about the science of eclipses and the upcoming total solar eclipse on August 21. The collection features books, magazine articles, websites, and animations, most of which are best suited for middle and high school classrooms. While the *ASP Eclipse Resource Guide* is likely the most useful because it presents many resources in a single central location, perhaps the most inspiring resource is the article "Confessions of an Eclipse Chaser," which chronicles the author's reactions to her first solar eclipse and how the event changed her life. Visit *https://goo.gl/1RBNX7.*

Cube for Teachers. A Looking to participate in a K–college educational sharing network? Thousands of educators are currently connecting, collaborating, and crowdsourcing their favorite resources at the Cube. This site saves teachers valuable time by providing instant access to peer-recommended digital resources. Members share resources in three main categories: Standards-Supported Resources, Tools and Technology, and Other Teaching Resources (i.e., strategies, ideas, and shared blogs). Users can also create private professional groups, which offer a personal search engine of shared web resources by group members and a discussion forum for ongoing dialogue, support, and idea sharing. Visit the website *www.cubeforteachers.com.*

Sloan Science and Film Teacher's Guide. K12 Published by the Museum of the Moving Image, with funding from the Alfred P. Sloan Foundation, this guide presents companion pages for 46 science-themed narrative (fiction) films for elementary, middle level, and high school classrooms. Each companion page highlights a single film and includes running length, suggested audience, plot summary, science questions for students to consider, and science resources for further engagement. Access the guide at *https://goo.gl/DdfLKV.*

History of Chemistry. M H The Chemical Heritage Foundation offers resources that highlight the stories of chemistry and the people behind them. At *https://goo.gl/XIaRVH,* teachers will find historical biographies and videos, iPad apps, role-playing games, and interactive timelines that make the history of chemistry come alive. Watch Women in Chemistry video segments, design a personal chemistry laboratory with the ChemCrafter app, or debate multiple perspectives on

See Freebies, pg G2

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

Freebies, from pg G1

plastics. The possibilities are as interesting and diverse as chemistry itself!

NASA/ROBERT THIRSK

Space Station Explorers. K12 Visit *https://goo.gl/HWzcEI* to learn about this amazing outpost in space, get to know the astronauts actively doing research there, and possibly launch an experiment of your own. The site features a searchable database of K–12 lesson plans; search for lessons by subject or grade. Selected titles include LS5 Cool Space Suits and Rockets Wind Tunnel (elementary); Human Needs in Space and Testing for Life's Molecules (middle level); and Pervasive Polymers and Those Wacky Invisible Waves (high school).

Expii.com. H HE This interactive digital math and science textbook for high school and college learners operates like a wiki. Anyone can author a section, which may include photos, videos, text explanations, and quiz questions to test the reader. Science subjects covered in Expii include astronomy, biology, chemistry, physics, and Earth science.

While a standard textbook can't adapt to each individual learner, Expii.com can. In Expii, topics are built to support multiple explanations, which helps learners build deeper knowledge of a topic by connecting with others who offer explanations that make sense to them. Learn more and share your knowledge at *www.expii.com*.

Next Generation Science Assessment Portal. M At *https://goo.gl/tT4Gp2*, middle level teachers can familiarize themselves with *NGSS*-style assessment tasks. The website currently offers performance expectations clusters in the areas of Chemical Reactions and Energy and Energy and Matter, with tasks for life science currently being developed. Teachers who register for a free teacher account can create classes, assign specific tasks, and get collated reports of student work. A detailed user manual can help teachers maximize the portal's resources.

Spectra Comic Series. M Follow the adventures of Spectra, a middle school superhero who possesses the powers of a laser beam. Through eight volumes (with a ninth on the way), Spectra and friends meet and overcome challenges and obstacles through physical science, addressing topics such as power, force, heat energy, water flow, quantum physics, and electric current. The comic is produced by PhysicsCentral.com, the American Physical Society's website dedicated to promoting physics for everyone. Read the series at *https://goo.gl/htyhPE*.

Listenwise. M H Teachers often want help finding stories, aligning them with the curriculum, and writing lesson plans. Listenwise, a listening and comprehension tool available online at *https://listenwise.com*, helps teachers do just that by bringing authentic voices and compelling nonfiction stories to the classroom. Targeted for middle level and high school classrooms, the website curates the best of public radio and develops learning materials, including lesson plans and graphic organizers, around the content. Current science stories include "Genetic Engineering Is Controversial But May Stop Zika" and "How Wind Affects Wildlife." (Note: The podcasts can be played directly, but free registration is required to access the accompanying teaching materials or organizers.)

The Show About Science. K12 Meet Nate, a curious kid and six-year-old host of this podcast series brimming with interesting facts and information from scientists around the globe. When Nate's not working hard at school, he's busy interviewing scientists, punk rockers, his mom, and others about animals, medicine, and other important scientific matters. The series covers a quirky, yet enjoyable range of topics, with episodes on everything from Fake Sugar and Fruit Flies to Santa Science and the Physics of Christmas. Access the series at *https://goo.gl/XCRzZ7*, or subscribe to the podcast in iTunes at *https://goo.gl/HZBV8c*.

GladeoX.org. M H This career exploration site can help middle and high school students discover their strengths, explore interesting careers, and find out how to pursue them in the real world. Through inspiring videos, career profiles, infographics, and live-streaming question-and-answer sessions, students can learn about themselves while gaining knowledge about potential careers.

Are you a builder, creator, organizer, or "people person"? Take the excelorator quiz to determine your personality type and choose your industries of interest. The computer then matches your responses to potential careers. The site also includes profiles of specific careers, including job facts and stats, education necessary to hold the job, and suggestions for landing a first job in the field. Visit *www.gladeox.org*.

EL C, U.S. DEPARTMENT OF AGRICULTURE

Wildfire Safety Videos. M H Do you know how fast a wildfire moves? The damage it can cause? What you can do to make yourself safer? Find the answers to these and other questions by taking a virtual field trip to the scene of a wildfire. This three-part video series and accompanying lesson plans for students in grades 6–12, produced by the National Fire Prevention Association as part of the TakeAction! Teens for Wildfire Safe Communities campaign, examines what happens to people, property, and natural areas one year, five years, and 10 years after a major wildfire. A fourth video offers tips for teens to take action to prevent wildfires. The materials support *CCSS* for language arts and can be used in both the classroom and in community outreach efforts. Consult *https://goo.gl/N1YUF5*.

The Wild Bird Club. K12 Students, teachers, and parents can share their love of birds in Cornell Lab of Ornithology's Wild Bird Club. Each month, the club's website features activities, quizzes, bird news, and other tips. You can also sign up for a free monthly newsletter. Teachers will especially appreciate the Citizen Science page, which features news about grants and articles such as "Top Three Signs That Birds Are Nesting Near You" and "When Does A Songbird Migrate? Depends On What It Eats." See *http://wildbirdclub.com*.

Wisconsin Instructional Resources Review Tool for Science. K12 The Wisconsin Department of Public Instruction and Wisconsin Society for Science Teachers prepared this rubric for educator teams to use to evaluate science education textbooks or other large-scale sets of instructional resources. The rubric can also serve as a tool for districts and schools to review instructional materials in relation to the *NGSS*. It builds on ideas from the EQuIP rubric and the Primary Evaluation of Essential Criteria alignment tools from Achieve. Access it at *https://goo.gl/gakUqW*.

Tablet apps from ScienceWerkz. M These five apps serve as a preview for middle level teachers considering purchasing an annual subscription from Werkz Publishing Inc. The apps don't require WiFi once they are downloaded. Choose from Introduction to Science, designed to help students understand the study and practice of science; Acids and Alkalis, for chemistry and integrated science courses; Earth's Landforms, for Earth science or integrated science courses; Transmission of Heat, for physical or general science classes; and Nutrition in Humans, for life science or biology classes.

Download them from the website *www.sciencewerkzapps.com*. ●

News Bits

- **Stanford University researchers developed a smartphone microscope that lets students have fun while printing and building their own devices.** H

The 3D-printed LudusScope—a name derived from the Latin word *Ludus,* meaning "play," "game," or "elementary school"—allows students to play games with light-seeking microbes called Euglena. The device has a 3D-printed platform for the microscope slide on which the Euglena swim; a joystick that activates light-emitting diodes and influences where the microbes go; and a smartphone holder that positions the phone's camera above the eyepiece. Students can also zoom in on individual cells, or track Euglena size and swimming speed in real time.

The microscope's 3D-printing patterns are open source. For the joystick, teachers simply wire a small circuit out of common electronic parts. And science supply companies sell Euglena.

In testing the microscope with high school students and teachers, Ingmar Riedel-Kruse, the Stanford assistant professor of bioengineering who led the project team, had some surprises. "I thought the interactive cell stimulation and the resulting games was the coolest thing, but…what they were more excited about is the more basic things like the ability to build your own instrument, that multiple people can see the screen at the same time, and that you can select and track individual cells," he reports.

Learn more at *https://goo.gl/0lXoAq.*

- **Research published in *Advances in Physiology Education* shows community colleges play a crucial role in the field: Up to 50% of students earning bachelor's degrees and 30% of first-year medical students have attended community college for at least some of their undergraduate education.** HE

But physiology faculty and students at these institutions don't receive the same resources and professional development (PD) and collaboration opportunities as their counterparts at four-year institutions, say authors Jenny McFarland of Edmonds Community College in Lynwood, Washington, and Pamela Pape-Lindstrom of Everett Community College in Everett. They call for professional societies, research journals, and universities to help level the playing field by discounting their memberships, inviting community college faculty to participate in professional events, and providing more open access to relevant papers and journals. Learn more at *https://goo.gl/PCnWyh.*

- **Funding—not politics—is a major barrier to environmental education (EE) in the United States.** K12

In her doctoral dissertation, Karena Mary Ruggiero examined 48 states' Environmental Literacy Plans (ELPs), outlining how a state will integrate EE into state standards, graduation requirements for environmental literacy, suggested sequence for teacher PD, and assessing and funding ELP programs. Her study found strong ELPs in both red and blue states, with the most robust ones in Oregon, the District of Columbia, Kansas, Illinois, and Colorado.

The North American Association for Environmental Education says for most states, funding is the issue: "63% have no funding at all; 35% have partial funding; and only 2% have full funding to support their ELPs." Read more at *https://goo.gl/ohdVkF.* ●

What's New

FROM U.S. GOVERNMENT SOURCES

U.S. Geological Survey (USGS)

TopoView Map Archive H

With TopoView, an open-access archive of historical maps, high school science and social studies educators (and others) can digitally access any of the USGS's 178,000 topographical maps, dating from the 1880s to the present. Because the USGS revises and reprints new versions of maps as changes occur and land is developed, the archive contains many maps of the same geographic areas from different periods of time. Comparing these historical maps allows students to see how a specific geographic area looked before development and gives students a detailed view of physical and cultural changes over time.

Learn more and watch a video tutorial exploring TopoView's features at *https://goo.gl/3C0FZG*.

National Aeronautics and Space Administration (NASA)

NASA's Journey to Mars K12

From the data-collecting endeavors of the rover Curiosity to the process of constructing Orion, a spacecraft designed for eventual travel to Mars, this 10-minute presentation appropriate for K–12 audiences highlights NASA's many efforts supporting current and future explorations of the Red Planet. Watch the presentation in the classroom to fuel the passions of the next generation of space explorers, or find out how to bring a dome-formatted version of the presentation to your school or local planetarium. Visit *https://goo.gl/DqhLsP*.

Solar System Scale Models E M H

Creating a scale model of the solar system is a tangible way for students in grades five and up to experience the vastness of the solar system and begin to understand the relative sizes and locations of planets and other solar system objects. At this education website from NASA's Planetary Science Division, teachers can access solar system model-building activities for the classroom, schoolyard, park, neighborhood, and computer.

Selected highlights include the Red Nickel Scale Model (grades 5–12), a classroom model that uses a few coins and some paint to explain the fundamentals of the solar system, and The Thousand Year Model (grades 9–12), an outdoor activity demonstrating both the relative size and spacing of the planets using a peppercorn to represent the size of the Earth. See *https://goo.gl/4i6Hqo*.

DIY Space: Stomp Rockets E M H

Targeted for students in grades 4–9 and created by educators at NASA's Jet Propulsion Laboratory, this lesson brings the excitement of model rocketry and engineering design to the classroom. Students work individually or in pairs to construct and launch paper rockets using a teacher-built PVC-pipe launcher, and calculate the flight achieved by the model. Then based on their rockets' flight performance, students analyze and modify their designs, launch again, and recalculate the altitude achieved to determine if their changes affected the performance of the rocket. The lesson supports the *Next Generation Science Standards* while exploring rocketry, the engineering design process, and mathematics.

Find the lesson plan, extension activities, and video tutorials at the website *https://goo.gl/f9LxMV*.

Eclipse Website M H

If your students are fascinated by solar eclipses, you can access a history of them by decade and more at NASA's Eclipse Website. Middle and high school educators and others can learn about eclipses by examining data from eclipses that occurred or will occur during a 10-year span. The tables describe an eclipse's calendar date, TD of greatest eclipse (the Terrestrial Dynamical time when the axis of the Moon's shadow passes closest to the Earth's center), eclipse type (partial, hybrid, or full), Saros series, magnitude, central duration, and geographic region of visibility. Each table also includes links to global maps, interactive Google maps, animations, path coordinate tables, and Saros tables to provide a complete picture of each eclipse event. Visit *https://goo.gl/D5vZFi*.

U.S. Department of Agriculture (USDA)

MyPlate, My State Educator Toolkit P E

Teach preK–5 students about nutrition and help them understand where their food comes from with the MyPlate, My State resources and activities. Organized by grade span, the lessons include activities such as Grocery Store Bingo (preschool/kindergarten), which challenges students to search for food of various colors and shapes at the store; Kids Food Critic (early elementary), in which students sample a new fruit, vegetable, or recipe, then use their senses and critical-thinking skills to determine if they'd like to eat it again; and The Farm to Plate Card Game (later elementary), which teaches students about the numerous roles involved in food production from farmer to waste manager.

The MyPlate, MyState activity sheets (all elementary levels) show students which foods are grown locally in each state as well as products made in each state, and can be easily incorporated into both science and social studies lessons.

Find these resources at the website *https://goo.gl/wQJHcz*.

National Park Service (NPS)

Junior Paleontologist Activity Book E M

This activity book for students ages 5–12 from the NPS's Junior Paleontologist Program presents facts, photographs, and games alongside more than a dozen activities exploring Earth's history, ancient plants and animals, and the changes in environment over time. Students can explore how fossils form in the Road to Fossilization board game; learn about plants and animals from different geologic time periods in activities such as Geologic Time and It's All Relative; or compare their size to the sizes of dinosaurs of the Mesozoic Era in Everything Is Bigger in Texas. Other activities encourage students to visit national park sites, such as Paleo-Park Passport, in which students collect stamps from parks they visit, and Climate Change, in which students discuss evidence of climate change with a park ranger at a national park site.

Students can earn a Junior Paleontologist badge for completing the activities in the book. To receive a badge, students can give the completed book to a park ranger at a national park site or mail the completed book and their address to the program's headquarters, and a badge will be mailed to them.

Download the book from the website *https://goo.gl/0Qne5q*.

U.S. Department of Education (ED)

Student Self-Assessment of Math and Science Ability in High School H

This report from the National Center for Education Statistics addresses how students' confidence in their ability to do math and science assignments changes during high school. The study examined data from the High School Longitudinal Study of 2009, collected in 2009 when students were high school freshmen, and in 2012, when most students were in their junior year. Results are presented by gender.

The study revealed that the percentages of both males and females who were confident they could do an excellent job on science assignments increased between 2009 and 2012, while the percentages of both males and females who were confident they could do an excellent job on math assignments decreased during the study's time period (although not by a statistically significant amount for males).

For more details about these and other results, download the full report at *https://goo.gl/6cY4p5*.

National Oceanic and Atmospheric Administration (NOAA)

Climate Stewards Webinars K12

K–12 educators can access an archive of webinars exploring climate change and its impacts. Produced by scientists and educators from NOAA's Climate Stewards Education Project, each 90-minute webinar addresses a different aspect of climate change. The webinars can help teachers stay informed on climate change issues, revitalize K–12 Earth science lessons, and learn how to develop and execute a climate action project with students.

Titles include The Connectedness in the Climate System; Sleuthing the Climate Past, Projecting the Climate Future; Spanning Time and Spatial Scales: Modeling the Planet's Climate; Using Simple Models in Climate Change Education; and Making Climate Change Communication Stick. View them at *https://goo.gl/IfFgTl*.

Lessons From the Monitor M

Two lessons for grades 6–8 from NOAA's Monitor National Marine Sanctuary develop students' graphing and data skills while increasing their understanding of the ocean. In Ocean Acidification: Plotting the Dangers, students explore how carbon dioxide makes the ocean more acidic and the effect of increased acidity on marine ecosystems. The lesson requires students to practice graphing techniques such as plotting points from data, scaling, and line of best fit. Students then apply what they've learned from the data to draw conclusions and make predictions about the increase of carbon dioxide over time.

Similiarly, in the lesson Shipwrecks as Reefs: Biological Surveys, students practice data sampling, collection, and analysis techniques as they "dive" a shipwreck, an artificial reef, to conduct a mock biological survey of fish populations at the site. The lesson teaches students how to conduct a scientific survey using the methods of visual census transects and stationary quadrats and provides valuable practice for students in making informed conclusions based on data.

View these lessons at the website *https://goo.gl/6ivR0g*.

Access these and other interdisciplinary science and math lessons at *https://goo.gl/VvWTs1*.

National Institutes of Health (NIH)

Environmental Health Science Resources A

At this website, K–college educators can access a table of annotated links describing booklets, fact sheets, interviews with scientists/researchers, lesson plans, videos, and websites that promote awareness and understanding of the connections between human health and the environment. The table also indicates the appropriate grade level targeted for each resource.

Of particular interest is the content about careers in environmental health sciences fields: Students can watch videos to learn what it takes to be a wetland ecologist, environmental analyst, growth biologist, microbiologist, and other related careers. In addition, the Healthy Homes = Healthy Kids flyer series presents kid-friendly, age-appropriate facts about environmental health triggers found in air, food, lead, poison, and water and how to minimize their effects. Consult the website *https://goo.gl/1loALK*.

MCAHSENS

Winter Safety Tips for Kids K12

From dressing appropriately for cold weather (i.e., wearing layered clothing and hats and gloves) to staying indoors when the temperature falls below -25°C or if the wind chill is -28°C or colder, these practical suggestions from NIH's National Library of Medicine will help ensure that students of all ages stay safe and healthy in the winter months. The document also presents tips for safer skating, skiing, snowboarding, and snowmobile use, and discusses some potential dangers for children when building snow forts and having snowball fights. Refer to *https://goo.gl/x7WqID*.

Kids Environment, Kids Health E M

The kids' website from NIH's National Institute of Environmental Health Sciences features games, activities, stories, and lessons that encourage elementary and middle level students to learn about the environment and have fun while doing it. Topic links like Environment and Health; Healthy Living; Pollution; Reduce, Reuse, Recycle; Science: How It Works; and The Natural World feature age-appropriate articles and other links related to each theme.

Activity suggestions include designing a poster to motivate friends to help the environment and conducting an experiment to investigate the effectiveness of different sunscreens. Younger students can also get in on the action: Click on the "Little Kids" frog in the right-hand corner of each page to access environmentally themed songs and coloring pages. See the website *http://kids.niehs.nih.gov*.

U.S. Environmental Protection Agency (EPA)

Listen UP! Activity Book E

Teach K–5 students about noise pollution and how to protect their hearing and health with this activity book from the EPA. Featuring facts, diagrams, photographs, word games, puzzles, and more, the book helps students understand how we hear, how sound is measured, and how to identify which sounds can harm your hearing. In addition, the book provides suggestions for students to protect against hearing loss, such as by turning down loud television sets or wearing hearing protectors while attending or participating in loud activities.

Read the book at the website *https://goo.gl/OGtHtd*.

Climate Change Impacts Website K12

Do you know what climate change means for your state? For your community? At this website, K–12 teachers can access fact sheets, quizzes, maps, and e-publications describing specific impacts of climate change on human health and in the United States. Learn about impacts specific to geographic regions, sectors (e.g., agriculture, ecosystems, energy, forests, and transportation), and states.

Each page features useful sidebars of key points summarizing the top impacts in that category, along with related links for more information. Consult the website *https://goo.gl/SEY2hX*.●

In Your Pocket

Editor's Note

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

January 20–31

Roy Award for Excellence in K–8 Earth Science Teaching E M

This American Geosciences Institute (AGI) award goes to one K–8 teacher who is a leader and innovator in Earth science. The winning teacher receives a plaque, $2,500, and a $1,000 grant to attend the NSTA National Conference in Los Angeles, March 30–April 2. The award honors Edward C. Roy, Jr., AGI past president.

Full-time K–8 teachers in the United States or the United Kingdom who teach Earth science are eligible. Apply by **January 20** at *https://goo.gl/lZ7N8Y.*

Outdoor Power Equipment Institute/TurfMutt Be a Backyard Superhero Contest E

To enter this contest, K–5 students create an original picture and write a story to accompany it that explains how they are Backyard Superheroes working to save living landscapes everywhere. K–2 students submit 25- to 50-word stories; students in grades 3–5 submit stories of 100–150 words. The winning student's school will receive $10,000 to improve its green spaces and send one of its teachers to the NSTA National Conference in Los Angeles, March 30–April 2.

Submit entries by **January 23** by mail or online at the following website: *www.scholastic.com/turfmutt.*

American Physiological Society Online Teacher Fellowship M H

The American Physiological Society offers these fellowships for middle and high school science teachers. Over the course of 10 months, online teacher (OT) fellows learn about Six Star Science, a research-based framework for excellence in science instruction, and develop methods for implementing it in their classrooms. During their time in the program, OTs also design experiments, engage in online discussions, and develop strategies to better understand the research process and make their current lessons more student-centered. Fellows receive a stipend, and graduate credit is available.

Science teachers in any discipline with at least one year of teaching experience and a current appointment are eligible. Those who are members of minority groups underrepresented in the sciences or who teach in schools with predominantly underrepresented minority students are especially encouraged to apply. Apply by **January 31.** Visit *https://goo.gl/0xNPzM.*

Captain Planet Foundation ecoSolution Grants A

These grants go to youth-led, solution-oriented projects that make real environmental change. Grants of between $500 and $2,500 are available for educators or nonprofits with an operating budget of less than $3 million. Preference is given to those who have secured matching or in-kind funding to support the project. Apply by **January 31** at *https://goo.gl/2fqYFX.*

Fund for Teachers Grants P K12

PreK–12 teachers with at least three years of experience can use these grants to support professional development (PD) experiences of their own design—anywhere in the world. Individual teachers receive up to $5,000, and groups receive up to $10,000 to conduct their own summer projects. Application instructions vary by state; check eligibility and apply online by **January 31** at *www.fundforteachers.org.*

MAXIMUS Charitable Foundation Grants A

The foundation awards these grants to nonprofit organizations serving disadvantaged populations and underserved communities in three focus areas: youth and children development, community development, and health care. Preference is given to programs that promote personal growth and serve disadvantaged, low-income youth.

Grants of between $2,500 and $5,000 are available, though larger grants may be awarded to programs with compelling needs. Apply by **January 31;** see *https://goo.gl/YEenYF.*

SPIE Education Outreach Grants A

SPIE, the international society for optics and photonics, 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 **January 31;** consult *https://goo.gl/hbR8Ls.*

February 1–15

American Association of School Librarians Collaborative School Library Award P K12

This $2,500 award recognizes partnerships between teachers and school librarians. Those who have teamed up to create a project, event, or program to further information literacy, independent learning, and social responsibility using the school library may apply. Projects should serve as a model for other similar collaborative projects.

School librarians with an American Association of School Librarians membership are eligible. Apply by **February 1;** see *https://goo.gl/OFOHg5.*

American Honda Foundation Grants K12

The American Honda Foundation (AHF) awards grants to youth education programs focused on science, technology, engineering, and math (STEM) and the environment. Grants of between $20,000 and $75,000 are available. Programs should be imaginative, creative, youthful, forward-thinking, scientific, humanistic, or innovative. Public and private K–12 schools, public school districts, and nonprofit organizations that have not previously received AHF grants can apply by **February 1** at *https://goo.gl/9IckUp.*

Toshiba America Foundation Science and Math Improvement Grants M H

These grants are awarded to science and math teachers of grades 6–12 with innovative classroom project ideas. Proposed projects should give students an opportunity to "do science" in new ways that will increase their engagement with the subject matter and improve their learning. Successful projects often tap into students' natural curiosity, enable them to ask their own scientific questions, and incorporate the expertise of community partners.

Applications requesting less than $5,000 are accepted year-round from teachers at public or private schools. Requests of more than $5,000 are due by **February 1.** Visit *www.toshiba.com/taf.*

Lowe's Toolbox for Education Grant Program K12

These grants help public and charter K–12 schools and associated parent-teacher groups fund projects, especially those that encourage parental involvement and community building. This year, the program aims to have the greatest impact by providing teachers and schools with funds they may lack for basic necessities. Grants of between $2,000 and $5,000 are available. Schools must register before they can apply (by **February 9**), which can take up to 24 hours to process. Consult *http://toolboxforeducation.com.*

Air Force Junior ROTC Grant M H

The Air Force Association offers grants of up to $250 to promote aerospace education in classrooms and Junior ROTC units. Grants may

be used for aerospace-related items, such as books, materials, or field trips to an aerospace museum, Air Force base, or other aerospace facility. Classrooms and units can apply every other academic year. Apply by **February 10;** see *https://goo.gl/U3ObjW.*

Bonnie Plant Farm Cabbage Program Scholarships E

This program provides free cabbage plants to third-grade classrooms nationwide and awards a $1,000 scholarship to one participating student in each state (excluding Alaska and Hawaii). The goal is for students to gain hands-on gardening experience and grow colossal cabbages! Teachers receive accompanying lesson plans, and they can register for free cabbage plants until **February 15.**

Learn more at the program's website: *http://bonniecabbageprogram.com.*

CDC Science Ambassador Fellowship M H

This Centers for Disease Control (CDC)–sponsored program is for teachers who want to incorporate public health into their middle and high school classrooms. Fellows complete a five-day summer course at the CDC headquarters in Atlanta July 10–14 and a one-year, distance-based PD program. Fellows will work with CDC scientists over the summer to develop public health STEM lesson plans that meet the *Next Generation Science Standards* and continue work remotely over the course of the next year to finalize, implement, and share their materials.

Middle and high school teachers who currently hold or aspire to hold an educational leadership position in their school, district, or state may apply by **February 15.** Learn more at the website *https://goo.gl/z675np.*

Apply Year-Round

Brown Rudnick Charitable Foundation Community Grant Program K12

The program aims to simultaneously encourage those involved broadly with the Brown Rudnick Center for the Public Interest to actively consider the educational needs in the communities of Boston, Massachusetts; Hartford, Connecticut; New York City; Providence, Rhode Island; and Washington, D.C.; recognize, encourage, and collaborate with front-line workers in the educational system who often don't have a voice in funding decisions; and provide funding to assist with small, concrete projects or needs that will make an improvement in inner-city education within a year of the grant award. The foundation reviews grant applications monthly and awards grants of up to $2,000 in any one month. Consult *https://goo.gl/vPZHbt.*

Fruit Tree 101 Program P K12

The Fruit Tree Planting Foundation (FTPF) is an international nonprofit charity devoted to planting fruitful trees and plants to alleviate world hunger, combat global warming, strengthen communities, and improve the surrounding air, soil, and water. FTPF programs strategically donate orchards where the harvest will best serve communities for generations, at places such as public schools, community gardens, city/state parks, low-income neighborhoods, and Native American reservations. Free arboricultural workshops are available throughout the day of the planting, and schools receive an age-appropriate curriculum emphasizing the importance of trees for the environment and of fruit in the diet. See *www.ftpf.org/apply.htm.* ●

Summer Programs

Editor's Note

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

Smithsonian Libraries Neville-Pribram Mid-Career Educators Awards M H HE

This program provides a residency at one of the Smithsonian's libraries for mid-career educators working on publications or curriculum development and allows them to use its collections to further their research. This year's program will take place at the National Museum of Natural History (NMNH) Library, which offers collections in entomology, invertebrate zoology, botany, vertebrate zoology, mineral sciences, and paleobiology. The awardee will also have the opportunity to engage with NMNH researchers and attend festivals, symposia, and other NMNH-sponsored events. After the residency, educators will present their research and submit a short report to the NMNH Library.

Middle and high school teachers, college professors, and museum educators are eligible, but applicants must not be located within commuting distance of the NMNH and can't use the award to further doctoral or postdoctoral research projects. Apply by **January 31;** visit *https://goo.gl/lWDGkQ.*

Goethe Institute Study in Germany for STEM Teachers K12

The Transatlantic Outreach Program offers two-week summer study tours of Germany for K–12 science, technology, engineering, and math (STEM) teachers. Participants will study Germany's education system and its environmental sustainability firsthand. The program covers most domestic and international transportation fees, hotel accommodation, two meals per day while abroad, and any mandatory study tour-related fees, such as museum entry fees.

K–12 STEM teachers, curriculum coordinators, principals, and some Department of Education employees are eligible. Apply by **February 3.** Consult *https://goo.gl/TG1FN2.*

Connecting With Marine Science Teacher Institute H

This institute, sponsored by the Monterey Bay Aquarium, invites teachers of grades 9–12 to explore the role humans have played in the bay's stability and change over time. During June 25–30, participants will do field investigations and learn about climate change science, plastic pollution, sustainable seafood, and the physics, chemistry, and biology of the kelp forest. Teams of teachers may apply, and interdisciplinary teams are encouraged.

Participants must attend all summer sessions and use the curriculum presented with their students. Room and board are provided, and a $50 daily stipend is available upon completion of the institute; credits from California State University, Monterey Bay, are available. Register by **March 17** at *https://goo.gl/Glj138.*

Project ATMOSPHERE Workshop K12

The American Meteorological Society (AMS) offers this free workshop for K–12 science supervisors and teachers of science courses with atmospheric content. The workshop introduces them to the latest technologies for sensing, analyzing, and forecasting weather and how to incorporate these technologies in the classroom.

The workshop will take place July 16–28 at the U.S. National Weather Service (NWS) Training Center in Kansas City, Missouri, and features lectures and seminars from NWS and National Oceanographic and Atmospheric Administration staff. Participants receive graduate credit, a $600 stipend, lodging, meals, travel funds, tuition, and instructional materials. Afterward, they are expected to conduct single-topic sessions for precollege teachers in their home states, supported by AMS.

Teachers and supervisors interested in promoting minority participation in science are particularly encouraged to apply (deadline **March 27**). See the website *https://goo.gl/HBqtZP.*

Climate Research Center's Argumentative Writing Workshop M H HE

This workshop, taking place at The Ohio State University (OSU) June 12–15, is for middle and high school teachers and introductory-level university instructors who want to incorporate argumentative writing and evidence-based claims in their classes. Aimed at science, social studies, and English language arts teachers, the workshop frames argument as a skill that spans the disciplines. Participants will learn how to teach argument through lessons and hands-on activities and develop instructional materials. They will also tour OSU's Byrd Center Archives and the Byrd Polar and Climate Research Center.

Preference is given to those applying by **May 1.** See *https://goo.gl/dMrD9k.*

SEE Turtles Costa Rica Leatherback Turtle Volunteer Vacation A

Participants will spend four nights in Costa Rica (June 10–16) patrolling nesting beaches, measuring leatherback turtles, collecting eggs and moving them to hatcheries, and working with the turtles once they hatch. In the daytime, participants can explore the rainforest, help clean up the beach, or rest. Proceeds from the trip can save at least 100 hatchlings per participant.

Individuals and groups of up to 15 may apply. Registration fees vary by group size. Visit *https://goo.gl/MkehV6.*

2017 ChemEd Conference H HE

South Dakota State University will host this conference for chemistry educators during July 23–27. Participants will collaborate and exchange ideas with other educators while learning best practices and new techniques. Register by **June 1** to receive the discounted rate. Learn more at *https://goo.gl/5a0thH.*

Bermuda Institute of Ocean Sciences Educator Workshop M H

During this six-day (June 26–July 1) workshop offered by the Bermuda Institute of Ocean Sciences (BIOS), 12 teachers, curriculum specialists, administrators, and informal educators will learn how to plan and execute field study courses for their students at BIOS. Participants will explore coral reefs, use Glider technology for ocean study, and visit Whalebone Bay, Cooper's Island, and Fort St. Catherine, among other attractions, to learn how to incorporate them in educational experiences for their students.

Preservice and inservice middle and high school educators may apply. Tuition must be fully paid by **June 2.** Refer to *https://goo.gl/BXR5Dy.*

SEE Turtles Costa Rica Leatherback Turtles and Marine Debris Research Trip A

On this eight-day trip, sponsored in conjunction with the Oceanic Society, participants will study how plastic pollution impacts the leatherback population at Las Tortugas Research Station on Costa Rica's Caribbean coast. During June 17–24, participants will spend three nights patrolling the beach for turtles and debris and two days exploring the rainforest and snorkeling the coast of Cahuita National Park. Individuals, families, and groups may register at *https://goo.gl/xD4Q5e.*

Climate Generation's Institute for Climate Change Education K12

The institute allows educators to connect with others who care about these issues, hear presentations from key scientists, and receive training on award-winning climate change and energy curricula. This year's institute will take place June 26–28 at the University of Minnesota's Institute on the Environment in St. Paul. On June 29, teachers can take an optional field trip to the Cedar Creek Ecosystem Science Reserve to interact with climate change scientists and do some hands-on learning and teaching.

To apply (deadline **June 9**) and learn more, visit *https://goo.gl/jDfhsS.* ●

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For more information on the competition and to submit projects before the February 6, 2017 deadline, visit

www.exploravision.org

NSTA National Science Teachers Association

BLICK ON FLICKS

International Cooperation: Good for Science and Science Fiction

By Jacob Clark Blickenstaff

Arrival is a science fiction film based on an award-winning short story from 1998 by Ted Chiang. The film opens when alien ships appear at 12 locations worldwide, including Montana, China, Venezuela, England, and Sudan. The giant oblong craft hang in the sky through no visible means, and every 18 hours, a door opens in the bottom of the ship, enabling people to enter and interact with the aliens.

Though people enter the ship, they don't have direct contact with the aliens: Some sort of transparent glass-like barrier separates the aliens from the humans. The aliens have a spoken language that the military can't decipher, so they approach linguist Louise Banks, PhD (played by Amy Adams) and physicist Ian Donnelly, PhD (played by Jeremy Renner) for assistance.

Initially, the military wants Banks to translate the language from her office, but when she insists it would be impossible, she travels to the Montana landing site to begin work. Banks uses basic tools like whiteboards, mime, and gestures to begin to communicate with the aliens. She takes a huge step forward when she removes the hazmat suit she has been wearing and shows her face and hands more clearly to the aliens.

People begin calling them "Heptapods" because they have seven legs, and overall I would describe them as a cross between an elephant and a giant squid. Banks learns that they have a written language that is formed by ink-like emissions from their tentacles. Most of the film follows Banks and Donnelly as they decode the written language, and we see how the alien language changes how Banks understands our world.

This is science fiction without big space battles; the film has only one alien species and not very much action. But it still offers science teachers much they can use to connect *Arrival* to their classes.

While Banks and Donnelly work at a landing site in Montana, they cooperate with scientists at the 11 other landing sites via video calls and data links. By sharing the results of their interactions with the Heptapods globally, the various teams make progress interpreting the written language of the aliens. This serves as a great model for how large-scale science projects often work.

The Large Hadron Collider (LHC) in Europe is the product of thousands of scientists and engineers from hundreds of countries collaborating to build the world's largest machine. The International Space Station (ISS) is another example of many nations working together on a huge, technically-demanding enterprise. No one country can afford these machines, and no one country has all the expertise needed to make the project a success.

In *Arrival*, a time comes in the story when the international collaboration

ends, and progress on deciphering the language slows. Eventually, Donnelly discovers that each of the landing sites has only one twelfth of the data. To fully understand the Heptapods' message, the collaboration has to be reinstated.

Another aspect of cooperation in the film that models real-world work is the interdisciplinary team assembled to work on the Heptapod language problem. Banks and Donnelly are a linguist and a physicist, and the international teams include computer scientists and engineers as well. The LHC and ISS are the products of millions of hours of work by teams spanning dozens of disciplines. Science teachers who use project-based-learning techniques can also model the interdisciplinary nature of the complex problems we face outside the classroom by having students with disparate skills work together in teams.

> ***"Now that is a proper introduction."***
> **— Louise Banks in *Arrival***

The story and the film are built around an idea from linguistics and cognitive science known as "linguistic relativity." Simply put, the idea is that the language a person speaks can influence how his or her mind works. The strongest version of the hypothesis is that a person's thinking is determined by the language he or she speaks. The weaker (and more accepted) version is that cognition is affected by language.

Perhaps the most straightforward example of this is in color perception. Different languages have different collections of words describing colors, and experiments have shown that people with different language backgrounds actually perceive colors differently. (See the *Business Insider* article, "No One Could Describe the Color 'Blue' Until Modern Times," at *http://read.bi/1Ak3M5y* for more information.) I can't say more without revealing a key plot point in the film, but Banks gains a new perception of how the universe works when she becomes immersed in the Heptapod language.

I wouldn't be surprised if *Arrival* is nominated for some Academy Awards this year, and science teachers can use the film to explore the interaction between language and cognition, problem-based learning, and international cooperation in science. ●

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

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Montana State University – Bozeman

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

NSTA 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

MS. MENTOR, **Advice Column**

Staying Engaged, Designing Safe Classrooms, Shorter Lessons

I have a degree in biology and teach high school. Although I love teaching, I miss doing real scientific work myself. Any suggestions for how I can still stay engaged and current in science?

—T., Illinois

Although we teach a variety of topics, teachers have areas of special interest and passions. When teaching unfamiliar topics, we may discover new interests. Social media is a good way to find out more about ways to continue and expand on your interests. Some other options you could explore include

- Participating in programs from universities or government agencies that help teachers contribute to investigations over the summer and partner with researchers.
- Attending programs and presentations at universities, museums, medical centers, or science centers to update your knowledge and connect with researchers and other science professionals.
- Volunteering your expertise at nature centers or museums.
- Inviting scientists to your classroom to share their experiences and expertise and perhaps to work with your students.
- Reading science journals and publications. Share what you read with your students.
- Using summer and term breaks to visit museums, science centers, national parks, and so on. If you tell the staff you're a teacher, you may get an in-depth or behind-the-scenes tour.
- Contributing to continuing investigations through citizen science projects (see the SciStarter website at *http://scistarter.com* for ideas for both you and your classes to participate).

As science teachers, we have an obligation to model lifelong learning for our students. And they enjoy finding out about our "secret" lives and interests.

I have a chance to contribute to the design of the science classrooms in a middle school. What should be on a "must-have" list?

—S., Connecticut

I would strongly recommend using the *NSTA Guide to Planning School Science Facilities.* This publication has a chapter on safety guidelines (including material storage), sample floor plans, Americans with Disabilities Act guidelines, and even suggestions for "green" labs. It has chapters on the planning process, photographs, checklists, and discussion starters.

Check on the recommendations or requirements from your state department of education and your local building codes. Consider the age level of your students and the types of activities and investigations in your curriculum.

The first priority should be safety features such as showers, eyewash stations, fume hoods, air exchange, fire extinguishers and blankets, sanitizing equipment for goggles, master shut-off switches for utilities, adequate workspaces, and unobstructed exits.

Other science teachers suggest

- Include more storage space than you think you'll need. Drawers and cupboards should be lockable.
- In addition to lab stations, get flat student desks or tables that can be pushed together for cooperative work and projects.
- Have a small refrigerator for making ice or chilling materials (but not for food!).

It's better to work out the details first rather than having to correct any mistakes or omissions. Include your administrators in any design discussions. Architects, contractors, or administrators may try to skimp on recommended features. Be adamant about student safety and ensuring the facility meets the learning needs of science students.

When I was student teaching, I had some really good science lessons for second graders that lasted about an hour. Now I have a half-hour for science each day. I need suggestions for shorter lessons.

– C., Colorado

I'm glad your school schedules science daily. Many elementary schools have deemphasized science and social studies in favor of reading and math.

If your schedule is flexible enough, you could "borrow" time from another subject to complete the activity, making up the time later. Or you could divide the activity into several parts, perhaps making observations or collecting data one day and doing the analysis or summarization later. Alternatively, you could use time during writing instruction for students to summarize the lesson in their science notebooks and include nonfiction books on the topic during reading instruction, read-alouds, or personal reading before or after the science lesson.

Each month, NSTA's *Science & Children* journal publishes features to help educators craft additional age-appropriate lessons:

- Teaching With Trade Books explores a concept with recommended books and lessons.
- The Early Years features easy-to-use ideas for developing student interest and curiosity. The July 2016 topic is "Discovering Through Deconstruction."
- Articles related to the monthly theme include lesson plans, connections to the *Next Generation Science Standards,* and related materials.

Even at the secondary level, the class period is often not long enough to complete an investigation or activity. ●

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

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NSTA National Science Teachers Association

NSTA PRESS: *Solar Science: Exploring Sunspots, Seasons, Eclipses, and More*

Experience 4.1: Predicting What the Moon Will Look Like

Editor's Note

NSTA Press publishes high-quality resources for science educators. This series features just a few of the books recently released. The following excerpt is from Solar Science: Exploring Sunspots, Seasons, Eclipses, and More, *by Dennis Schatz and Andrew Fraknoi, edited for publication here. To download the full text of this chapter, go to* https://goo.gl/FX7ZTb. *NSTA Press publications are available online through the NSTA Science Store at* www.nsta.org/store.

Overall Concept

Students examine and predict the order of six photographs of the Moon that show different phases. Their predictions are then compared to the actual observations students make over the next 10 to 30 days as part of *explore* Experience 4.3, "Observing the Moon."

Objectives

Students will

1. use photos of the Moon to predict the sequence of the Moon's phases based on their prior knowledge,
2. recognize that the Moon's overall appearance changes on a regular cycle,
3. question how and why the Moon's appearance changes, and
4. identify a number of features on the Moon's surface.

Teacher note: Many students—and teachers—think of the Moon as having eight phases. There is not a specific number of phases, since the Moon goes through a continuous change in phase as it slowly shows more of its lit side after its new phase until we see the full Moon. It then shows less and less of its lit side until it gets back to new phase after 29.5 days. The selection of only six photos for this experience rather than eight is to reinforce the idea that there are not eight specific lunar phases. The photos are also oriented in a random pattern to encourage students to look at the features on the Moon to determine "which way is up" when viewing each image. This provides a reason for the students to learn about craters, maria, and rays.

Materials

Provide one per group:

- "Six Lunar Photographs, Set 1" (p. 291)
- Blank sheet of paper
- Scissors
- Tape or glue

Provide one per student:

- Astronomy lab notebook

Advance Preparation

Make a copy of the "Six Lunar Photographs, Set 1" handout for each group.

Procedure

1. Tell the students that a teacher colleague of yours (identify by name, if desired) had a set of lunar photographs sent to him or her by an amateur astronomer friend. Unfortunately, your colleague dropped the photos on the floor and no longer knows the order or orientation of the photographs. The friend asked for help from you and your class to get them in the correct order. You have made copies of the photos so the students can help with this challenge.
2. Distribute copies of the "Six Lunar Photographs, Set 1" handout, scissors, tape or glue, and a blank sheet of paper to each work group. It is important to use a photocopying machine that will preserve the detail in the photos. The students' goal is to place the photographs on the sheet of paper in the order in which they think they would see the shape of the Moon if they made observations for several weeks. Allow 10 to 15 minutes for discussion and decision making in each group.
3. Once each group is satisfied with the order, students should tape or glue the photos to the blank sheet of paper. Have them number the pictures from 1 to 6 in the order each would be seen. Be sure they indicate which way is up. They should also put their names on the paper to show who made the prediction.
4. When all of the groups have completed their photo sequences, have them move around the room to see the predictions of other groups. Ask the work groups, one by one, to explain their reasoning for choosing the sequence they came up with. These reasons should not yet be judged for appropriateness since the students are only presenting their best guess.
5. Use this discussion as a transition to Experience 4.3, "Observing the Moon," by pointing out that the best way to know the correct order is to observe the Moon over a number of days. The students' predictions should be posted on a wall of the room for ongoing reference during Experience 4.3. Alternatively, one member of each work group can keep the team's photo sheet in his or her astronomy lab notebook for later reference

Source: Fred Espenak, www.astropixels.com

Teacher note: Students will want to be immediately told the "right" answer for the order of the Moon photographs. It is important not to share the right answer at this point, but to use Experience 4.3 as a way for students to discover the correct order for themselves.

6. The discussion in step 4 is also an effective transition to the next *engage* experience, which lets students think about and express what they already know about lunar phases and eclipses. ●

"I'm a new STEM teacher and would love to learn more so that I can better serve the diverse needs of my students. I'm excited to explore the great resources NSTA has to offer!"

—NSTA Press reader Kellie C.

Grades K–12

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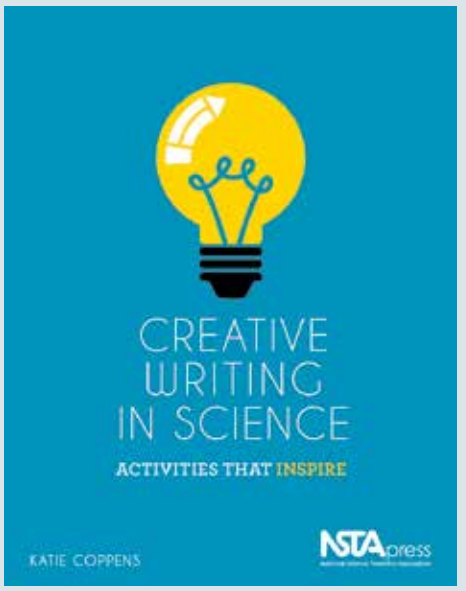

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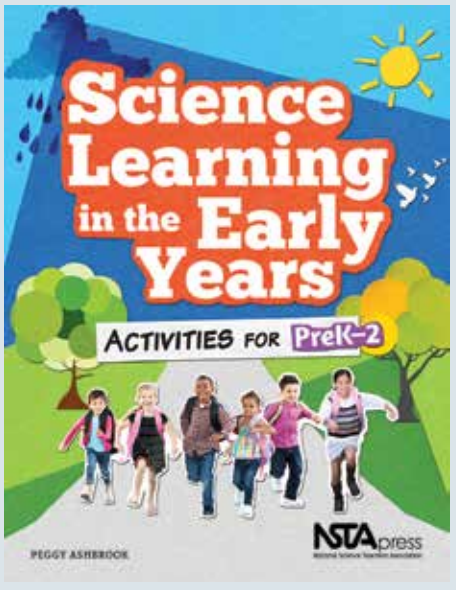

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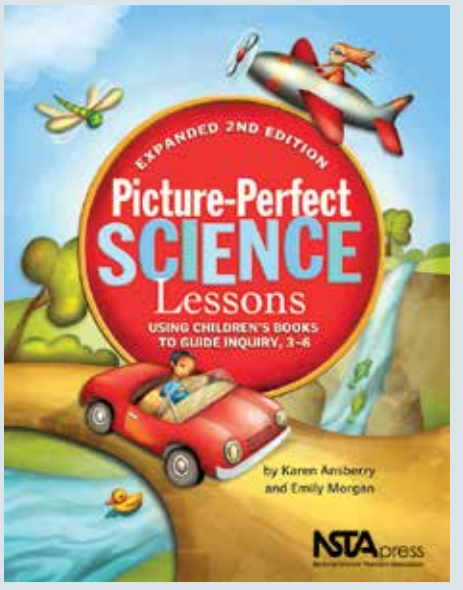

Grades 3–6

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To place an order or download a free chapter, visit

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NSTA National Science Teachers Association

(All dates are deadlines unless otherwise specified.)

January 17—Sharing what you've learned is an essential part of professional development. Submit your **proposal for the 2017 NSTA Area Conferences** in Baltimore (October 5–7), Milwaukee (November 9–11), and New Orleans (November 30–December 2). For more information on submitting a session proposal, visit *https://goo.gl/eTVbJK*.

February 1—***Science and Children***, NSTA's peer-reviewed journal for elementary science education, **is accepting manuscripts** on the theme **"Early Childhood: Life Science"** for the October issue. Share how you provide problem-solving opportunities, use local resources, and more with your fellow early childhood educators. General-interest manuscripts may be submitted at any time. Read the call for papers at *https://goo.gl/UXBmlh*.

February 1—Submit your manuscript on teaching about "Climate Change" now for the October issue of ***Science Scope,*** NSTA's peer-reviewed journal for middle level science teachers! General-interest manuscripts, commentaries, and column submissions may be submitted at any time. Read the call for papers and access submission guidelines at *https://goo.gl/l6bNbz*.

February 1—Submit your manuscripts featuring strategies for **"Using Evidence and Evidence-Based Reasoning"** with your students to ***The Science Teacher*** (*TST*), NSTA's peer-reviewed high school–level journal. The journal also accepts articles unrelated to a theme at any time. For more information on writing for *TST,* issue themes, and more, go to *https://goo.gl/kQOmsh*. For help preparing a manuscript, see an annotated sample manuscript at *https://goo.gl/0y9S35*.

February 3—Maximize your savings by registering for the **2017 NSTA Los Angeles National Conference on Science Education**, March 30–April 2! The conference features strands on *NGSS*: The Next Generation of Science Teaching; 2017: A STEM Odyssey, Science and Literacy Reloaded; and Mission Possible: Equity for Universal Access. Andy Weir, author of the *New York Times* best seller *The Martian* and a lifelong space nerd, will deliver the keynote presentation. Earlybird registration for NSTA members costs $275 and ends today. Members of the California Science Teachers Association may also register at the NSTA member rate. For more information or to register, go to *www.nsta.org/la*.

February 11—No travel is required to join **NSTA's virtual conference, Exploring Three-Dimensional Instruction.** Via your internet connection, you can join presenters and educators from across the country as they explore the three dimensions of the *Next Generation Science Standards*. Attendees will also receive access to the conference archives so they can watch the event on-demand, and a discount on select NSTA Press books. The virtual conference will be held at 10 a.m.–2 p.m. Eastern Time. Member registration costs $63; attendance/participation certificates, $9.95. For more information on NSTA Virtual Conferences or to register, visit the website *https://goo.gl/wD5ogc*.

March 1—Share your best activities and practices for teaching **"Global Climate Change"** with your fellow high school teachers in ***TST***. In addition, the journal accepts articles unrelated to a theme at any time. For more information on writing for *TST*, future issue themes, and more, go to *https://goo.gl/kQOmsh*. An annotated sample manuscript is available for reference at *https://goo.gl/0y9S35*.

March 31—Make your contribution to ***Connected Science Learning,*** NSTA's new digital journal bridging in-school and out-of-school STEM learning. The theme for the fourth issue is "STEM for Early Learners." Manuscripts are also being accepted for regular *Connected Science Learning* departments including Emerging Connections; Research to Practice, Practice to Research; Diversity and Equity; and Connected Science Learning Briefs. Visit the website *https://goo.gl/udvT6w* to read the call for contributions, submission guidelines, and more.

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

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Vote for NSTA's Board and Council

Voting for NSTA's Board and Council is open, with electronic ballots e-mailed to NSTA members. NSTA Board and Council members serve three-year terms, beginning June 1. The 2017 nominees for president-elect are Christine Anne Royce, professor and co-director of the Master of Arts in Teaching STEM (science, technology, engineering, and mathematics) Education at Shippensburg University, and Jerry Valadez, director of the Central Valley Science Project at Fresno State University and chief executive officer of the Community Science Workshop Network.

Also up for election to the NSTA Board are the Multicultural/Equity Division Director (candidates Natacia Campbell and Gary Nakagiri); Preservice Division Director (Paul Adams and William R. Veal); and Research Division Director (Michael Bowen and Emily Schoerning).

Six district director positions on the NSTA Council are also up for election:

- **District I** (Connecticut, Massachusetts, and Rhode Island): Carolyn Higgins and Susan Kelly
- **District VI** (North Carolina, South Carolina, Tennessee): Cindi Smith-Walters and Dedric McGhee
- **District VII** (Arkansas, Louisiana, Mississippi): Sheila Smith and Alicia Conerly
- **District XII** (Illinois, Iowa, Wisconsin): Nicole Vick and Rachael Heffington
- **District XIII** (New Mexico, Texas, Oklahoma): Deb Novak and Rebecca Hite
- **District XVIII** (Canada): Dawn Wiseman and Gabe Kraljevic

For more information on all the candidates, see the full ballot. If you did not receive an e-mail link to the ballot, contact *nominations@nsta.org*. Members can also access their ballots by logging in at *www.nsta.org,* selecting "My Account," and clicking on "Vote Now." Voting ends on **January 30.** ●